TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

BALTIMORE GAS AND ELECTRIC CO.

CALVERT CLIFFS NUCLEAR POWER PLANTS UNITS 1 AND 2

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

1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report documents an independent review of general load handling policy and procedures at Baltimore Gas and Electric Co.'s (BG&E) Calvert Cliffs Nuclear Power Plant Units 1 and 2. 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 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'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 provided to control the handling of heavy loads, the staff developed a series of guidelines designed to achieve a two-part objective using an accepted approach or protection philosophy. The first part 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 so that their probability of failure is uniformly small and appropriate for the critical tasks in which they are employed. The second part 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:

1. 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

2. 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 BG&E, the Licensee for Calvert Cliffs Nuclear Power Plant, requesting that the Licensee review provisions for handling and control of heavy loads at the Calvert Cliffs plant, 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. BG&E responded to this request on June 25, 1981 [4], January 4, 1982 [5], February 26, 1982 [6], and March 1, 1982 [7].

Based on References 4 through 7, a draft Technical Evaluation Report (TER) was prepared and informally transmitted to the Licensee. Following a conference call on June 6, 1982, a meeting was held on October 25, 1982, involving the evaluators and representatives of the NRC, BG&E, and Bechtel Corporation to discuss unresolved issues in the draft TER. In response to the draft TER and to this meeting, BG&E provided additional information in submittals dated August 2, 1982 [8] and January 25, 1983 [9]. References 4 through 9 have been incorporated into this final technical evaluation.

2. EVALUATION

This section presents a point-by-point evaluation of load handling provisions at the Calvert Cliffs plant 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 followed 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 by all overhead handling systems and programs in order to handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool, or in other areas where a load drop may damage safe shutdown systems. The Licensee's verification of the extent to which these guidelines have been satisfied and an independent evaluation of this verification are contained in the succeeding paragraphs.

Table 2.1. Calvert Cliffs Nuclear Power Plant/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. Polar Crane	180/25	--	--	C	--	--	C	C	--	C
Neutron Shield	5	C	C	--	--	C	--	--	--	C
PAR Device and Hoist	2.75	C	C	--	P	--	--	--	--	C
Main Hoist Load Block	4.5	C	C	--	--	--	--	--	--	C
Reactor Cavity Seal Ring	6	C	C	--	P	--	--	--	--	C
RCP Motor	45.2	C	C	--	--	C	--	--	--	C
Reactor Vessel Head	90	C	C	--	P	--	--	--	--	C
RVH Lift Rig	9.1	C	C	--	P	--	--	--	--	C
RV Stud Tensioners	1.1	C	C	--	--	--	--	--	--	C
ICI Removal Tool	3.8	C	C	--	--	C	--	--	--	C
Refueling Pool Stairs	4	C	C	--	--	C	--	--	--	C
Upper Guide Structure and Lift Rig	58	C	C	--	P	C	--	--	--	C
Core Support Barrel and Lift Rig	132	C	C	--	P	--	--	--	--	C

C = Licensee action complies with NUREG-0612 Guideline.
-- = Not applicable.
P = Licensee information indicates partial compliance 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
2. Spent Fuel Cask Crane	150/15	--	--	C	--	--	C	C	C	--
Irradiated Specimen Cask	5	C	C	--	P	--	--	--	--	--
Spent Fuel Shipping Cask	10	C	C	--	P	--	--	--	--	--
New Fuel Shipping Cont.	3	C	C	--	--	C	--	--	--	--
Spent Fuel Divider Gate	1.6	C	C	--	--	C	--	--	--	--
CE Superstand (U)	4	C	C	--	P	--	--	--	--	--
CE Superstand (L)	7	C	C	--	P	--	--	--	--	--
3. Turbine Bldg. Main Crane	200/25	--	--	C	--	--	C	C	--	--
Generator Rotor	175	C	C	--	--	C	--	--	--	--
HP Turbine Rotor	56	C	C	--	--	C	--	--	--	--
Casing	88	C	C	--	--	C	--	--	--	--
LP Turbine Rotor	130	C	C	--	--	C	--	--	--	--
4. Turbine Bldg. Aux. Crane	40/10	--	--	C	--	--	C	C	--	--
5. Intake Structure Semi-Gantry Crane	35/10	--	--	C	--	--	C	C	--	--
Load Block	0.9	C	C	--	--	C	--	--	--	--
Roof Hatch Covers	4.5	C	C	--	--	C	--	--	--	--

