(DRAFT)

TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS

PHILADELPHIA ELECTRIC COMPANY

PEACH BOTTOM ATOMIC POWER STATION UNITS 2 AND 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.

Mr. I. H. Sargent and Mr. D. J. Vito 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 Philadelphia Electric Company's (PECO) Peach Bottom Atomic Power Station Units 2 and 3. This evaluation was performed with 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 U.S. Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to assure the safe handling of heavy loads and to recommend necessary changes to these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [2] to all power reactor 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's conclusion from this evaluation was that existing measures to control the handling of heavy loads at operating plants, although providing protection from certain potential problems, do not adequately cover the major causes of load handling accidents and should be upgraded.

In order to upgrade measures for the control of heavy loads, the staff developed a series of guidelines designed to achieve a two-phase objective using an accepted approach or protection philosophy. The first portion of the objective, achieved through a set of general guidelines identified in NUREG-0612, Section 5.1.1, is to ensure that all load handling systems at

nuclear power plants are designed and operated such that their probability of failure is uniformly small and appropriate for the critical tasks in which they are employed. The second portion of the staff's objective, achieved through guidelines identified in NUREG-0612, Sections 5.1.2 through 5.1.5 is to ensure that, for load handling systems in areas where their failure might result in significant consequences, either (1) features are provided, in addition to those required for all load handling systems, to ensure that the potential for a load drop is extremely small (e.g., a single-failure-proof crane) or (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 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 of NUREG-0612 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 PECO, the Licensee for the Peach Bottom Atomic Power Station, requesting that the Licensee review provisions for handling and control of heavy loads, evaluate these provisions with respect to the guidelines of NUREG-0612, and provide certain additional information to be used for an independent determination of conformance to

these guidelines. On June 18, 1981, PECO provided the initial response [4] to this request. Additional information was provided by the Licensee on December 22, 1981 [5] and May 20, 1982 [6]. Subsequently, a telephone conference call was conducted on September 13, 1982, involving representatives of the NRC, FRC, and PECO to discuss unresolved issues in the draft TER. As a result of this conference call, PECO provided additional information on October 25, 1982 [7], which has been incorporated into this technical evaluation.

2. EVALUATION AND RECOMMENDATIONS

This section presents a point-by-point evaluation of load handling provisions at Peach Bottom Units 1 and 2 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 which must be met in order to provide the defense-in-depth approach for the handling of heavy loads. These guidelines consist of the following criteria from Section 5.1.1 of NUREG-0612:

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

These seven guidelines should be satisfied for all overhead handling systems that handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool, or in other areas where a load drop may damage safe shutdown systems. The Licensee's verification of the extent to which these guidelines have been satisfied and an evaluation of the Licensee's verification are contained in the succeeding paragraphs.

Table 2.1. Peach Bottom/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. Reactor Building Crane	125/5	--	--	R	--	--	R	C	--	--
a. Shield Plug	95	C	C	--	--	R	--	--	--	C
b. Cool Plug	40/63	C	C	--	--	R	--	--	C	--
c. Slot Plug (Fuel Pool)	5.5	C	C	--	--	R	--	--	C	--
d. Drywell Head	6.5	C	C	--	P	--	--	--	--	C
e. RV Head	96.5	C	C	--	P	--	--	--	--	C
f. Steam Dryer	31	C	C	--	--	R	--	--	--	C
g. Steam Separator	52	C	C	--	--	R	--	--	--	C
h. Fuel Cask	100/37.1	C	C	--	P	--	--	--	C	--
i. Fuel Pool Gate No. 1	3.75	C	C	--	--	R	--	--	C	--
j. Fuel Pool Gate No. 2	3.75	C	C	--	--	R	--	--	C	--
k. Refueling Channel Shield	9	C	C	--	--	R	--	--	C	--

C = Licensee action complies with NUREG-0612 Guideline.
P = Licensee action partially complies with NUREG-0612 Guideline.
R = The Licensee has proposed revisions or modifications which will comply with NUREG-0612.
-- = Not applicable.
NC = Licensee action does not comply with NUREG-0612 Guideline.

