

TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

NRC DOCKET NO. 50-236

FRC PROJECT C5506

NRC TAC NO. 08062

FRC ASSIGNMENT 13

NRC CONTRACT NO. NRC-03-81-130

FRC TASK 370

Prepared by

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Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

Lead NRC Engineer: A. Singh

January 30, 1984

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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 the Northern States Power Company's Monticello Nuclear Generating Plant. 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 U.S. Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to ensure the safe handling of heavy loads and to recommend necessary changes to these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [2] to all power reactor licensees, requesting information concerning the control of heavy loads near spent fuel.

The results of Task A-36 were reported in NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The staff's conclusion from this evaluation was that existing measures to control the handling of heavy loads at operating plants, although providing protection from certain potential problems, do not adequately cover the major causes of load handling accidents and should be upgraded.

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

nuclear power plants are designed and operated such that their probability of failure is uniformly small and appropriate for the critical tasks in which they are employed. The second portion of the staff's objective, achieved through guidelines identified in NUREG-0612, Sections 5.1.2 through 5.1.5, is to ensure that, for load handling systems in areas where their failure might result in significant consequences, either (1) features are provided, in addition to those required for all load handling systems, to ensure that the potential for a load drop is extremely small (e.g., a single-failure-proof crane) or (2) conservative evaluations of load handling accidents indicate that the potential consequences of any load drop are acceptably small. Acceptability of accident consequences is quantified in NUREG-0612 into four accident analysis evaluation criteria.

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

- o define safe load travel paths through procedures and operator training so that, to the extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment
- o provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure reliable operation of the handling system.

Staff guidelines resulting from the foregoing are tabulated in Section 5 of NUREG-0612. Section 6 of NUREG-0612 recommended that a program be initiated to ensure that these guidelines are implemented at operating plants.

1.3 PLANT-SPECIFIC BACKGROUND

On December 22, 1980, the NRC issued a letter [3] to Northern States Power Company, the Licensee for the Monticello Nuclear Plant, requesting that the Licensee review provisions for handling and control of heavy loads, evaluate these provisions with respect to the guidelines of NUREG-0612, and provide certain additional information to be used for an independent

determination of conformance to these guidelines. On July 7, 1982, Northern States Power Company provided a revised initial response [4] to this request. Additional information provided on October 11, 1982 [5], September 27, 1983 [6], and October 25, 1983 [7] has been incorporated into this final technical evaluation.

2. EVALUATION

This section presents a point-by-point evaluation of load handling provisions at the Monticello Nuclear Generating 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 to provide the defense-in-depth appropriate for the safe handling of heavy loads. They are identified under the following topics in Section 5.1.1 of NUREG-0612:

Guideline 1 - Safe Load Paths

Guideline 2 - Load Handling Procedures

Guideline 3 - Crane Operator Training

Guideline 4 - Special Lifting Devices

Guideline 5 - Lifting Devices (Not Specially Designed)

Guideline 6 - Cranes (Inspection, Testing, and Maintenance)

Guideline 7 - Crane Design.

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

Table 2.1. Monticello Nuclear Plant/NUREG-0612 Compliance Matrix

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedurea	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	85/5	--	--	C	--	--	C	C	--	--
Vessel Inspection Platform	3	C	C	--	--	C	--	--	--	C
Stud Detensioner Carousel	10	C	C	--	R	--	--	--	--	C
Fuel Pool Shield Block	5	C	C	--	--	C	--	--	C	--
PRV Head	45	C	C	--	R	--	--	--	--	C
Drywell Head	40	C	C	--	R	--	--	--	--	C
Fuel Pool Skimmer	3	C	C	--	--	C	--	--	C	--
Steam Separator	33	C	C	--	R	C	--	--	--	C
Steam Dryer	22	C	C	--	R	C	--	--	--	C
Reactor Head Insulation	4.5	C	C	--	--	C	--	--	--	C
Refueling Canal Shield	15	C	C	--	--	C	--	--	C	--
Spent Fuel Shipping Cask	24.7	C	R	--	R	--	--	--	C	--

C = Licensee action complies with NUREG-0612 Guideline.
R = Licensee has proposed revisions/modifications designed to comply with NUREG-0612 Guideline.
-- = Not applicable.

