

## TECHNICAL EVALUATION REPORT

**CONTROL OF HEAVY LOADS (C-10)**

NEBRASKA PUBLIC POWER DISTRICT

COOPER NUCLEAR STATION

NRC DOCKET NO. 50-298

NRC TAC NO. 07982

NRC CONTRACT NO. NRC-03-81-130

FRC PROJECT C5506

FRC ASSIGNMENT 13

FRC TASK 346

*Prepared by*

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

Author: F. Vosbury, D. Vito

FRC Group Leader: I. H. Sargent

*Prepared for*

Nuclear Regulatory Commission  
Washington, D.C. 20555

Lead NRC Engineer: F. Clemenson

December 30, 1982

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

**Franklin Research Center**

A Division of The Franklin Institute

The Benjamin Franklin Parkway, Phila., Pa. 19103 (215) 448-1000

8306090388 830526  
PDR ADOCK 05000298  
P PDR

## CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1	INTRODUCTION. . . . .	1
	1.1 Purpose of Review . . . . .	1
	1.2 Generic Background . . . . .	1
	1.3 Plant-Specific Background . . . . .	2
2	EVALUATION . . . . .	4
	2.1 General Guidelines . . . . .	4
	2.2 Interim Protection Measures. . . . .	14
3	CONCLUSION . . . . .	18
	3.1 General Provisions for Load Handling . . . . .	18
	3.2 Interim Protection Measures. . . . .	19
4	REFERENCES . . . . .	20

## FOREWORD

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

Mr. F. Vosbury, 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 the Nebraska Public Power District's (NPPD) Cooper Nuclear Station. This evaluation was performed with the following objectives:

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

### 1.2 GENERIC BACKGROUND

Generic Technical Activity Task A-36 was established by the Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to 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 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.

The approach used to develop the staff guidelines, based on defense-in-depth, was 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 assure 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 NPPD, the Licensee for Cooper Nuclear Station, requesting that NPPD review provisions for handling and control of heavy loads at Cooper Station, 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. NPPD responded to this request on June 30, 1981 [4] and October 9, 1981 [5]. In response to the December 7, 1981 conference call with the NRC, the reviewer, and NPPD, the Licensee provided additional information on May 14, 1982 [6] which has been incorporated into this final technical evaluation.

## 2. EVALUATION

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

### 2.1 GENERAL GUIDELINES

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

- 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 programs used to handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool, or in other areas where a load drop may damage safe shutdown systems.

#### 2.1.1 Overhead Heavy Load Handling Systems

##### a. Summary of Licensee Statements and Conclusions

The Licensee's review of overhead load handling systems identified the following cranes as subject to the general guidelines of NUREG-0612:



Table 2.1. Cooper 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 Building Crane	100 Main	--	--	C	--	--	C	C	C	--
	Outside Semi- circular Cavity Plug	80	P	C	--	NC	--	--	--	--	P
	Center Cavity Plug	92	P	C	--	NC	--	--	--	--	P
	Bottom Dryer Plug	44	P	C	--	NC	--	--	--	--	P
	Upper Dryer Plug	56	P	C	--	NC	--	--	--	--	P
	Bottom Fuel Pool Plug	5	P	C	--	NC	--	--	--	C	P
	Upper Fuel Pool Plug	9	P	C	--	NC	--	--	--	C	P
	Drywell Head	43	P	C	--	NC	--	--	--	--	P
	RPV Head Insulation	4	P	C	--	--	C	--	--	--	--
	RPV Head and Lifting Device	80	P	C	--	NC	--	--	--	--	P
	Steam Dryer	32.5	P	C	--	NC	--	--	--	--	P
	Steam Separator	42	P	C	--	NC	--	--	--	--	P

C = Licensee action complies with NUREG-0612 Guideline.

P = Licensee information indicates partial compliance with NUREG-0612 Guideline.

-- = Not applicable.

NC = Licensee action is not in 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
Vessel Service Platform	5	P	C	--	--	C	--	--	--	--
Waste and Debris Shipping Cask	35	P	C	--	NC	--	--	--	--	P
2. Intake Structure Crane	35	--	--	C	--	--	C	C	--	--
Service Water Pump	6	P	C	--	--	C	--	--	--	--
Service Water Pump Motor	1.75	P	C	--	--	C	--	--	--	--
3. Control Building Hoist H-7	5	--	--	C	--	--	C	C	--	--
RHR Service Water Booster Pump	1.5	P	C	--	--	C	--	--	--	--
RHR Service Water Booster Pump	3.25	P	C	--	--	C	--	--	--	--

- o reactor building crane
- o intake structure crane
- o control building hoist (H-7).