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
l. Personnel Basket	4	C	C	--	--	R	--	--	--	--
m. RPV Head Insulation	10	C	C	--	P	--	--	--	--	C
n. New Fuel Crates	4.5	C	C	--	P	--	--	--	C	--
o. Equipment Handling Platform	2	C	C	--	--	R	--	--	--	C
p. RPV-Drywell Head Strong-back	3.1	C	C	--	--		--	--	--	C
q. Fuel Cask Yoke	1.41	C	C	--	P	--	--	--	C	--
r. Hydraulic Tensioner	3.1	C	C	--	P	--	--	--	--	--
s. Dryer-Separator Sling	1.75	C	C	--	--	R	--	--	--	C
t. Load Block	7.2	C	C	--	--	R	--	--	C	C
u. Head Stud Rack	1.5	C	C	--	--	R	--	--	--	C
v. Service Platform	2	C	C	--	--	R	--	--	--	C
2. Turbine Bldg. Crane	110/15	--	--	R	--	--	R	NC	--	--
a. Gen. Wound Rotor	205	C	C	--	--	NC	--	--	--	--

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
b. Gen. Outer End Sect.	44	C	C	--	--	NC	--	--	--	--
c. Gen. Trunnion	8	C	C	--	--	NC	--	--	--	--
d. Gen. Outer Shield (Upper)	10.3	C	C	--	--	NC	--	--	--	--
e. Gen. Outer Shield (Lower)	10.8	C	C	--	--	NC	--	--	--	--
f. Gen. Inner Shield	1	C	C	--	--	NC	--	--	--	--
g. Gen. Terminal Box	10.3	C	C	--	--	NC	--	--	--	--
h. HP Turbine Outer Shell (Upper)	72	C	C	--	--	NC	--	--	--	--
i. HP Turbine Outer Shell (Lower)	68	C	C	--	--	NC	--	--	--	--
j. HP Turbine Rotor	64	C	C	--	--	NC	--	--	--	--
k. LP Turbine Exhaust Hood	63	C	C	--	--	NC	--	--	--	--
l. LP Turbine Inner Casing	60	C	C	--	--	NC	--	--	--	--
m. LP Turbine A-Rotor	144	C	C	--	--	NC	--	--	--	--
n. LP Turbine B-Rotor	149	C	C	--	--	NC	--	--	--	--
o. LP Turbine C-Rotor	153	C	C	--	--	NC	--	--	--	--

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
p. LP Turbine Diaphragm	6	C	C	--	--	NC	--	--	--	--
3. Recirculation Pump MG Hoist	25	--	--	R	--	--	R	--	--	--
a. Motor Rotor	7.63	C	C	--	--	NC	--	--	--	--
b. Motor Bearings	2	C	C	--	--	NC	--	--	--	--
c. Gen. Rotor	7.9	C	C	--	--	NC	--	--	--	--
d. Gen. Bearings	2	C	C	--	--	NC	--	--	--	--
e. Fluid Drive (Dry)	17.5	C	C	--	--	NC	--	--	--	--
f. Fluid Drive (Wet)	21	C	C	--	--	NC	--	--	--	--
4. Pump Structure Crane	35/12	--	--	R	--	--	R	NC	--	--
a. HP SW Pump	3.5	C	C	--	--	NC	--	--	--	--
b. HP SW Pump Motor	3.75	C	C	--	--	NC	--	--	--	--
c. HP SW Pump Base	2	C	C	--	--	NC	--	--	--	--
d. Emergency SW Pump	2.75	C	C	--	--	NC	--	--	--	--
e. Emergency SW Pump Motor	1.5	C	C	--	--	NC	--	--	--	--