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
CW Pump (Total)	35	C	C	--	--	C	--	--	--	--
Salt Water Pump	4	C	C	--	--	C	--	--	--	--
Salt Water Pump Motor	4.2	C	C	--	--	C	--	--	--	--
6. Transfer Machine Jib Crane	6	--	--	C	--	--	C	C	--	--
Spent Fuel Transfer Carriage	6	C	C	--	P	--	--	--	--	--
7. Filter Cask Monorail	7.5	--	--	C	--	--	C	C	--	--
Filter Cask	5	C	C	--	P	--	--	--	--	--
Resin Cask	20	C	C	--	P	--	--	--	--	--
Filter Hatch Floor Plugs	6	C	C	--	--	C	--	--	--	--
8. Solid Waste Disp. Trolley Hoist	40	--	--	C	--	--	C	C	--	--
Resin Cask	40	C	C	--	P	--	--	--	--	--
9. D.G. Room Monorail	5	--	--	C	--	--	C	C	--	--
Engine Head	5	C	C	--	P	C	--	--	--	--
Upper Crankshaft	--	C	C	--	P	C	--	--	--	--
10. Main Steam Room Monorails	3/1	--	--	C	--	--	C	C	--	--
MSIV Cylinder Module	7	C	C	--	--	C	--	--	--	--
MSIV Yoke	1.2	C	C	--	--	C	--	--	--	--

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity, (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
11. Machine Shop Monorail	5	--	--	C	--	--	C	C	--	--
12. Cont. Equip. Hatch Hoist	15	--	--	C	--	--	C	C	--	--
13. CE Bay Jib Crane	5	--	--	C	--	--	C	C	--	--
14. CE Bay Beam Crane	3	--	--	C	--	--	C	C	--	--
15. Component Cooling Room Hoist	1	--	--	C	--	--	C	C	--	--
16. SWGR Room Monorail Hoist	10	--	--	C	--	--	C	C	--	--

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee has evaluated the load handling systems at Calvert Cliffs plant and concluded that the following systems should be subject to the general guidelines of NUREG-0612:

- o Polar crane
- o Spent fuel cask crane
- o Intake structure semi-gantry crane
- o Transfer machine jib crane.

The following overhead handling systems have been excluded from NUREG-0612 because (1) lift points and safe shutdown equipment are sufficiently separated or (2) the largest load lifted is not a heavy load.

1. Sufficient separation:

Chlorine house monorail
Condensate demineralizer area monorail
Condenser waterbox removal monorail
Vertical lifting rail
Hot machine shop crane
Decontamination room hoist
Turbine building main crane
Turbine building auxiliary crane
Filter cask monorail
Solid waste disposal trolley hoist
Diesel generator room monorail
Main steam room monorails
Containment equipment hatch hoist
Containment equipment bay jib crane
Component cooling room hoist
Switch gear room monorail hoist

2. Capacity less than a heavy load:

Reactor head stud handling jib crane
Spent fuel pool jib crane.

b. Evaluation and Conclusion

The Licensee's evaluation of those overhead handling systems subject to compliance with the general guidelines is consistent with NUREG-0612 criteria. Suitable justification has been provided to exclude remaining

cranes on the basis of (1) physical separation between lift points and safe shutdown equipment or (2) a hoist capacity less than that of a heavy load.

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

General arrangement drawings have been provided which identify load paths for heavy load movements. Drawings of these load paths are attached to the controlling procedures for review prior to and during load movement. Crane operators and signalmen are made aware of the requirements of load paths during operator training. Operators and signalmen are required to sign off the appropriate procedure prior to a lift to indicate that paths have been reviewed. If a deviation from a defined load path is necessary, current procedures call for an engineering review to be forwarded to the Plant Operations and Safety Review Committee for review before the deviation can be allowed. The Licensee states that use of equipment landmarks as indicated on the load path drawings is preferable to marking load paths on the floor, and further notes that training of handling systems operators will be an important factor in ensuring adherence to safe load paths.