Other load handling devices identified by the Licensee have been excluded from compliance with NUREG-0612 for the following reasons:

1. No safe shutdown/decay heat removal equipment or irradiated fuel is located in proximity to the load handling device
  - o reactor building jib crane/trolley
  - o MK-I containment project 4.5-ton hoists (2) and 7.5-ton hoist
  - o reactor building hoist/monorails (H-10 and H-12)
2. The load handling device has a sole purpose maintenance function such that a load drop will damage only equipment which is already out of service for maintenance
  - o reactor building hoists/monorails (H-9A, H-9B, H-13, H-14, and C2)
  - o diesel generator monorail (C-4).

#### b. Evaluation

The Licensee's exclusion of certain load handling systems from compliance with Section 5.1.1 is consistent with the intent of the NUREG-0612 objective to improve load handling reliability.

#### 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 general arrangement drawings identifying safe load paths for the reactor vessel head, reactor vessel plugs, dry-separator

pool plugs, drywell head, and bellows shield. The safe load paths for the steam dryer and steam separator are defined by the layout of dryer and separator storage pool since the dryer and separator follow and are not lifted out of the storage pool. The load paths for the concrete plugs follow, to a great extent, structural floor members. Movement of the drywell head and reactor pressure vessel head follows structural floor members before angling to the respective laydown areas. The loads are moved in a manner to minimize the potential to impact irradiated fuel and are not moved over safe shutdown equipment. The load paths will be added to their respective procedures and written alternatives will be approved by the Cooper Station Operations Review Committee (SORC). Marking load paths on the floor will not be done as it is not good practice in terms of Cooper Station radiation and contamination control procedures.

Further, procedures are being revised to minimize the exposure of safe shutdown equipment to damage from loads dropped from control building hoist H-7.

b. Evaluation

Safe load paths on the refueling floor meet the intent of Section 5.1.1(1) of NUREG-0612 with the exception of load path markings. While it is agreed that floor markings may conflict with radiation and contamination control in some instances, the need to provide visual aids to guide the operator cannot be neglected. Alternative methods of providing visual aids, such as a dedicated load handling supervisor (whose responsibilities have been delineated in appropriate procedures), bench marking the crane, or temporary markings, should be considered.

Since the load path for control building monorail H-7 is fixed by the path of the rail, the Licensee's commitment to procedurally limit the exposure of safe shutdown equipment to potential damage from a load drop is consistent with the guidance in NUREG-0612.

c. Conclusion and Recommendation

Cooper Nuclear Station substantially complies with Guideline 1 of NUREG-0612. In order to fully comply, the Licensee should provide visual aids to crane operators to identify 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 load handling procedures specify the equipment required, inspection and acceptance criteria required prior to load movement, the sequence of events, precautions and limitations, and safe load paths for the major loads in accordance with Section 5.1.1(2) of NUREG-0612.

Station Procedure 7.6.1, "Operation of Reactor Building Crane and Miscellaneous Reactor Building Hoists," controls the operation of the reactor building crane and other miscellaneous hoists in the reactor building. This procedure requires that a special procedure be written any time heavy loads not covered by a specific procedure are to be moved over or near the open vessel, fuel pool, or safety equipment. Station Procedures 7.4.1 through 7.4.6 and 7.4.19 have precautions to ensure that load handling operations remain within the safe load paths. Station Procedure 3.7 and Special Procedure 77-3 show the horizontal controlled path of the spent fuel cask. The service water pump is covered by Procedure 7.2.15, which states that no pump or motor parts shall be lifted where a load drop could result in damage to the other pumps and motors or associated safety-related equipment. The residual heat removal service water booster pumps are covered by Procedure 7.2.14, which states that no pump and motor parts shall be lifted where a load

drop could result in damage to the other pumps and motors or associated safety-related equipment.

b. Evaluation

Load handling procedures used at Cooper Nuclear Station meet the intent of Section 5.1.1(2) of NUREG-0612 based on the Licensee's description of the existing procedures.

c. Conclusion

Cooper Nuclear 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' [5]."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that a new procedure has been written to ensure that ANSI B30.2-1976 has been met with respect to operator training, qualification, and conduct. Any conduct not in accordance with Chapter 2-3 of ANSI B30.2-1976 will disqualify an employee as a crane operator.

b. Evaluation

Crane operator training at Cooper Nuclear Station meets the intent of Section 5.1.1(3) of NUREG-0612 based on verification by the Licensee of compliance with the training requirements in Chapter 2-3 of ANSI B30.2-1976.

c. Conclusion

Cooper Nuclear 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' [6]. 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 Licensee has identified the following special lifting devices used in the vicinity of irradiated fuel or safe shutdown equipment at Cooper Nuclear Station:

- o reactor pressure vessel head strongback
- o dryer and separator sling
- o strongback for concrete shield plugs
- o redundant crane adapter and pins
- o spent fuel cask redundant lifting yoke.