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
f. Fire Pump	1.15	C	C	--	--	NC	--	--	--	--
g. Fire Pump Motor	0.6	C	C	--	--	NC	--	--	--	--
h. Fire Pump Diesel Drive	1.6	C	C	--	--	NC	--	--	--	--
i. Circ. Water Pump	17	C	C	--	--	NC	--	--	--	--
j. Circ. Water Pump Motor	18.8	C	C	--	--	NC	--	--	--	--
k. Service Water Pump & Motor	7.6	C	C	--	--	NC	--	--	--	--
5. Recirculation Pump Motor Hoist	24	--	--	R	--	--	R	--	--	--
a. Recirc. Pump Motor	21.5	C	C	--	--	NC	--	--	--	--
b. Recirc. Pump	13.6	C	C	--	--	NC	--	--	--	--
6. CRD Removal Platform Winch Hoist	1	C	C	R	--	--	R	--	--	--
7. CRD Removal Hoist	0.25	C	C	R	--	--	R	--	--	--
8. Equipment Access Lock Removal Hoist	12	--	--	R	--	--	R	--	--	--
a. Hatch Cover	3.5	C	C	--	--	NC	--	--	--	--

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
b. Concrete Shielding Block	0.8	C	C	--	--	NC	--	--	--	--
c. Concrete Plug	0.5	C	C	--	--	NC	--	--	--	--
9. Personnel Lock Hoist	24	--		R	--	--	R	--	--	--
a. Recirc. Pump	13.6	C	C	--	--	NC	--	--	--	--
b. Recirc. Pump Motor	21.5	C	C	--	--	NC	--	--	--	--
c. Air Lock	24	C	C	--	--	NC	--	--	--	--
d. Concrete Shielding	0.8	C	C	--	--	NC	--	--	--	--
e. Concrete Plug	0.5	C	C	--	--	NC	--	--	--	--
10. Torus Equipment Removal Hoist	3	--	--	R	--	--	R	--	--	--
a. Access Hatch	3	C	C	--	--	NC	--	--	--	--
11. 15 Ton Yard Crane	15	--	--	R	--	--	R	--	--	--
a. Misc. Loads	15	C	C	--	--	NC	--	--	--	--
12. Precoat Materials Handling Hoist (Unit 2 only)	0.5	--	--	R	--	--	R	--	--	--

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
a. Misc. Loads	0.5	C	C	--	--	NC	--	--	--	--
13. Emergency Cooling Tower Jib Crane and Hoist	0.5	--	--	R	--	--	R	--	--	--
a. Misc. Loads	0.5	C	C	--	--	NC	--	--	--	--
14. CRD Transport Jib Crane	3	--	--	R	--	--	R	--	--	--
a. Misc. Loads	3	C	C	--	--	NC	--	--	--	--
15. CRD Maintenance Jib Crane	1	C	C	R	--	--	R	--	--	--

2.1.1 Heavy Load Overhead Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee has performed a detailed review and evaluation of load handling systems at Peach Bottom Units 2 and 3 and has determined that the following load handling systems are within the scope of NUREG-0612:

- o reactor building crane
- o turbine building crane
- o recirculation pump motor/generator hoist
- o pump structure crane
- o recirculation pump motor hoist
- o control rod drive (CRD) removal platform winch hoist
- o CRD removal hoist
- o equipment access lock removal hoist
- o personnel lock hoist
- o torus equipment removal hoist
- o 15-ton yard crane
- o precoat material handling hoist (Unit 2 only)
- o emergency cooling tower jib crane and hoist
- o CRD transport jib crane
- o CRD maintenance jib crane.

The remaining load handling systems were eliminated from further consideration under NUREG-0612. These load handling systems and the respective criteria by which they were excluded are as follows:

Criterion A: The crane or hoist is located in a structure which does not contain systems or equipment required for safe shutdown or decay heat removal. Buildings and structures that do not contain systems required for safe shutdown or decay heat removal are the administration building, screen structure, off-gas recombiner building, off-gas filter building,

and off-gas stack. The following handling systems are located in these structures:

- o machine shop crane
- o off-gas filter trolley
- o recombiner building hoist
- o off-gas stack hoist jib crane
- o screen structure trash handling equipment hoist.