b. Evaluation

The Licensee's submittal in response to Phase I suitably identified safe load paths for heavy loads at Calvert Cliffs Units 1 and 2. Although safe load paths are not marked at the Calvert Cliffs plant, the objective of providing a visual aid for operators is accomplished by using signalmen to guide the operators. However, the duties of these signalmen with regard to

safe load handling should be clearly defined (i.e., ensure that the load path is clear prior to the start of the lift) in appropriate procedures. Deviations from existing procedures are acceptably managed at the Calvert Cliffs plant.

c. Conclusion and Recommendation

Contingent upon the Licensee acceptably demonstrating that the duties of load handling signalmen are clearly defined, it is concluded that Calvert Cliffs Units 1 and 2 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

Procedures for individual loads have been identified (e.g., RV-7, 8 - Reactor vessel head/shroud; RCS-1, 2 - Reactor coolant pump motor), and Calvert Cliffs Instruction CCI-201A provides additional guidelines for crane operation and inspection reports. Procedures now in effect at both Units 1 and 2 comply with NUREG-0612 and referenced standards. For loads which are not covered by an applicable procedure, the Licensee has agreed to make a written procedure available before allowing the lifting of these loads.

b. Evaluation

From the information provided, it is noted that lifting procedures have been identified for the majority of heavy loads. These procedures, now in effect, satisfy the requirements of NUREG-0612. The review also indicates that several loads are not now covered by a written procedure, but the Licensee has agreed to prepare written procedures prior to lifting such loads.

c. Conclusion

Calvert Cliffs Nuclear Power Plant Units 1 and 2 comply with Guideline 2 on the basis of the Licensee's verification that written load handling procedures either currently exist or will be prepared for all critical heavy loads subject to compliance with 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

CCI-210A has been instituted to establish guidelines for crane operator training. This procedure ensures the training of all crane operators in accordance with ANSI B30.2-1976 in its entirety.

b. Evaluation

Crane operator training and qualification programs at the Calvert Cliffs plant satisfy the criteria of this guideline on the basis of the Licensee's verification of compliance with ANSI B30.2-1976.

c. Conclusion

Calvert Cliffs Nuclear Power Plant Units 1 and 2 comply with this guideline.

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' [12]. 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 [NUREG-0612, Guideline 5.1.1(4)]."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that special lifting devices used at the Calvert Cliffs plant were designed and fabricated prior to the issuance of ANSI N14.6-1978, but were designed using accepted engineering practices and welding procedures according to design drawings. Special lifting devices used at the Calvert Cliffs plant include:

- o reactor vessel head lift rig
- o upper guide structure lift rig
- o upper/lower superstand lift rig
- o spent fuel cask yoke.

The spent fuel cask yoke and upper/lower stand lift rig are certified by the vendors to meet ANSI N14.6. Slings and spreader beams designated for a specific device were reviewed and verified to meet ANSI B30.9-1971 and ANSI N14.6-1978 design criteria.

The reactor vessel head lift rig and the upper guide structure lift rig were evaluated to determine compliance with ANSI N14.6. In this evaluation, dynamic load factors of 1.5 and 1.3, respectively, were used, and the results demonstrated that the stress design factors of these lifting devices satisfy the ANSI requirements. Further, these lifting devices have been tested to 125% of the design load prior to initial use.

The Licensee states that a nondestructive examination (NDE) program has been implemented. This program requires periodic liquid penetrant examination of the lifting shackles in accordance with ANSI N14.6-1978, Section 5.3.1(2). These shackles are the single load transmitting element between the crane hook and the lifting devices and, as such, are considered to be the "weakest link" in each of the lifting devices. Further, requirements for both pre-use visual inspection for gross structural integrity and a detailed inspection following mishandling of any device are addressed in plant procedures. The Licensee

concluded that the inspection program ensures continued reliability of these lifting devices without having to perform periodic load testing.

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 lift rig and the upper guide structure lift rig, it is evident that these devices will provide a high-degree-of-load handling reliability. The Licensee has verified that all devices satisfy the recommended stress design margins of 3 on yield strength and 5 on ultimate strength, inclusive of dynamic load considerations. Further, the initial load testing of the two devices to 125% of the design load sufficiently stressed the devices to provide an adequate guarantee of the devices' structural integrity.

