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TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION 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. D. J. Vito 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 Virginia Electric and Power Company's (VEPCO) Surry Power Station 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 assure 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.

The approach used to develop the staff guidelines for minimizing the potential for a load drop was based on defense-in-depth, and the intent of the guidelines is to ensure that licensees of all operating nuclear power plants perform the following:

1. provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to assure reliable operation of the handling system

2. 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

3. provide mechanical stops or electrical interlocks to prevent movement of heavy loads over irradiated fuel or in proximity to equipment associated with redundant shutdown paths.

Staff guidelines resulting from the foregoing are tabulated in Section 5 of NUREG-0612. 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 VEPCO, the Licensee for Surry Power Station, requesting that the Licensee review provisions for handling and control of heavy loads at Surry Units 1 and 2, 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. VEPCO responded to this request on November 16, 1981 [4], December 22, 1981 [5], and March 22, 1982 [6].

2. EVALUATION AND RECOMMENDATIONS

This evaluation of load handling at the Surry Station is divided into two categories. These categories deal separately with the general guidelines of Section 5.1.1 and the recommended interim measures of Section 5.3 of NUREG-0612. Applicable guidelines are referenced in each category. Conclusions and recommendations are provided in the summary for each guideline.

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:

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

These seven guidelines should be satisfied by all overhead handling systems and procedures used to handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool, or in other areas where a load drop may damage safe shutdown systems. 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.

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee's review of load handling systems at Surry Station indicates that the following load handling systems are subject to compliance with NUREG-0612:

- o Reactor containment polar cranes
- o Reactor containment annulus monorails
- o New fuel crane (fuel building)
- o Motor-driven platform (fuel building)
- o Fuel building trolley
- o Decontamination building crane
- o 6-Ton monorail system (auxiliary building)
- o 10-Ton monorail system (auxiliary building)
- o Filter cartridge removal monorails (auxiliary building)
- o Unit 1 switchgear room 2-ton monorail (service building).

The Licensee has also identified several other load handling systems that have been excluded from satisfying the criteria of NUREG-0612 due to physical separation from safe shutdown equipment or irradiated fuel, or insufficient load handling capacity:

- o Reactor cavity manipulator cranes
- o Neutron detector carriages
- o Drumming room monorails
- o Hoist area monorail (auxiliary building)
- o Machine shop jib crane
- o Machine shop monorail system
- o Turbine building cranes
- o Condensate polishing building monorail system (elevation 64 feet)
- o Condensate polishing building monorail system (elevation 42 feet)
- o CW intake structures trash rakes.

b. Evaluation, Conclusions and Recommendations

The Licensee's conclusions regarding the applicability of NUREG-0612 are consistent with the general guidelines in Section 5.1.1.

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 safe load paths for the movement of heavy loads at Surry Power Station which follow, to the extent practical, structural floor members, beams, etc., such that if a load is dropped, the structure is most likely to withstand the impact. These load paths, in the form of sketches, are being incorporated into lifting (operating or mechanical maintenance) procedures and will be incorporated in existing station drawings. Safe load paths shall be clearly marked on the floor in the area where the load is to be handled.

Deviations from defined safe load paths after the procedures are issued will require use of existing channels for approval of deviations to procedures.

Safe load paths sketches shall not be generated for movement of the fuel transfer canal gates in the fuel pool. Updated fuel pool maps will be used instead. These maps are more accurate than one safe load path sketch.

b. Evaluation

A review of the Licensee's response and drawings indicates that Surry Power Station substantially satisfies the criteria of Section 5.1.1 of NUREG-0612, with the exception of the handling of deviations. The Licensee has not provided sufficient information to verify that deviations from established safe load paths will require written alternatives to be approved by the plant safety review committee.

c. Conclusions and Recommendations

Surry Power Station substantially complies with Guideline 1 of NUREG-0612. In order to fully comply, the Licensee should clarify the procedure for handling deviations from safe load paths.