GE supplied the reactor pressure vessel head strongback and the dryer and separator slings, and testing was performed by Stearns-Rogers, Inc. The strongbacks for the concrete shield plug were constructed by Jelco, Inc. The redundant crane adapter and pins were designed, constructed, and tested in conjunction with Stearns-Roger, Inc. The record search and conformance analysis for these special lifting devices is in progress.

The Licensee provided calculations and analyses performed by GE for the spent fuel cask redundant lifting yoke.

#### b. Evaluation

The spent fuel cask redundant lifting yoke meets the intent of Section 5.1.1(4) of NUREG-0612 with respect to design and fabrication. Similar data

are required for the other special lifting devices. In addition, for all of the special lifting devices, a continuing compliance testing program in accordance with ANSI N14.6-1978, Section 5.0, is critical to ensure the reliability of the device. Lastly, no information has been provided to determine whether routine dynamic loads have been accounted for in the ratings of these devices.

c. Conclusion and Recommendation

Cooper Nuclear Station has not provided sufficient information and therefore is not in compliance with Guideline 4 of NUREG-0612. The Licensee should provide a design comparison to ANSI N14.6-1978 criteria for the reactor pressure vessel head strongback, dryer and separator sling, strongback for the concrete shield plug, and the redundant crane adapter and pins, including provisions for routine dynamic loads. Further, a continuing compliance testing and inspection program should be implemented to conform with Section 5.0 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' [7]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that slings at Cooper Nuclear Station are selected and used in accordance with ANSI B30.9-1971. A new procedure for the selection, storage, and inspection of slings will consider the effects of dynamic loading on slings.



b. Evaluation

Sling usage and selection at Cooper Nuclear Station meets the intent of NUREG-0612 based on verification by the Licensee of compliance to ANSI B30.9-1971. Further, the Licensee has made a commitment to consider dynamic loading effects in sling selection.

c. Conclusion

Contingent upon implementation of the new procedures which will consider the effects of dynamic loading on sling selection, Cooper Nuclear Station complies with Guideline 5 of NUREG-0612.

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

"The crane should be inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' with the exception that tests and inspections should be performed prior to use where it is not practical to meet the frequencies of ANSI B30.2 for periodic inspection and test, or where frequency of crane use is less than the specified inspection and test frequency (e.g., the polar crane inside a PWR containment may only be used every 12 to 18 months during refueling operations, and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed daily or monthly. For such cranes having limited usage, the inspections, test, and maintenance should be performed prior to their use)."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that ANSI B30.2-1976 has been invoked under Cooper Nuclear Station Maintenance Procedure 7.2.32, "Crane Hoist, Sling and Cable Inspection." The individual procedures for the intake structure and the reactor building cranes call for further inspection before the cranes are used.

b. Evaluation

Crane inspection, maintenance, and testing at the Cooper Nuclear Station are consistent with Section 5.1.1(6) of NUREG-0612 based on the Licensee's commitment to the guidance in ANSI B30.2-1976.

c. Conclusion

Cooper Nuclear Station complies with Guideline 6 of NUREG-0612.

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 cranes at Cooper Station comply with the guidelines of CMAA-70 and Chapter 2-1 of ANSI B30.2-1976.

b. Evaluation and Conclusion

Crane designs at Cooper Nuclear Station 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 general Guideline 1, Safe Load Paths; Guideline 2, Load Handling Procedures; Guideline 3, Crane Operator Training; and Guideline 6, Cranes (Inspection, Testing, and Maintenance). The two remaining interim measures cover the following criteria:

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

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 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 [of NUREG-0612]."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that the overhead crane in the fuel pool area is considered single failure proof. As stated in Section 9.2 of the Safety Evaluation Report of Cooper Nuclear Station dated February 14, 1973, "The failure of any single component would not result in the dropping of the (spent fuel) cask." Therefore, the additional technical specification is not required.