The Licensee takes exception to periodic performance of load testing. It is noted that ANSI N14.6-1978 provides acceptable alternatives to periodic load tests if an initial acceptance load test has been satisfactorily performed; the owner may opt to perform an annual (or prior-to-use, depending on frequency of use) series of inspections in accordance with Section 5.3.1(2) of the ANSI standard. In this regard, the Licensee has implemented performance of visual inspections and limited NDE prior to each use of the lifting devices and is of the opinion that such an inspection program is adequate. The proposed continuing inspection program of visual examination for gross structural defects and periodic surface examination of a "weakest link" is questioned on two counts.

- A surface examination of a single load transmitting element, such as the lifting shackle, in lieu of such examination for additional connected members is reasonable only if it is evaluated as the "weakest link" on the basis of design margins or degradation (e.g., wear) and not on the basis of location, as seems to be implied in the Licensee response.

- The proposed approach does not account for tension load bearing welds. Considering the cyclic nature of stresses in these special lifting devices, the periodic surface examination of load bearing welds required by ANSI N14.6-1978 in the absence of periodic overload

tests seems prudent. While it can be agreed that the limited use made of these devices does not necessitate an annual 100% inspection of these welds, we cannot conclude that they may be ignored. A periodic inspection program which provides for the surface examination of these welds, possibly similar to that provided for in the Boiler and Pressure Vessel Code for Class 2 supports, would be appropriate.

It is recommended that the Licensee review the requirements for dimensional and NDE testing of the upper/lower superstand lift rigs and the spent fuel cask yoke and modify their inspection program accordingly.

c. Conclusion and Recommendation

Calvert Cliffs Units 1 and 2 substantially comply with Guideline 4. To fully comply, the Licensee should perform the following:

- o verify that the selection of the weakest link is based upon design margins or expected degradation, or implement a program of periodic inspections of all load bearing welds located on these special lifting devices.

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' [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' that 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

A program for material handling equipment maintenance, inspection, and testing (CCI-219A) was instituted in early 1980 for Calvert Cliffs Units 1 and 2 and is in compliance with ANSI B30.9-1971. The Licensee stated that all slings were purchased from reliable vendors who sell products manufactured in accordance with industry standards, including OSHA 1910.184. This ensures that the requirement of a factor of safety of 5 for slings is met. Further,

as inventory is replaced, manufacturer-certified factors of safety will be obtained as a matter of policy and in accordance with plant procedures. At present, newly purchased lifting devices are attended by a certificate of compliance of the design load to specified requirements of ANSI B30.9-1971. The Licensee stated that the maximum impact for all load handling systems under the scope of NUREG-0612 is less than or equal to 10%, thereby minimizing the effect of dynamic loading on the design factor of safety. A formal inspection program and the training of riggers has been implemented.

b. Evaluation

Since slings used at the Calvert Cliffs plant are procured to ANSI B30.9-1971 standards, and since a formal sling inspection program has been implemented, sling usage at the Calvert-Cliffs plant meets the intent of Section 5.1.1(5) of NUREG-0612. On the basis of information provided by the Licensee, hoist speeds are relatively slow and dynamic loads are therefore a reasonably small percentage of the overall static load and may be disregarded.

c. Conclusion

Calvert Cliffs Units 1 and 2 comply with Guideline 5 based on the Licensee's verification.

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 when 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, tests, and maintenance should be performed prior to their use)."

a. Summary of Licensee Statements and Conclusions

The Licensee is committed to implement ANSI B30.2-1976 and has completed this review and comparison of existing inspection, testing, and maintenance procedures with this standard. CCI-219A, which outlines the necessary inspection, testing, and maintenance requirement intervals, has been established. Although some overhead handling systems have been identified as a result of the NUREG-0612 review which will require development of specific inspection, testing, and maintenance procedures, these systems are now included within the scope of CCI-219A which requires such procedures.

b. Evaluation

The Calvert Cliffs plant satisfies the requirements of this guideline on the basis that existing procedures have been reviewed for compliance with ANSI B30.2-1976. In addition, the Licensee has made a commitment to comply with those handling systems which have been included as required by this review of NUREG-0612.

c. Conclusion

Calvert Cliffs Nuclear Power Plant complies with Guideline 6.