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 Surry Power Station lifting procedures (mechanical maintenance and operating procedure) are being revised or have been revised to include the general guidance and evaluation requirements of Section 5.1.1(2) of NUREG-0612. A generic procedure shall be used to control the movement of heavy loads over spent fuel, fuel in the core, or over equipment that may be required to achieve safe shutdown and continue decay heat removal, and not covered by existing station procedures.

b. Evaluation

Procedural control of the movement of heavy loads at Surry Power Station meets the intent of Section 5.1.1(2) of NUREG-0612 based on the Licensee's certification that lifting procedures are being revised or have been revised to include the general guidance and evaluation requirements in NUREG-0612.

c. Conclusions and Recommendations

Surry Power Station complies with Guideline 2 of NUREG-0612.

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

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

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that Surry Power Station crane operators are trained in accordance with ANSI B30.2-1976 which complies with the requirements of NUREG-0612. Crane operators have completed a course in crane and rigging operations which provided certification that the crane operators have been trained, qualified, and instructed in proper conduct in accordance with ANSI B30.2-1976. This course was conducted by an independent contractor.

b. Evaluation

Crane operator training, qualification, and conduct are consistent with the guidance in Section 5.1.1(3) of NUREG-0612. However, the Licensee should ensure that a mechanism is in place to provide future crane operator training that meets the intent of ANSI B30.2-1976, Chapter 2-3.

c. Conclusions and Recommendations

Surry Power Station complies with Guideline 3 of NUREG-0612.

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

"Special lifting devices should satisfy the guidelines of ANSI N14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials' [8]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants, certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is 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 the reactor vessel head lifting device, internals lifting rig, and the reactor coolant pump motor sling were designed and fabricated prior to the issuance of ANSI N14.6-1978 or ANSI B30.9-1971. These devices were designed and built to current industry standards using good engineering practices. The Licensee has contacted the lifting devices supplier, Westinghouse, and has requested verification of conformance of these lifting devices to the above listed standards.

The reactor vessel head lifting device and the internals lifting rig are inspected prior to each refueling and at each containment maintenance period if they are needed and have been idle for a period of more than six months or if over a year has passed since the last inspection. The reactor coolant pump motor sling is inspected prior to each refueling and at each containment maintenance period if it is to be used and more than one month has passed since the last inspection.

Special handling devices used to lift the new fuel containers, irradiated specimen, and spent fuel shipping casks are supplied by the particular cask supplier. The Licensee will verify with equipment suppliers the conformance of these lifting devices to ANSI N14.6-1978 and ANSI B30.8-1971.

b. Evaluation

Although insufficient information has been provided by the Licensee to evaluate compliance with Guideline 4 of NUREG-0612, the Licensee has committed to obtain verification of conformance of these lifting devices to ANSI N14.6-1978 from Westinghouse.

The following evaluation has been provided to assist the Licensee in determining compliance with ANSI N14.6-1978 and should be addressed in its response to this guideline.

Section 3.1:

a. limitations on the use of the lifting devices (3.1.1)
b. identification of critical components and definition of critical characteristics (3.1.2)
c. signed stress analyses which demonstrate appropriate margins of safety (3.1.3)

d. indication of permissible repair procedures (3.1.4)

Section 3.2:

a. use of stress design factors of 3 for minimum yield strength and 5 for ultimate strength (3.2.1)
b. similar stress design factors for load bearing pins, links, and adapters (3.2.4)
c. slings used comply with ANSI B30.9-1971 (3.2.5)
d. subjecting materials to dead weight testing or Charpy impact testing (3.2.6)

Section 3.3:

a. consideration of problems related to possible lamellar tearing (3.3.1)
b. design shall assure even distribution of the load (3.3.4)
c. retainers fitted for load carrying components which may become inadvertently disengaged (3.3.5)
d. verification that remote actuating mechanisms securely engage or disengage (3.3.6)

Section 4.1:

a. verify selection and use of material (4.1.3)
b. compliance with fabrication practice (4.1.4)
c. qualification of welders, procedures, and operators (4.1.5)
d. provisions for a quality assurance program (4.1.6)
e. provisions for identification and certification of equipment (4.1.7)
f. verification that materials or services are produced under appropriate controls and qualifications (4.1.9).