Criterion B: No equipment required for safe shutdown or decay heat removal is located in the load path for the crane or hoist. The load path is defined on the load drawings. Equipment in the area was checked against revision 13 of the Q-list and the list of equipment required for safe shutdown contained in FSAR Supplement 2 to determine if the equipment is required for safe shutdown or decay heat removal. The following handling systems are in this category:

- o reactor feed pump crane
- o condensate pump hoist and auxiliary
- o CRD transfer/removal winch
- o condensate demineralizer hoist and auxiliary
- o 5000-lb escapement door lift hoist
- o 2500-lb escapement door lift hoist
- o radwaste building hoist
- o fuel pool filter demineralizer hoist
- o circulating water (CW) pump structure trash handling equipment hoist
- o radwaste building equipment hoist
- o CRD jib crane
- o CRD storage jib crane.

The table provided by the Licensee indicates that irradiated fuel and safety-related equipment at all plant elevations were considered in the evaluation.

In addition, the Licensee states that a mechanical stop that cannot be bypassed has been permanently added to the diesel generator rails, which will protect any safety-related equipment. The diesel generator cranes are only used when the respective diesel generator has been placed out of commission for maintenance or repairs.

b. Evaluation and Conclusion

The Licensee's contention that NUREG-0612 is not applicable to those handling systems identified is consistent with the intent of the NUREG for those reasons indicated.

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 has provided drawings detailing the locations of safe load paths, spent fuel, and safety-related equipment. Operation of the overhead handling systems in question is governed by one or more of the following procedures:

M17.2 - Reactor Building Crane Operation
MA7 - Procedure for Handling Q-Listed Items (Maintenance Division)
CD13.1 - Procedure for Handling Q-Listed Items (Construction Division).

The drawings provided by the Licensee define safe load paths for the movement of heavy loads that 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. A draft administrative procedure (Procedure for the Control of Heavy Loads) stipulates that cognizant supervisors shall "review safe load path drawings and determine if the proposed handling can be performed while avoiding exclusion zones." (An exclusion zone is defined as the area of the reactor vessel or spent fuel pool, or other areas where an accidental drop of the heavy load could damage

irradiated fuel or a safe shutdown system without a redundant system.) The decision for the actual load path rests with the cognizant construction supervisor or maintenance supervisor. Since the draft administrative procedure will be approved by the Plant Operations Review Committee, the authority of the cognizant supervisor in this matter has been vested by this committee.

The Licensee has taken exception to the requirement that safe load paths be marked on the floors. Load movement is directed by a signalman who is responsible for signaling and directing the crane operator along the designated load path specified in the Item Handling Report (IHR).

b. Evaluation

The safe load paths specified by the Licensee meet the intent of Section 5.1.1(1) of NUREG-0612. Since a cognizant supervisor designated by the Plant Operations Review Committee reviews the safe load paths and authorizes any deviations, the PECO approach to handling load path deviations at Peach Bottom Station is consistent with NUREG-0612. Further, the use of dedicated signalmen to guide the crane operator along the load path is an acceptable alternative to load path markings.

c. Conclusion

Peach Bottom Station Units 2 and 3 comply 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

The Licensee has stated that procedures governing the movement of heavy loads handled by NUREG-0612 load handling systems include:

A - Procedure for Control of Heavy Loads
M17.2 - Reactor Building Crane Operation
MA7 - Procedure for Handling Q-Listed Items (Maintenance Division)
CD13.1 - Procedure for Handling Q-Listed Items (Construction Division).

Administrative Procedure 'A' generically addresses load handling by those load handling systems subject to the general guidelines of NUREG-0612. Procedures MA7 and CD13.1 provide specific details and methods of implementation to be used by maintenance and construction divisions.

Procedures MA7 and CD13.1 classify handling activities into one of three categories based on ANSI N45.2.2-1972 (Packaging, Shipping, Receiving and Handling of Items for Nuclear Power Plants):

Category A: Load requires specially selected equipment and detailed procedures for handling operations because of large size and weight. Examples of items that may be assigned to this category are:

- reactor vessels
- steam generators
- major components of reactor vessel internals
- spent fuel casks.

Category B: Load is handled with conventional handling equipment but requires detailed procedures because of weight, size, susceptibility to shock damage, high nil-ductility transition temperature, or any similiar conditions. Examples of items that may be assigned to this category are:

- primary and intermediate coolant pumps and their internals
- safety-related instrument cabinets and control boards
- control rod drive mechanisms
- fuel handling equipment
- purification equipment
- fuel

- o core components (small)
- o reactor vessel head.