b. Evaluation and Conclusion

Based on the fact that the NRC has reviewed the modified Cooper Station reactor building crane and concluded that it meets the intent of Branch Technical Position (BTP) Auxiliary Power Conversion Systems Branch (APCSB) 9-1, Cooper Nuclear 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 Reviews for Heavy Loads 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 operations, and content of procedures."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that revisions to pertinent procedures which call for visual inspection of special lifting devices and crane hoists, slings, and cables have been drafted. These revisions also provide for the appropriate repair or replacement of defective components.

b. Evaluation

In light of the responses to Guidelines 2 and 3, it is apparent that procedures for handling loads over the core and operator training have been reviewed and upgraded as appropriate. In addition, design of cranes at Cooper Station and programs for selection and use of slings have been reviewed and found to comply with NUREG-0612; the Licensee, however, should ensure that the new procedure for sling selection is expeditiously implemented. Therefore, to

satisfy the requirements of this interim measure, the Licensee should perform the requested special review of all special lifting devices used over the core since a design review has not been completed by the vendor.

c. Conclusion and Recommendation

Cooper Nuclear Station substantially complies with Interim Protection Measure 6. In order to fully comply, the Licensee should perform a visual inspection of load-bearing components of special lifting devices used to handle heavy loads over the core, pending completion of the full design and continuing compliance review being performed in accordance with Guideline 4.



### 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 Cooper Nuclear Station. 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 the Cooper Nuclear Station 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:

- o NPPD should provide suitable visual aids to assist crane operators when transporting loads via established safe load paths.
- o NPPD should provide a design comparison of special lifting devices at Cooper Station with the criteria of ANSI N14.6-1978, Section 3.2.1. Consideration of dynamic loading of both special and non-special lifting devices should also be documented.

- o NPPD should develop and implement a program for acceptance testing and continuing compliance of special lifting devices that conforms to the criteria contained in ANSI N14.6-1978, Section 5.

### 3.2 INTERIM PROTECTION MEASURES

The NRC staff has established certain measures (NUREG-0612, Section 5.3) that should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until 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. Actions needed to satisfy NUREG guidelines for safe load paths have been previously addressed in Section 3.1 of this evaluation. Evaluation of remaining information provided by the Licensee identified only one area requiring further Licensee action to ensure that the staff's measures for interim protection at Cooper Station are satisfied:

- o NPPD should perform a visual inspection of all load-bearing components of special lifting devices used to handle heavy loads over the core.



## 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 1978
3. D. G. Eisenhut (NRC)  
Letter to All Operating Reactors  
Subject: Control of Heavy Loads  
22 December 1980
4. J. M. Pilant (NPPD)  
Letter to D. G. Eisenhut (NRC)  
Subject: Control of Heavy Loads  
30 June 1981
5. J. M. Pilant (NPPD)  
Letter to D. G. Eisenhut (NRC)  
Subject: Control of Heavy Loads  
9 October 1981
6. J. M. Pilant (NPPD)  
Letter to D. G. Eisenhut (NRC)  
Subject: Control of Heavy Loads  
14 May 1982
7. American National Standards Institute  
"Overhead and Gantry Cranes"  
New York: 1976  
ANSI B30.2-1976
8. American National Standards Institute  
"Standard for Special Lifting Devices for Shipping Containers Weighing  
10,000 Pounds (4500 kg) or More for Nuclear Materials"  
ANSI N14.6-1978
9. American National Standards Institute  
"Slings"  
ANSI B30.9-1971

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

TER-C5506-346

## ADDITIONAL INFORMATION REQUIRED FROM COOPER NUCLEAR STATION

1.a. RECOMMENDATION/OPEN ITEM

To ensure safe movement of loads at Cooper Station, Nebraska Public Power District (NPPD) should ensure that suitable visual aids are available to assist crane operators when conducting heavy load movements.

b. EVALUATION CRITERIA

To ensure compliance and avoid unnecessary distractions to crane operators while controlling suspended loads (e.g., trying to read procedural steps or drawings with the hook under load), NUREG-0612 requires that safe load paths be marked on the floors. Due to the number of load paths as well as contamination control methods, several licensees have argued against such marking; it has previously been found acceptable to use other appropriate visual aids in lieu of permanent markings to accomplish the same purpose. Acceptable visual aids may consist of tape, pylons, rope, crane benchmarks, or use of a crane supervisor/signalman (with responsibilities delineated in appropriate procedures) to direct the crane operator along the designated load path.

c. DISCUSSION

NPPD states that load paths will not be marked on the floor as it is not good practice in terms of Cooper Station radiation and contamination control procedures. No alternative methods have been recommended by the Licensee that would meet the intent of this issue; therefore, one of the alternatives listed above or any equivalent alternative should be incorporated into plant procedures.