Section 5.1:

a. implementation of a periodic testing schedule and a system to indicate the date of expiration (5.1.3)
b. provisions for establishing operating procedures (5.1.4)
c. identification of subassemblies which may be exchanged (5.1.5)
d. suitable markings (5.1.6)
e. maintaining a full record of history (5.1.7)
f. conditions for removal from service (5.1.8)

Section 5.2:

a. load test to 150% and appropriate inspections prior to initial use (5.2.1)
b. qualification of replacement parts (5.2.2)

Section 5.3:

a. satisfying annual load test or inspection requirements (5.3.1)
b. testing following major maintenance (5.3.2)
c. testing after application of substantial stresses (5.3.3)
d. inspections by operating (5.3.6) and non-operating or maintenance personnel (5.3.7).

c. Conclusions and Recommendations

Insufficient information has been provided by the Licensee to determine compliance with Guideline 4. In order to fully comply, the Licensee should submit the Westinghouse analysis of special lifting devices used at the Surry plant for evaluation to substantiate design and reliability.

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' [9]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' 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

The Licensee has stated that lifting devices which are not specially designed (slings) are marked, maintained, stored, and inspected in accordance with ANSI B30.9-1971. Lifting procedures are reviewed prior to approval and implementation for proper selection of size, length, capacity, and rigging configuration of slings in order to meet all requirements of ANSI B30.9-1971.

b. Evaluation

Programs developed at Surry Power Station satisfy the criteria of this guideline on the basis that they are in compliance with ANSI B30.9-1971. However, the Licensee has made no mention of the selection and marking of slings based on the load which produces the maximum static and dynamic load. Further, the Licensee has not indicated whether slings restricted in use to only certain cranes are clearly marked to so indicate.

c. Conclusion and Recommendations

Surry Units 1 and 2 partially comply with Guideline 5. In order to fully comply, the Licensee should perform the following:

1. select and mark all slings based on the load which produces the maximum static and dynamic loads

2. mark all slings which are restricted in use to only certain cranes.

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 has stated that Surry Power Station cranes, both inside and outside of the containment, are inspected, tested, and maintained in accordance with station maintenance procedures MMP-P-CR-015 or MMP-P-CR-017. These procedures were revised in 1977 to incorporate ANSI B30.2-1976.

In addition to the above stated station maintenance procedures, the fuel handling system is visually inspected and performance tested in accordance with station procedure PT 20.1 prior to refueling.

Prior to initial use, all new, reinstalled, altered, extensively repaired, or modified cranes shall be operationally tested and rated load tested (if required) in accordance with ANSI B30.2-1976. Crane test procedures shall be written, as required, to ensure that cranes are in compliance with ANSI B30.2-1976.

b. Evaluation

The Surry Power Station satisfies the requirements of this guideline on the basis that existing procedures have been revised to comply with ANSI B30.2-1976.

c. Conclusion and Recommendation

Surry Power Station 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' [10]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that CMAA-70 and ANSI B30.2-1976 apply to the reactor containment polar cranes, fuel building trolley, and the new fuel crane. These cranes were designed and fabricated prior to the issuance of the above referenced standards, in accordance with Electric Overhead Crane Specification #61 [11]. The Licensee has provided the results of a review of existing crane designs with the recommendations contained in CMAA-70 and Chapter 2-1 of ANSI B30.2-1976.

The reactor containment jib cranes were designed and fabricated in accordance with ANSI B30.16-1973 and ANSI B30.11-1973. The reactor containment annulus monorails, 6-ton and 10-ton monorail systems, decontamination building crane, new fuel crane, and motor-driven platform and hoists were designed in accordance with EOCI 61. These cranes and monorails meet the requirements of ANSI B30.11 and ANSI B30.16.

b. Evaluation

The Licensee's analysis of the crane design for the reactor containment polar cranes, the fuel building trolley, and the new fuel crane indicates that the design of these cranes is consistent with the guidance in Section 5.1.1 (7) of NUREG-0612.