Category C: Load is handled with conventional equipment using standard rigging practice. Construction and permanent plant materials not included in Categories A or B are included in this category.

When the cognizant supervisor has determined that Administrative Procedure 'A' shall be invoked, an IHR shall be prepared which includes:

- o sketch of the proposed rigging arrangement
- o size of the rigging tools to be used
- o specific lift points
- o center of gravity of the item
- o size, length, and angle of all chokers, slings, and chain hoists.

For Category 'A' items, separate detailed procedures will be prepared. For Category 'B' items, special handling instructions will be specified with the IHR.

b. Evaluation

The procedures referenced in, and provided with, the Licensee's response appear to provide the protection against load handling accidents intended by Guideline 2 of NUREG-0612. Administrative Procedure 'A' provides the overall controls intended by Section 5.1.1(2) of NUREG-0612. Each lift requires a unique IHR with specific load handling instructions. The IHR is reviewed and approved by the cognizant supervisor authorized by the Plant Operations Review Committee. The specific division procedures provide additional details for the handling of specific loads by classifying the loads into different categories.

c. Conclusion

Peach Bottom Units 2 and 3 comply 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' [8]."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that procedures MA20, CD2.1, and CD10.2 describe operator training, qualification, and conduct. Although no exceptions are taken to ANSI B30.2-1976, procedures do not presently invoke the standard. However, revisions have been initiated to rectify this matter. Steps have been taken to ensure that crane operators meet ANSI B30.2-1976 requirements.

b. Evaluation

When revised, PECO's procedures for crane operator training, qualification, and conduct will satisfy Guideline 3 of NUREG-0612 on the basis of the Licensee's verification that the program will be based on ANSI B30.2-1976. However, it should be noted that MA20, CD2.1, and CD10.2 apply primarily to personnel indoctrination and rigger training. Consequently, significant revisions will be necessary to meet the ANSI B30.2-1976 training, qualification, and conduct requirements for crane operators.

c. Conclusion and Recommendations

Peach Bottom Units 2 and 3 will comply with Guideline 3 when crane operator training, qualification, and conduct requirements are revised to satisfy the requirements of ANSI B30.2-1976.

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' [7]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device."

a. Summary of Licensee Statements and Conclusions

The following special lifting devices are used at Peach Bottom Units 2 and 3:

- o reactor pressure vessel (RPV) drywell head strongback
- o fuel cask yoke
- o hydraulic tensioner strongback
- o dryer/separator sling (with hook box)
- o service platform sling
- o Type 1 dryer/separator pool plug lifting device
- o spent fuel grapple
- o fuel pool gates lifting device.

The Licensee states that, for a limited number of those lifting devices identified, it may not be possible to meet completely the requirements of ANSI N14.6-1978. Detailed analyses have been performed for each of these devices and were provided for review in Reference 7. Several devices, including the RPV head strongback, the steam dryer/separator sling assembly, the service platform lifting rings, and the Unit 2 hydraulic tensioner, do not fully meet the guidelines of NUREG-0612. The modification process has been initiated to bring the equipment into compliance with the applicable sections of the standards.

Shipping cask yokes are supplied by the spent fuel cask supplier and will be addressed on a case-by-case basis using ANSI N14.6-1978.

For the service platform sling and fuel pool gate lifting device, the Licensee states that the vendor has been requested to evaluate these devices for compliance. The spent fuel grapple is excluded from compliance since failure of the device will not exceed the consequences of a fuel bundle drop. Regarding the steam dryer/separator pool plug lifting device, the Licensee states that the device is being modified and upgraded to be in compliance with NUREG-0612 and ANSI N14.6-1978.

b. Evaluation

Design reviews performed by the Licensee indicate that the design of several of the special lifting devices satisfy the stress design factors of NUREG-0612 and ANSI N14.6-1978, including the following: the RPV insulation removal lifting device, the fuel pool gate lifting device, and the Unit 3 hydraulic tensioner. Modification of remaining lifting devices in accordance with vendor recommendations is in progress and, when complete, should satisfy ANSI design criteria for these lifting devices. Proposed Licensee action regarding shipping cask yokes is consistent with the intent of this guideline.