## 2.a. RECOMMENDATION/OPEN ITEM

NPPD should confirm that special lifting devices are designed to standards comparable to the criteria of ANSI N14.6-1978, Section 3.2. In addition, documentation should also be provided to demonstrate that dynamic loads have been considered for both special and non-special lifting devices.

## b. EVALUATION CRITERIA

The general guidelines of NUREG-0612 specify that special lifting devices used to carry heavy loads should satisfy the requirements of ANSI N14.6-1978. In order to determine actual compliance or equivalence with the standard, the licensee, as a minimum, should demonstrate that the design of these lifting devices is comparable to that required by Section 3.2 of ANSI N14.6-1978. In addition, NUREG-0612 requires that routine dynamic loading be considered and incorporated into selection and use of special and non-special lifting devices. As noted by several licensees, hoist speeds for most handling systems at nuclear power plants are generally slow and, therefore, the dynamic loads routinely imparted to the lifting devices are also reasonably small. It has been argued and previously found acceptable that if a licensee can demonstrate that dynamic loads are a reasonably small percentage of the overall static load, by use of an engineering analysis or in accordance with the guidance of CMAA-70 for crane design (dynamic load =  $0.5\% \times$  static load per foot per minute (fpm) of hoist speed), it is unnecessary to consider the dynamic loads imposed.

## c. DISCUSSION

Five special lifting devices that are used at Cooper Nuclear Station have been identified by NPPD. They include the reactor pressure vessel head strongback, the dryer and separator sling, the concrete shield plugs strongback, the redundant crane adapter and pins, and the spent fuel cask redundant lifting yoke.

Information has been provided by NPPD for the spent fuel cask redundant lifting yoke which provides reasonable assurance of the lifting yoke design and fabrication. For the remaining special lifting devices, however, the

Licensee states only that the record search and conformance analysis of these devices is in progress. Results of this search and comparison with ANSI N14.6-1978 should be provided by the Licensee to document compliance with the standard.

Regarding incorporation of routine dynamic loads, the Licensee has stated that selection and use of slings will consider the effects of dynamic loads. Details of the specific manner in which routine dynamic loads are considered or implemented should be provided for review.

3.a. RECOMMENDATION/OPEN ITEM

NPPD should develop and implement a program for acceptance testing and continuing compliance of special lifting devices that conforms to the criteria contained in ANSI N14.6-1978, Section 5.

b. EVALUATION CRITERIA

NUREG-0612 specifies, through guidance contained in ANSI N14.6-1978, that a program should be implemented for special lifting devices which provides reasonable assurance of continued safe operation through a regularly scheduled program of testing and inspections.

c. DISCUSSION

The intent of the NUREG-0612 guidelines, in addition to determining that special lifting devices have been designed and fabricated in a manner consistent with high reliability, is also to make certain that appropriate steps are taken to ensure that these devices are inspected, tested, and maintained so as to ensure continued reliability. Guidance for a program to support the goal is contained in Section 5 of ANSI N14.6. NPPD has provided no information addressing these issues.

#### 4.a. RECOMMENDATION/OPEN ITEM

NPPD should perform a visual inspection of all load-bearing components of special lifting devices used to handle heavy loads over the core.

#### b. EVALUATION CRITERIA

NUREG-0612 specified that several interim measures be implemented until full compliance with remaining general guidelines had been achieved. One interim measure consists of a special review of procedures, equipment, and personnel used to handle heavy loads directly over the core. This special review consists of the following issues:

- o review of procedures to ensure sufficient detail, clarity, and conciseness
- o visual inspections of load-bearing components of cranes, slings, and special lifting devices
- o repair and replacement of defective components
- o verification of operator training and familiarity with specific procedures.

#### c. DISCUSSION

Information provided by NPPD indicates that revisions to pertinent procedures requiring visual inspections have been drafted. In addition, although specific information relative to the interim measure in question has not been provided, it is apparent from compliance with the general guidelines regarding procedures, crane operator training, lifting devices, crane maintenance, and crane design that Cooper Station is in substantial compliance.

One remaining open item could not be accounted for by compliance with the general guidelines; therefore, the Licensee should perform a visual inspection of all load-bearing components of the special lifting devices subject to compliance with NUREG-0612 to satisfy the remaining recommendation of the NUREG-0612 interim protection measures.