Since CMAA-70 applies to top running bridge and gantry type multiple girder electric overhead traveling cranes, verification of compliance to ANSI

B30.11 [12] and ANSI B30.16 [13] for the remaining load handling systems meets the intent of NUREG-0612 for crane design.

c. Conclusions and Recommendations

Surry Power Station complies 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. Summary of Licensee Statements and Conclusions

The Licensee has stated that Surry Technical Specification 3.10 prohibits the movement of heavy loads exceeding 110% of the weight of a fuel assembly (not including fuel handling tools) over spent fuel.

b. Evaluation

NUREG-0612 defines a heavy load as any load whose weight is greater than the combined weight of a single spent fuel assembly and its handling tool. Considering the typical weight of spent fuel assemblies and handling tools, designation of 110% of the weight of a fuel assembly as a heavy load is consistent with the guidance in NUREG-0612.

c. Conclusions and Recomendations

Surry Power Station 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

For Surry Unit 2, the Licensee has stated that the only heavy loads carried over the reactor when the reactor is fueled are the reactor components. Each heavy load is covered by its own unique procedure. The crane load block does not have a lift procedure since it is an integral portion of the crane; however, it has been identified as a potential heavy load drop. To ensure that the crane load block is not dropped, the existing redundant limit switches will be performance-tested prior to use.

Prior to refueling, a minimum visual inspection is performed for each lifting rig in the maintenance procedure (MMP-P-CR-015) or in the performance test. This check insures that each device receives an inspection prior to use. If any components are found to be defective, they are replaced, or repaired, and reinspected before use.

Surry crane operators recently passed a two-week course on crane operations.

b. Evaluation

Based on the Licensee's response to Guidelines 2 and 3, crane operator training and lifting procedure content meets the intent of Interim Protection measure 1 for Surry Units 1 and 2. However, the Licensee has not provided

sufficient information to determine if the one-time visual inspections of load-bearing components of cranes, slings, and special lifting devices to identify flows or deficiencies that could lead to component failure have been performed and the appropriate repairs/replacements have been completed.

c. Conclusions and Recommendations

Surry Power Station partially complies with Interim Protection Measure 6. In order to fully comply, the Licensee should verify that the one-time visual inspections of load bearing components of cranes, slings, and special lifting devices to identify flow or deficiencies that could lead to a component failure have been performed and the appropriate repairs/replacements have been completed.

3. CONCLUDING SUMMARY

This summary is provided to consolidate the conclusions and recommendations of Section 2 and to document the overall evaluation of the handling of heavy loads at VEPCO's Surry Power Station. It is divided into two sections, one dealing with general provisions for load handling at nuclear power plants (NUREG-0612, Section 5.1.1), and the other with staff recommendations for interim protection, pending complete implementation of the guidelines of NUREG-0612 (NUREG-0612, Section 5.3). In each case, recommendations are made for additional Licensee action and, where appropriate, for additional NRC staff action.

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 safe shutdown systems. Compliance with these guidelines is necessary to ensure that load-handling system design, administrative controls, and operator training and qualification are such that the possibility of a load drop is appropriately small for the critical functions and potential consequences of failures of cranes at nuclear power plants. These guidelines are partially satisfied at Surry Power Station. This conclusion is presented in tabular form as Table 3.1. Specific recommendations for achieving full compliance with these guidelines follow:

Guideline	Recommendations
1	Clarify the procedure for handling deviations from safe load paths.
2	(Surry Power Station complies with this guideline.)
3	(Surry Power Station complies with this guideline.)
4	Verify that special lifting devices used are in compliance with ANSI N14.6-1978.

Table 3.1 Surry Power Station - 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 Containment Polar Crane	125/15	--	--	C	--	--	C	C	--	--
a. RV Head and Lifting Device	122.5	P	C	--	I	--	--	--	P	--
b. Upper Internals and Lifting Rig	52	P	C	--	I	--	--	--	P	--
c. ISI Tool	10	P	C	--	--	P	--	--	--	--
d. RCP Motor/Sling	41	P	C	--	--	P	--	--	--	--
e. Reactor Cavity Inner Seal	12.2	P	C	--	--	P	--	--	--	--
f. CRDM Missile Shield	36.5	P	C	--	--	P	--	--	--	--
g. Stud Carriers (Full)	3.6	P	C	--	--	P	--	--	--	--
h. Operating Floor Removable Plug (#1)	13	P	C	--	--	P	--	--	--	--
i. Octagonal Floor Plug (Elev. 18'-4")	31.5	P	C	--	--	P	--	--	--	--
j. Polar Crane Bottom Block and Hook	2.4	P	C	--	--	--	--	--	--	--

C = Licensee action complies with NUREG-0612 Guideline.
I = Insufficient information provided by the Licensee to determine compliance with NUREG-0612.
-- = Not applicable.
P = Licensee action partially complies with NUREG-0612 Guideline.