Table 2.1 (Cont.)

<u>Heavy Loads</u>	<u>Weight or Capacity (tons)</u>	<u>Guideline 1 Safe Load Paths</u>	<u>Guideline 2 Procedures</u>	<u>Guideline 3 Crane Operator Training</u>	<u>Guideline 4 Special Lifting Devices</u>	<u>Guideline 5 Slings</u>	<u>Guideline 6 Crane - Test and Inspection</u>	<u>Guideline 7 Crane Design</u>	<u>Interim Measure 1 Technical Specifications</u>	<u>Interim Measure 6 Special Attention</u>
New Fuel Storage Block	2.5	C	R	--	--	C	--	--	C	--
GE Model 1600 Cask	13	C	C	--	R	--	--	--	--	--
Equipment Storage Pool Shield Block	43.5	C	C	--	R	--	--	--	--	--
Reactor Cavity Shield Block	50	C	C	--	--	C	--	--	--	C
Fuel Pool Shield Blocks	5	C	C	--	--	C	--	--	C	--
New Fuel Shipping Container	1	C	C	--	--	C	--	--	C	--
Drywell Radiation Shield	15	C	C	--	--	C	--	--	--	--
RPV Head	1	C	C	--	--	C	--	--	--	C
Fuel Preparation Machine	5	C	C	--	--	C	--	--	C	--
RPV Invesel Work Platform	50	C	C	--	--	C	--	--	--	C
2. Turbine Building Crane	125/5	--	--	C	--	--	C	C	--	--
Turbine H.C. Hood	54.2	R	C	--	--	C	--	--	--	--
Turbine L.P. Hood 'A'	30.3	R	C	--	--	C	--	--	--	--
Turbine L.P. Hood 'B'	30.3	R	C	--	--	C	--	--	--	--

Table 2.1 (Cont.)

<u>Heavy Loads</u>	<u>Weight or Capacity (tons)</u>	<u>Guideline 1 Safe Load Paths</u>	<u>Guideline 2 Procedures</u>	<u>Guideline 3 Crane Operator Training</u>	<u>Guideline 4 Special Lifting Devices</u>	<u>Guideline 5 Slings</u>	<u>Guideline 6 Crane - Test and Inspection</u>	<u>Guideline 7 Crane Design</u>	<u>Interim Measure 1 Technical Specifications</u>	<u>Interim Measure 6 Special Attention</u>
L.P. Inner Closing 'A'	51.6	C	C	--	--	C	--	--	--	--
L.P. Inner Closing 'B'	51.6	C	C	--	--	C	--	--	--	--
L.P. Rotor A & B	113	C	C	--	--	C	--	--	--	--
H.P. Rotor	41.3	C	C	--	--	C	--	--	--	--
L.P. Turbine Diaphragms	4.5-6.0	C	C	--	--	C	--	--	--	--
Bypass Valves Shield Block	1.4	C	C	--	--	C	--	--	--	--
Generator Rotor	140.9	C	C	--	--	C	--	--	--	--
Generator Endbells	6	C	C	--	--	C	--	--	--	--
Exciter Hood	11	C	C	--	--	C	--	--	--	--
Exciter Rotor	17.5	C	C	--	--	C	--	--	--	--
RFP Motor	17.5	C	C	--	--	C	--	--	--	--
Condensate Pump Shield Block	5.4	C	C	--	--	C	--	--	--	--
Condensate Pump	9.3	C	C	--	--	C	--	--	--	--
Condensate Pump Motor	6.5	C	C	--	--	C	--	--	--	--
WIP Heaters	22.6	C	C	--	--	C	--	--	--	--
HP Heaters	23.5	C	C	--	--	C	--	--	--	--

Table 2.1 (Cont.)