The intent of this guideline, in addition to verifying the design adequacy of these lifting devices, is also to ensure that they are tested, inspected, and maintained in a manner which assures their continued reliability. Guidelines for such a program are contained in Section 5 of ANSI N14.6-1978. No information has been provided by the Licensee addressing such a program, including provisions for an initial load test and subsequent annual inspections (i.e., load tests or nondestructive examinations). The brief program of special lifting device inspections outlined in Administrative Procedure 'A' is insufficient to satisfy these requirements.

c. Conclusion and Recommendations

Peach Bottom Units 2 and 3 partially comply with Guideline 4 of NUREG-0612. To comply fully, the Licensee should perform the following:

1. Complete the design and structural modifications recommended by GE for the individual lifting devices.

2. Implement a continuing compliance testing program in accordance with Section 5 of ANSI N14.6-1978.

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 guidelines of ANSI B30.9-1971, 'Slings' [8]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the

sling should be in terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

a. Summary of Licensee Statements and Conclusions

All slings used at Peach Bottom Units 2 and 3 to handle components of Q-listed systems by the Construction Division will meet the requirements of ANSI N45.2.2-1972 (packaging, receiving, storage, and shipping). The Maintenance Division is in the process of upgrading all slings to the level of ANSI N45.2.2-1972. In addition, the Licensee has stated that slings used on the refueling floor comply with ANSI B30.9-1971 and that sling selection will include both static and dynamic loading. Procedures will be modified to invoke the requirements of ANSI B30.9-1971 for sling inspection, replacement, and safe operating practices.

b. Evaluation

Slings used on the refueling floor at Peach Bottom Units 2 and 3 meet the intent of Section 5.1.1(5) of NUREG-0612 based on compliance to ANSI B30.9-1971. However, slings used with load handling systems subject to NUREG-0612 which are not located on the refueling floor comply with ANSI N45.2.2-1972. ANSI N45.2.2-1972 is not an adequate substitute for ANSI B30.9-1971. Therefore, the Licensee should implement procedures for those slings used to handle heavy loads in other areas similar to those implemented for slings on the refueling floor.

c. Conclusion and Recommendations

Peach Bottom Units 2 and 3 will comply with Guideline 5 of NUREG-0612 for slings used on the refueling floor when procedural modifications have been completed. Slings used in other areas do not comply with this guideline. In order to comply fully, the Licensee should ensure that the selection, maintenance, and use of slings used to handle heavy loads comply with Guideline 5.

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

The Licensee has stated that current maintenance procedures covering crane inspection, testing, and maintenance are based on ANSI B30.2-1967, which PECO believes to satisfy the NRC's requirements for equivalence to ANSI B30.2-1976.

b. Evaluation

The Licensee's evaluation of crane inspection, testing, and maintenance at Peach Bottom Units 2 and 3 is generally consistent with the requirements of this guideline. Only one significant change was noted which should be incorporated into the present crane inspection program: Paragraph 2-2.3.3, "Adjustments and Repairs," item d, requires that "if repairs of load sustaining members are made by welding, identification of materials shall be made and appropriate welding procedures shall be followed."

Other changes to Section 2-2 in the 1976 version do not directly affect the load handling reliability of the handling system. In fact, in several cases, the 1976 version inspection requirements are less restrictive than those required by ANSI B30.2-1967. Since this review is intended to establish a baseline for compliance for crane systems, the Licensee should consider review of current procedures to incorporate changes contained in ANSI B30.2-1976.

c. Conclusion

Contingent upon revising current procedures to include a requirement comparable to paragraph 2-2.3.3 of ANSI B30.2-1976, PECO complies with Guideline 6 of NUREG-0612 at Peach Bottom Units 2 and 3.

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' [8]. 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 has stated that the procurement specifications for the reactor building cranes, turbine building cranes, and the pump structure crane stipulate compliance with the requirements of EOCI-61 [9]. At the time of manufacture of the above cranes, EOCI-61 was the accepted standard for crane design. As such, the Licensee considers EOCI-61 to be in compliance with the intent of CMAA-70.