Table 3.1 (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
k. Containment Recirc. Spray Cooler	23.7	P	C	--	--	P	--	--	--	--
l. Regenerative Heat Exchanger	2.4	P	C	--	--	P	--	--	--	--
m. RHR Exchange	12.8	P	C	--	--	P	--	--	--	--
n. RHR Pump Motor	2.4	P	C	--	--	P	--	--	--	--
o. Recirc. Spray Pump Motor	1.3	P	C	--	--	P	--	--	--	--
2. RC Annulus Monorail	5	--	--	C	--	--	C	C	--	--
3. RC Jib Cranes	8	--	--	C	--	--	C	C	--	--
4. New Fuel Crane	5	--	--	C	--	--	C	C	--	--
a. New Fuel Container (Full)	3.3	P	C	--	I	--	--	--	--	--
b. Removable Slabs	1	P	C	--	--	P	--	--	--	--
5. Motor Drive Platform and Hoist	2	--	--	C	--	--	C	C	--	--
a. Fuel Pool Gates		P	C	--	--	P	--	--	C	--
6. Fuel Building Trolley	125/10	--	--	C	--	--	C	C	--	--
a. Spent Fuel Shipping Cask	12.5 (Max)	P	C	--	I	--	--	--	C	--

Table 3.1 (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. Bottom Block and Hook	2.4	P	C	--	--	--	--	--	--	--
c. Spent Resin Shipping Container and Cask	3.7	P	C	--	--	P	--	--	C	--
d. Irradiated Specimen Shipping Cask	11.3	P	C	--	I	--	--	--	C	--
e. Failed Fuel Container	I	P	C	--	--	P	--	--	C	--
7. Decon Building Crane	5	--	--	C	--	--	C	C	--	--
8. Six-Ton Monorail System	6	--	--	C	--	--	C	C	--	--
a. Component Cooling Water Pump	2.7	P	C	--	--	P	--	--	--	--
b. Component Cooling Water Pump Motor	3.2	P	C	--	--	P	--	--	--	--
c. Charging Pump	1.3	P	C	--	--	P	--	--	--	--
d. Charging Pump Motor	2.1	P	C	--	--	P	--	--	--	--
e. Removable Slab	4.5 (Max)	P	C	--	--	P	--	--	--	--

Table 3.1 (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
9. Ten-Ton Monorail System	10	--	--	C	--	--	C	C	--	--
a. Removable Slab	8.5 (Max)	P	C	--	--	P	--	--	--	--
10. Filter Cartridge Removal Monorail	2	--	--	C	--	--	C	--	--	--
11. Unit #1 Switchgear Room Monorail	2	--	--	C	--	--	C	--	--	--
a. Motor-Generator Set Motor	2	P	C	--	--	P	--	--	--	--

Guideline	Recommendations
5	a. Verify that slings are selected and marked based on the load which produces the maximum static and dynamic load.
	b. Verify that slings which are restricted in use to only certain cranes are so marked.
6	(Surry Power Station complies with this guideline.)
7	(Surry Power Station complies with this guideline.)

3.2 INTERIM PROTECTION

The NRC staff has established (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. Evaluation of information provided by the Licensee indicates that the following actions are necessary to ensure that the staff's measures for interim protection at the Surry Power Station are taken:

Interim Measure	Recommendation
1	(Surry Power Station complies with this interim measure.)
2	Implement the recommendations concerning Guideline 1 identified in Section 3.1.
3, 4, 5	(Surry Power Station complies with these interim measures.)
6	Complete the one-time visual inspection of load handling components of cranes, slings, and special lifting devices.

3.3 SUMMARY

The NRC's general guidelines and interim protection measures established in NUREG-0612 have been substantially complied with at VEPCO's Surry Power Station. In several areas (procedures, crane operator training, inspection, test and maintenance; crane design; technical specifications), the Licensee has provided sufficient information to allow definitive evaluation of compliance with NUREG-0612 criteria. Licensee action is required on the remaining general guidelines and interim protection measures.

4. REFERENCES

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   Subject: Control of Heavy Loads, Surry Power Station Unit 2
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   "Standard for Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials"
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   "Slings"
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