<u>Heavy Loads</u>	<u>Weight or Capacity (tons)</u>	<u>Guideline 1 Safe Load Paths</u>	<u>Guideline 2 Procedures</u>	<u>Guideline 3 Crane Operator Training</u>	<u>Guideline 4 Special Lifting Devices</u>	<u>Guideline 5 Blings</u>	<u>Guideline 6 Crane - Test and Inspection</u>	<u>Guideline 7 Crane Design</u>	<u>Interim Measure 1 Technical Specifications</u>	<u>Interim Measure 6 Special Attention</u>
Turbine Generator Diaphragms	2.8	R	C	--	--	C	--	--	--	--
Pallets & Misc. Materiel	1	R	C	--	--	C	--	--	--	--
Turbine Rotor Stands	11.2	R	C	--	--	C	--	--	--	--
<hr/>										
3. SRV Drywell Monorail	5	C	C	C	--	C	C	--	--	--
4. Torus Monoreil	5	C	C	C	--	C	C	--	--	--
5. Torus Access Hatch Hoist and Lifting Lug	2	C	C	C	--	C	C	--	--	--
6. Chlorine Container Monoreil and Cylinder Grab	2	C	C	C	--	C	C	--	--	--
7. Radwaste and Fuel Pool Shield Blocks Monorails	5	C	C	C	--	C	C	--	--	--
8. Reactor Building Floor Equipment Drain Tank Hatch Lifting Device	4	C	C	C	--	C	C	--	--	--
9. RCIC Pump Room Access Hatch Lifting Device	4	C	C	C	--	C	C	--	--	--
10. Drott Mobile Crane	3.5	C	C	C	--	C	C	--	--	--

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee's review of overhead handling systems has identified the following devices, which are in the vicinity of irradiated fuel or safe shutdown equipment, as subject to the criteria of NUREG-0612:

<u>Location</u>	<u>Handling System</u>	<u>Main/Auxiliary</u>
Turbine Building	Turbine Building Crane	125/5
Reactor Building	Reactor Building Crane	85/5
Drywell	SRV Drywell Monorail	5
Torus	Torus Monorail	5
Reactor Building	Torus Access Hatch Hoist and Lifting Lug	2
Intake Structure	Chlorine Container Monorail and Cylinder Grab	2
Reactor Building	Radwaste and Fuel Pool Shield Blocks Monorails	5
Reactor Building	Reactor Building Floor/ Equipment Drain Tank Hatch Lifting Device	4
Reactor Building	RCIC Pump Room Access Hatch Lifting Device	4
Reactor Building	Drott Mobile Crane	3.5

The Licensee also identified numerous other load handling devices, summarized in Tables 2.2 and 2.3, that have been excluded from the necessity of satisfying the general guidelines of NUREG-0612, Section 5.1.1, based on the following criteria:

1. physical separation between load impact points and any systems or components required for plant shutdown or decay heat removal, and/or
2. handling device capacity, and/or
3. a sole-purpose lift function and the fact that a load drop would damage only the equipment lifted.

Table 2.2. NUREG-0612 Handling System Exclusions

<u>Equipment</u>	<u>Reason for Exclusion</u>
1. Reactor Recirculation Pump Monorail Motor Hoist	Sole-purpose maintenance lift
2. High Pressure Coolant Injection Turbine Monorail	Sole-purpose maintenance lift
3. "A" Turbine Floor Portable A-Frame and Monorail	Sole-purpose maintenance lift
4. "A" RHR Pump Room Access Hatch Lifting Lugs	Will be removed
5. "B" RHR Pump Room Access Hatch Lifting Lugs	Will be removed
6. "B" Turbine Building Portable A-Frame Lifting Lugs	Sole-purpose maintenance lift

Table 2.3. Overhead Load Handling Devices Not Considered
Because of Physical Separation or Capacity