The Licensee also stated that the procurement documents for the above cranes did not specifically require compliance with ANSI standards. However, a review of the procurement documents indicates that the crane specifications exceed the scope of the mandatory safety features required by ANSI B30.2-1967. The Licensee believes that ANSI B30.2-1967 complies with the NRC requirement for equivalence to ANSI B30.2-1976.

Further, the Licensee has stated that the turbine building cranes and the pump structure crane do not require compliance with CMAA-70 because these cranes will be modified to restrict the carrying of heavy loads over safety-related items required for safe shutdown. The addition of electrical interlocks (area travel limit switch with a key override) to the turbine and pump structure cranes, supplemented by procedures and load paths, will provide adequate protection to the safety-related items that may be damaged by a load drop.

Since CMAA-70 and B30.2-1976 apply to top-running overhead bridge and gantry cranes, the balance of the cranes listed in Section 2.1.1 of this report are not covered by these specifications. In addition, the miscellaneous cranes and hoists purchased for Peach Bottom Units 2 and 3 were industry standard hoists and monorails required to comply with portions of EOCI-61.

b. Evaluation

An independent review of the crane design data provided in References 5 and 7 indicates that the reactor building crane meets the intent of Section 5.1.1(7) of NUREG-0612.

Although the Licensee states that procurement documents indicate compliance with ANSI B30.2-1967, it is not agreed that chapter 2-1 of ANSI B30.2-1967 is equivalent to the 1976 version. Several paragraphs have been added which may directly affect the load handling reliability of these cranes, including the following revised requirements:

1. Paragraph 2-1.8.3 'Trolley Bumpers' - details the energy absorbing characteristics of these bumpers.

2. Paragraph 2-1.9.5 'Trolley and Bridge Brake Means' - specifies requirements for service, emergency, and parking brakes.

3. Paragraph 2-1.11.2 'Ropes' - specifies total load to include rated load and load block weights in determining rope breaking strength.

The Licensee should evaluate existing crane design with these added requirements to demonstrate compliance with ANSI B30.2-1976.

Exclusion of the turbine building cranes and the pump structure crane from compliance with Section 5.1.1(7) of NUREG-0612 is not consistent with the objectives of NUREG-0612. While the use of travel limit switches with key override may be adequate rationale for exclusion from the single-failure-proof criteria of Phase II, this logic is not adequate justification for exclusion from the safe load handling practices specified in the general guidelines in Section 5.1.1 of NUREG-0612. Therefore, the Licensee should perform a comparison of those items affecting load-handling reliability as noted in the previous evaluation submitted to the Licensee.

c. Conclusion and Recommendations

Peach Bottom Units 2 and 3 partially comply with Guideline 7 of NUREG-0612. In order to fully comply, the Licensee should verify by comparison that the designs of the turbine building and pump structure cranes are comparable to the criteria of CMAA-70 and ANSI B30.2-1976 relative to crane safety and reliability.

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 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 encompass the following criteria:

1. Heavy load technical specifications
2. Special review for heavy loads handled over the core.

The Licensee's implementation of these interim protection measures is summarized and evaluated in the succeeding paragraphs of this section.

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

"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. Evaluation

Although the Licensee did not make a specific statement regarding Interim Protection Measure 1, Special Precaution 2 of Procedure M17.2 (Reactor Building Crane Operation) states the following:

> "Loads of 1000 lbs or greater shall not be moved over fuel assemblies in the fuel pool at any time, per Tech. Spec. 3.10.D."

b. Conclusion

Peach Bottom Units 2 and 3 comply with Interim Protection Measure 1 based on the limitations contained in Technical Specification 3.10.D.

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

> "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 the Licensee's statements and conclusions are contained in discussions of the respective 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 of the respective general guidelines in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7.