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

"The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' and of CMAA-70, 'Specifications for Electric Overhead Travelling 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 Calvert Cliffs overhead cranes were purchased using the Electric Overhead Crane Institute's Specification Number 61 (EOCI-61), design codes of the American Institute of Steel Construction (AISC) and the American Welding Society (AWS), and American Society for Testing and Materials (ASTM) specifications. As a minimum, structural design is in accordance with EOCI-61

except where governed by more restrictive requirements. Structural members not covered by EOCI-61 were designed and fabricated with standard AISC codes and specifications. The Licensee also notes that CMAA-70 is a revision of EOCI-61 and that the most significant difference between the two standards relates to an increase in impact factor. The Licensee has completed detailed structural, electrical, and mechanical analyses of the overhead cranes. No significant deviations were revealed by this review that would necessitate further action to ensure adherence to NUREG-0612.

b. Evaluation

The designs of the reactor building polar crane, turbine building main and auxiliary cranes, spent fuel crane, and intake structure crane at the Calvert Cliffs plant meet the intent of Section 5.1.1(7) of NUREG-0612 on the basis of the point-by-point review of CMAA-70 and ANSI B30.2 provided by the Licensee. As indicated by the Licensee, the cranes substantially comply with CMAA-70 criteria. Several areas of the design, however, were noted not to be in verbatim compliance. For each of those areas, the Licensee has provided reasonable justification to conclude that these differences will not affect the cranes' ability to safely handle heavy loads.

c. Conclusions and Recommendations

The Calvert Cliffs plant load handling systems subject to NUREG-0612 comply with Guideline 7.

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 cover the following criteria:

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

Licensee implementation and evaluation of these interim protection measures are contained 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 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 [of NUREG-0612]."

a. Evaluation

A review of Calvert Cliffs Nuclear Power Plant technical specifications indicates that Specification 3.9.7 prohibits movement of loads greater than 1600 lb (the weight of a fuel rod and combined element assembly) over irradiated fuel in the spent fuel pool.

b. Conclusion

The Calvert Cliffs Nuclear Power Plant complies with Interim Protection Measure 1.

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. Evaluation

The specific requirements for load handling administrative controls are contained in NUREG-0612, Section 5.1.1, Guidelines 1, 2, 3, and 6. The Licensee's compliance with these guidelines has been evaluated in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7, respectively, of this report.

b. Conclusions and Recommendations

Conclusions and recommendations concerning the Licensee's compliance with these administrative controls are contained in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7 of this report.

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

"...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 operation, and content of procedures."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that a special review of load handling over the core has been completed.

b. Evaluation and Conclusion

Calvert Cliffs Units 1 and 2 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 the Calvert Cliffs Nuclear Power Plant Units 1 and 2. Overall conclusions and recommended Licensee actions, where appropriate, are provided with respect to both general provisions for load handling (NUREG-0612, Section 5.1.5) 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 the Calvert Cliffs plant are conducted in a highly reliable manner consistent with the staff's objectives as expressed in these guidelines.

In only one area was a need for further action by the Licensee indicated.

- BG&E should implement a program of periodic nondestructive examination of load bearing welds in special lifting devices.

3.2 INTERIM PROTECTION

The NRC staff has established (NUREG-0612, Section 5.3) that certain measures should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until final implementation of the general guidelines of NUREG-0612, 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.I; a review of load handling procedures and operator training; and a visual inspection program, including component repair or replacement as necessary of cranes, slings, and special lifting devices to eliminate deficiencies that could lead to component failure. An evaluation of the information provided indicates that the Licensee substantially complies with the staff's measures for interim protection.

4. REFERENCES

1. NRC
   "Control of Heavy Loads at Nuclear Power Plants"
   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-78

3. D. G. Eisenhut (NRC)
   Letter to all operating reactors
   Subject: Control of Heavy Loads
   22-Dec-80

4. A. E. Lundvall (BG&E)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   25-Jun-81

5. A. E. Lundvall (BG&E)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   4-Jan-82

6. R. F. Ash (BG&E)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   26-Feb-82

7. A. E. Lundvall (BG&E)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   1-Mar-82

8. R. F. Ash (BG&E)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   2-Aug-82

9. R. F. Ash (BG&E)
   Letter to D. G. Eisenhut (NRC)
   Subject: Control of Heavy Loads
   25-Jan-83

10. American National Standards Institute
"Overhead and Gantry Cranes"
ANSI B30.2-1976

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

12. American National Standards Institute
"Slings"
ANSI B30.9-1971

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