<u>Location</u>	<u>Handling Device</u>	<u>Capacity*</u>	<u>ID No.</u>
Reactor Building	Refueling Facilities Channel Handling Jib Boom	50 lb	3
Reactor Building	Refueling Facilities Motor-Drive Jib Crane A	1,500 lb	4
Reactor Building	Refueling Facilities Motor-Drive Jib Crane B	1,500 lb	5
Reactor Building	Channel Handling Overhead Rigging	50 lb	7
Radwaste Building	Radwaste Conveyor Load-Out Monorail	12,000 lb	8
Radwaste Building	Radwaste Centrifuge Hoist A	4,000 lb	9
Radwaste Building	Radwaste Centrifuge Hoist B	4,000 lb	10
Radwaste Building	Radwaste Building Monorail	6,000 lb	11
Off-Gas Stack	Off-Gas Stack Monorail	6,000 lb	12
Radwaste Building	Radwaste Building Sump Monorail	6,000 lb	13
Turbine Building	C Turbine Building Portable A Frame Monorail C	1,500 lb	16
Drywell	MSIV Area Lifting Lug	1,000 lb	18
Drywell	MSIV Area Lifting Lug	1,000 lb	19
Steam Chase	MSIV Area Monorail	6,000 lb	20

*"A heavy load has been defined (per NUREG-0612) as any load carried in a given area after a plant becomes operational that weighs more than the combined weight of a single spent fuel assembly and its associated handling tool for the specific plant in question. At the Monticello Nuclear Plant, this weight has been conservatively calculated to be 1500 lb."

Table 2.3 (Cont.)

<u>Location</u>	<u>Handling Device</u>	<u>Capacity*</u>	<u>ID No.</u>
Steam Chase	MSIV Area Monorail	6,000 lb	21
Diesel Generator Building	Diesel Generator A Monorail A & B Lifting Lugs	470 lb	22
Diesel Generator Building	Diesel Generator B Monorail A & B Lifting Lugs	470 lb	23
Turbine Building	Electric Breakers Bridge Hoist Room A	1,000 lb	24
Turbine Building	Electric Breakers Bridge Hoist Room B	1,000 lb	25
Radwaste Building	Radwaste Storage Bridge Crane	20,000 lb	26
Hot Machine Shop	Hot Machine Shop Monorail	4,000 lb	27
H ₂ Storage Building	CO ₂ and H ₂ Monorail	4,000 lb	29
Intake Structure	Screen House Bridge Crane	10,000 lb	30
Intake Structure	Trash Basket Jib Crane	4,000 lb	32
Turbine Building	Tube Pulling Pit Monorail and Lifting Lug	2,000 lb	33
Radwaste Building	Radwaste Capping Station Monorail	1,000 lb	34
Reactor Building	RWCU Filter Shield Block Monorail	10,000 lb	35
Turbine Building	Condensate Drain Holding Pump A Hatch Monorail	6,400 lb	37
Turbine Building	Condensate Drain Holding Pump B Hatch Monorail	6,400 lb	38
Turbine Building	Condensate Drain Holding Pump C Hatch Monorail	6,400 lb	39
Turbine Building	Condensate Drain Holding Pump D Hatch Monorail	6,400 lb	40

Table 2.3 (Cont.)

<u>Location</u>	<u>Handling Device</u>	<u>Capacity*</u>	<u>ID No.</u>
Turbine Building	Condensate Drain Holding Pump E Hatch Monorail	6,400 lb	41
Radwaste Storage Bldg	New Shipping Building Crane	20,000 lb	42
Reactor Building	Reactor Refueling Platform Handling Device	1,000 lb	43
Reactor Building	Reactor Vessel Service Platform	1,500 lb	46
Radwaste Building	Redwaste Devices Entrance Monorail	2,000 lb	47
Radwaste Building	Hot Machine Shop Jib Crane and Lifting Lug	2,000 lb	48
Off-Gas Storage Bldg	Off-Gas Storage Building Jib Crane	15,000 lb	49
Off-Gas Storage Bldg	Off-Gas Storage Building Monorails	1,000 lb	50
Reactor Building	CRD Rebuild Area Monorail	1,000 lb	51
Reactor Building	Drywell Equipment Hatch Monorail and Lifting Device	3,000 lb	52
Reactor Building	Low-Level Contamination Work Area Monorail	1,000 lb	56
Reactor Building	Reactor Building Closed Cooling Water Heat Exchange Lifting Lugs	6,000 lb	57
Turbine Building	Reactor Feedwater Pump A Monorail	2,000 lb	58
Turbine Building	Reactor Feedwater Pump B Monorail	2,000 lb	59
Turbine Building	Miscellaneous Lifting Lugs	6,000 lb	60

b. Evaluation and Conclusion

Based upon the discussion provided, the Licensee's rationale for excluding certain handling devices listed in Tables 2.2 and 2.3 is consistent with the intent of NUREG-0612.