2.2.3 Special Reviews for Heavy Loads Over the Core [Interim Protection Measure 6, NUREG-0612, Section 5.3(1)]

> "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 or 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 reviews recommended by Interim Protection Measure 6 were completed prior to May 15, 1981.

b. Evaluation, Conclusion, and Recommendations

Peach Bottom Units 2 and 3 comply 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 Peach Bottom Units 2 and 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 Peach Bottom Units 2 and 3 can be expected to be conducted in a highly reliable manner consistent with the staff's objectives as expressed in these guidelines. A need for further Licensee action, however, was identified in the following areas:

- PECO should upgrade special lifting devices to be consistent with the criteria of ANSI N14.6-1978. This program should include implementation of design modifications recommended in the design analysis performed by GE, as well as implementation of a continuing compliance testing program which complies with Section 5 of ANSI N14.6-1978 to ensure continued reliability of these special lifting devices.

- PECO should ensure that the selection, maintenance, and use of slings used to handle heavy loads in the vicinity of safe shutdown decay heat

removal equipment or irradiated fuel comply with Guideline 5. (This recommendation is satisfied for slings used on the refueling floor.)

- PECO should conduct an assessment of the turbine building and pump structure cranes to verify that their designs are comparable to the criteria of CMAA-70 and ANSI B30.2-1976 relative to crane safety and reliability.

3.2 INTERIM PROTECTION MEASURES

The NRC staff has established in NUREG-0612, Section 5.3, certain measures 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. Peach Bottom Units 2 and 3 have satisfactorily completed the interim protection measures.

4. REFERENCES

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

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
   Letter to Philadelphia Electric Company. Subject: NRC Request for Additional Information on Control of Heavy Loads Near Spent Fuel
   22 December 1980

4. S. L. Daltroff (PECO)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads at Peach Bottom Atomic Power Station
   18 June 1981

5. S. L. Daltroff (PECO)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads at Peach Bottom Atomic Power Station
   22 December 1981

6. S. L. Daltroff (PECO)
   Letter to J. F. Stolz (NRC)
   Subject: Control of Heavy Loads
   20 May 1982

7. S. L. Daltroff (PECO)
   Letter to J. F. Stolz (NRC)
   Subject: Control of Heavy Loads
   25 October 1982

8. "Overhead and Gantry Cranes"
   New York: American National Standards Institute, 1976
   ANSI B30.2-1976

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

10. "Specifications for Electric Overhead Traveling Cranes"
    Pittsburgh, PA: Crane Manufacturers Association of America, 1975
    CMAA-70

11. "Specifications for Electric Overhead Traveling Cranes"
Pittsburgh, PA: Electric Overhead Crane Institute, 1961
ECCI-61

ENCLOSURE

SYNOPSIS OF ISSUES ASSOCIATED WITH NUREG 0612

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

GUIDELINE 1 SAFE LOAD PATHS

Exception 1

In the opinion of the licensee, development of individual load paths is impractical since there are a significant number of loads for which the pickup and laydown areas vary from outage to outage. Further, in some cases the location of safety related equipment combined with the design of the floor over which heavy loads are carried indicates that for a number of lifts there is no preferred load path.

Discussion

The purpose of this portion of Guideline 1 is to ensure that the paths over which heavy loads are carried have been developed and approved in advance of the lift and are based on considerations of safety. In particular it is provided to avoid the ad hoc selection of load paths by maintenance personnel since such a situation could result in the use of a load path which has been established by a process wherein considerations other than safety have taken precedence.

It is recognized that there are a class of loads which, although in excess of the weight specified for classification as a heavy load, are actually miscellaneous or maintenance related loads for which it is impractical to identify a specific laydown area which can be fixed from outage to outage. Conversely there are a number of loads for which specific laydown areas have been allocated in the original plant design and which should reasonably be expected to be carried over the same load paths during every outage. A tabulation of loads in this latter category, generally applicable to PWR's and BWR's, was provided in NUREG 0612 as Table 3-1.

A fundamental principal of NUREG 0612 is protection through defense in depth. Specifically, the first line of protection from an accident which could result in damage to spent fuel or equipment required for safe shutdown or decay heat removal is to avoid or minimize the exposure of such equipment to crane borne loads overhead. Where such exposure is minimized, rather than avoided, a second line of defense can then be provided by intervening barriers such as floors or the provision of additional lifting device redundancy or safety factors. Considering the foregoing, the use of exclusion areas, rather than safe load paths, is consistent with this 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.

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.

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.