2.1.2 Safe Load Paths [Guideline 1, NUREG-0612, Section 5.1.1(1)]

"Safe load paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The path should follow, to the extent practical, structural floor members, beams, etc., such that if the load is dropped, the structure is more likely to withstand the impact. These load paths should be defined in procedures, shown on equipment layout drawings, and clearly marked on the floor in the area where the load is to be handled. Deviations from defined load paths should require written alternative procedures approved by the plant safety review committee."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that safe load paths are procedurally defined for the reactor building crane and the turbine building crane. All other NUREG-0612 handling systems have fixed load paths as determined by the path of the associated monorail or have no load paths because the lifting point is fixed.

Designated safe load paths are not marked on the floor for the reactor and turbine building cranes. Safe load paths in the reactor building are not marked because protective coverings used to minimize the spread of contamination would obscure the marked load paths. Further, the physical dimensions and the space available for laydown of major heavy loads do not allow major deviations from the designated load paths. In the turbine building, an exclusion area over safe shutdown equipment on lower levels has been identified and marked with painted lines. Normally, heavy loads are excluded from this area.

However, due to the significant maintenance scheduled for the 1984 maintenance outage (i.e., replacement of both low pressure turbine spindles), the Operations Committee has approved a procedure to allow transportation and

storage of major turbine generator components within the exclusion area. The procedure, which does not allow movement of the generator rotor or turbine rotors within the area, contains the following additional provisions:

1. Lift height is restricted to a maximum height of 6 inches.
2. Load paths shall follow, as much as practicable, structural floor members or beams.

To ensure that load paths are adhered to where designated, procedures will be modified to require a second individual who will be responsible for ensuring compliance.

Any deviation from designated load paths requires prior approval by the Operations Committee.

b. Evaluation

The safe load path drawings provided by the Licensee indicate that load paths developed for use on the refueling floor satisfy the requirements of NUREG-0612. Exclusion areas which have been developed in the turbine building are acceptable on the basis that they are well defined, well marked, and normally exclude movements of all heavy loads. The Licensee should ensure, however, that adequate instructions and warnings are included in formal administrative or load handling procedures to prevent nonapproved movements into this exclusion area. In addition, the instance noted (1984 maintenance outage) by the Licensee in which movements into this area will occur appears to be acceptable on the basis that the deviation has been reviewed and approved by the Operations Committee and a formal procedure has been prepared for use. However, the Licensee should ensure that, following completion of the major maintenance, movements of heavy loads into the exclusion area are again prohibited and that the procedure is removed from use. Future movements of heavy loads into the turbine building exclusion area should be identified and approved by the Operations Committee on a case-by-case basis so that the movements are clearly identified and individually approved.

Although the marking of safe load paths on the floor may not be practical, the intent of NUREG-0612 is to provide some type of suitable visual

aid to the crane operator so that the operator is not distracted by a procedure or drawing when a load is attached under hook. Suitable visual aids have also been implemented at the Monticello plant which are consistent with guideline requirements. Use of a designated individual to ensure that load paths are followed is acceptable, as is permanent marking of the turbine building exclusion area.

The method of review and approval of safe load path deviations is consistent with Section 5.1.1(1) of NUREG-0612.

c. Conclusion and Recommendations

Implementation of safe load paths and exclusion areas at the Monticello Nuclear Generating Plant is consistent with Guideline 1 of NUREG-0612.

2.1.3 Load Handling Procedures [Guideline 2, NUREG-0612, Section 5.1.1(2)]

"Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612. These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

a. Summary of Licensee Statements and Conclusions

The Licensee has stated that procedures were prepared or revised to meet the requirements of NUREG-0612, Section 5.1.1(2), as part of the interim actions for the control of heavy loads. A detailed list of heavy loads and procedures governing the handling of each load has been supplied by the Licensee for the reactor building and the turbine building.

b. Evaluation

Specific procedures identified by the Licensee for load handling at the Monticello plant are consistent with the criteria of Guideline 2 based on the

Licensee's statement that procedures were developed in accordance with Section 5.1.1(2) of NUREG-0612. In addition, the detailed listing and load path drawings provided by the Licensee indicate that the handling of the heavy loads identified in Table 3-1 of NUREG-0612 has been adequately addressed.

c. Conclusion

Development of procedures at the Monticello Nuclear Plant is consistent with Guideline 2.

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

"Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [8]."

a. Summary of Licensee Statements and Conclusions

The Licensee states that Monticello Nuclear Plant operator training, qualifications, and performance were reviewed as part of the interim actions for the control of heavy loads and comply with ANSI B30.2-1976 with no exceptions.

b. Evaluation and Conclusion

Crane operator training and qualification are performed in a manner consistent with Guideline 3.

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' [9]. 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 dryer/steam separator and reactor vessel/drywell head special lifting devices as being subject to the requirements of NUREG-0612. A detailed design verification [5] was provided for both special lifting devices. The results of the design review indicate that all components of the two special lifting devices meet the applicable requirements for design stated in paragraph 3.2 of ANSI N14.6-1978. The Licensee has stated that procedures and administrative control will be prepared and/or revised as appropriate to correct the deficiencies identified in the design review.

Regarding testing to ensure continuing compliance, the Licensee states that the dryer/steam separator sling lifting device has been load-tested to 145% of the maximum service load and the head lifting device has been tested to 125% of rated capacity (this corresponds to greater than 160% of the maximum service load). In addition, existing procedures for the removal and installation of the drywell and reactor vessel heads require that visual inspections be performed on the lifting device prior to usage. These procedures will be revised to require verification of continued compliance by periodic load tests or NDE methods.

b. Evaluation

The design review of the dryer/separator and the drywell/reactor vessel head special lifting devices indicates that the device designs are comparable to the criteria in ANSI N14.6-1978. All major components of both devices meet or exceed the stress design factors specified in ANSI N14.6-1978. Certificates of compliance exist for most materials, and welders/weld procedures were qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. Documentation exists to support the performance of ultrasonic and magnetic particle inspections and rated load tests. Load tests of at least

160% for the drywell/reactor vessel head and 145% for the dryer/separator head have been performed and are in compliance with ANSI N14.6-1978. In addition, design specifications provided by the Licensee indicate that the test and inspection program required by Section 5 of ANSI N14.6-1978 has been implemented.

While the special lifting device review by the Licensee's representative indicated several procedural and administrative deficiencies, the Licensee has made a commitment to correct these deficiencies in accordance with the contractor's recommendations. When these corrections are completed, the Monticello special lifting devices will satisfy the requirements of this guideline.

c. Conclusion and Recommendation

Contingent upon completing the specified procedural and administrative controls revisions to the special lifting device program, the Monticello Nuclear Plant will comply with Guideline 4 of NUREG-0612.

2.1.6 Lifting Devices (Not Specially Designed) [Guideline 5, NUREG-0612, Section 5.1.1(5)]

"Lifting devices that are not specially designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, 'Slings' [10]. 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 states that slings used with the reactor and turbine building cranes for handling heavy loads comply with the design and inspection requirements of ANSI B30.9-1971. The slings have a minimum factor of safety of 5 and the rated capacity of the slings used for handling heavy loads shall be taken

from tables in ANSI B30.9. Information received from the Wire Rope Technical Board revealed that the basis for the ANSI B30.9 safety factor is the dynamic loading associated with the transporting of any load. Since dynamic load is accounted for in the sling rating, no additional downrating is believed necessary.

b. Evaluation

The Monticello Nuclear Generating Plant substantially meets the intent of Section 5.1.1(5) of NUREG-0612 based on compliance to ANSI B30.9-1971. However, while it is agreed that the sling safety factors include some allowance for dynamic loading, the intent of Guideline 5 is to ensure that routine dynamic loads do not affect or impact the factor of safety inherent in this rope. The NUREG requirement to independently consider routine dynamic loads is based on the intention to reserve the built-in factor of safety of 5 for non-routine variables such as aging, wear, and unexpected dynamic loads (i.e., load hangup). It has previously been found acceptable that if it can be demonstrated that the dynamic loads are a reasonably small percentage of the overall static load, the dynamic contribution may be disregarded. Review of available information determined that crane hoist speeds at the Monticello plant do not exceed 30 fpm. Considering the nominal allowance for dynamic loading provided in CMAA-70 for crane design (dynamic load = $0.5\% \times$ static load per foot per minute of hoist speed), it can be concluded that the maximum dynamic loading in Monticello slings subject to NUREG-0612 will be relatively small. Since these slings were designed with a safety factor of 5 in accordance with ANSI B30.9-1971, the dynamic loading is not considered significant and may be disregarded in determining the sling's maximum rated load.

c. Conclusion

Selection and use of slings at the Monticello Nuclear Plant is in accordance 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 states that procedures for inspection, testing, and maintenance of the cranes were reviewed and revised to comply, with no exceptions, to requirements in ANSI B30.2-1976.

b. Evaluation and Conclusion

Inspection, testing, and maintenance of cranes at the Monticello Nuclear Plant are performed in accordance 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' [11]. 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 reactor building crane and turbine building crane were both manufactured prior to the issuance of CMAA-70 and ANSI B30.2. These cranes were designed to comply with EOCI 61. A detailed design review of the crane design criteria used and the requirements of CMAA-70, ANSI B30.2-1976 and Regulatory Guide 1.13 was provided by the

Licensee [4]. One item was noted to be not in strict compliance with CMAA-70 for the turbine building crane; however, an argument demonstrating the adequacy of the current design is provided as follows:

- o The gear durability rating of the main hoist external reduction gear is 26% less than that required by CMAA-70. (The CMAA-70 value is 26.4 hp; the actual rating is 21 hp.) The crane manufacturer does not believe this to be a problem because the purpose of the requirement is to account for service-related deterioration of the gear teeth. Periodic inspections that are consistent with normal maintenance routines are sufficient to qualify the serviceability of the gearing from a durability standpoint.

b. Evaluation

Review of information provided indicates that the NRC has previously evaluated the modifications that provide redundant lifting features [12] of the Monticello reactor building crane. That evaluation concluded that the reactor building crane, with its proposed modifications, incorporates all provisions of draft Regulatory Guide 1.104 that are practical in Monticello's crane design. Therefore, since this crane has been found to meet the criteria for a single-failure-proof crane, the reactor building crane satisfies the requirements of this guideline.

The design data provided for the turbine building crane indicate that the crane substantially meets the intent of Guideline 7 on the basis that the crane was originally built to EOCI-61 and complies with the majority of those sections of CMAA-70 noted to contain more restrictive requirements. The existing design will be comparable to the CMAA-70 requirements.

For the item noted to not be in compliance with CMAA-70, it is agreed that the proposed inspection program will accommodate the reduced gear durability ratio below that required by CMAA-70; the Licensee's commitment to perform these gear inspections will provide assurances of load handling reliability comparable to that of a crane designed to CMAA-70.

c. Conclusion

Design of the Monticello Nuclear Plant reactor and turbine building cranes is consistent 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.

The status of the Licensee's implementation and the evaluation of these interim protection measures are summarized in the succeeding paragraphs of this section.

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

"Licenses for all operating reactors not having a single-failure-proof overhead crane in the fuel storage pool area should be revised to include a specification comparable to Standard Technical Specification 3.9.7, 'Crane Travel - Spent Fuel Storage Pool Building,' for PWR's and Standard Technical Specification 3.9.6.2, 'Crane Travel,' for BWR's, to prohibit handling of heavy loads over fuel in the storage pool until implementation of measures which satisfy the guidelines of Section 5.1."

a. Evaluation

Review of available information indicates that an evaluation of modifications providing redundant lifting features for the Monticello reactor building crane was performed by the NRC and the results forwarded to NSP on May 19, 1977 [12]. That letter concluded that the reactor building crane, with proposed modifications, incorporates all provisions of draft Regulatory Guide 1.104 that are practical in Monticello's crane design. Therefore, since Regulatory

Guide 1.104 preceded NUREG-0554, "Single-Failure-Proof Cranes for Nuclear Power Plants," Monticello's reactor building crane satisfies the NRC's intent for single-failure-proof/redundant lifting features and NSP is not required to implement the technical specification of this interim protection measure. However, the NRC's conclusions were subject to the following operational requirements that still should be adhered to by the Licensee:

1. The carry height of the IF-300 70-ton cask shall be administratively limited to a maximum of the minimum height necessary to gain floor clearance during cask swing plus 2 inches.
2. The carry height of the NFS-4 and NAC-1 casks, approved for use in NRC's letter of January 25, 1977, shall be limited to a maximum of 6 inches.
3. The travel path of all spent fuel shipping casks shall be within the limits established in NSP submittals of January 22 and June 16, 1976.
4. Loads of weight greater than one fuel element (excluding the crane load blocks and associated tackle) shall not be transported directly over spent fuel stored in the spent fuel pool without prior NRC approval.

b. Conclusion

The Monticello Nuclear Plant is not required to comply with Interim Protection Measure 1, but remains subject to the NRC conditions noted in the evaluation.

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

"Procedural or administrative measures [including safe load paths, load handling procedures, crane operator training, and crane inspection]... can be accomplished in a short time period and need not be delayed for completion of evaluations and modifications to satisfy the guidelines of Section 5.1 of [NUREG-0612]."

a. Summary of Licensee Statements and Conclusions

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

b. Evaluations, Conclusions, and Recommendations

The evaluations, conclusions, and recommendations are contained in discussions of the respective general guidelines in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7.

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

"Special attention should be given to procedures, equipment, and personnel for the handling of heavy loads over the core, such as vessel internals or vessel inspection tools. This special review should include the following for these loads: (1) review of procedures for installation of rigging or lifting devices and movement of the load to assure that sufficient detail is provided and that instructions are clear and concise; (2) visual inspections of load bearing components of cranes, slings, and special lifting devices to identify flaws or deficiencies that could lead to failure of the component; (3) appropriate repair and replacement of defective components; and (4) verify that the crane operators have been properly trained and are familiar with specific procedures used in handling these loads, e.g., hand signals, conduct of operations, and content of procedures."

a. Evaluation

Although not specifically addressed by the Licensee, it is apparent from responses to Guidelines 2 and 3 that procedures for handling loads over the core and operator training have been reviewed and upgraded as appropriate. In addition, review of special lifting devices for compliance with ANSI N14.6-1978 was completed and procedures upgraded. The programs for the selection and use of slings have been reviewed and found to comply with NUREG-0612. Finally, the design of cranes at the Monticello plant has been reviewed and found to substantially comply with NUREG-0612.

c. Conclusion

The Monticello Nuclear Plant complies with Interim Protection Measure 6.

3. CONCLUSION

This summary is provided to consolidate the results of the evaluation contained in Section 2 concerning individual NRC staff guidelines into an overall evaluation of heavy load handling at Northern States Power Company's (NSP) Monticello Nuclear Generating Plant. 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 Monticello Nuclear Plant can be expected to be conducted in a highly reliable manner consistent with the staff's objectives as expressed in these guidelines.

3.2 INTERIM PROTECTION MEASURES

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. The evaluation of information provided by the Licensee indicates that measures have been properly implemented which ensure compliance with the staff's measures for interim protection at the Monticello Nuclear Generating Plant.

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