TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

VERMONT YANKEE NUCLEAR POWER CORPORATION

VERMONT YANKEE NUCLEAR POWER STATION

NRC DOCKET NO. 50-271

NRC TAC NO. 47132

NRC CONTRACT NO. NRC-03-81-130

FRC PROJECT C5506

FRC ASSIGNMENT 13

FRC TASK 401

Prepared by

Franklin Research Center
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Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

Lead NRC Engineer: A. Singh

June 15, 1984

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Principal Author	Group Leader	Department Director
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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. R. 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 Vermont Yankee Nuclear Power Corporation's (VYNPC) Vermont Yankee Nuclear Power Station. This evaluation was performed with the following objectives:

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

1.2 GENERIC BACKGROUND

Generic Technical Activity Task A-36 was established by the U.S. Nuclear Regulatory Commission (NRC) staff to systematically examine staff licensing criteria and the adequacy of measures in effect at operating nuclear power plants to assure the safe handling of heavy loads and to recommend necessary changes to these measures. This activity was initiated by a letter issued by the NRC staff on May 17, 1978 [2] to all power reactor licensees, requesting information concerning the control of heavy loads near spent fuel.

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

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

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

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

- 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
- provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure reliable operation of the hand ing 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 Vermont Yankee Nuclear Power Corporation (VYNPC), the Licensee for the Vermont Yankee 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 September 11, 1981, VYNPC provided the initial response [4] to this request. A draft technical evaluation report was prepared based upon this submittal and was informally transmitted to the Licensee for review and comment. On March 15, 1982, a telephone conference call was conducted with representatives of the NRC, FRC, and VYNPC to discuss unresolved issues. Additional information forwarded by VYNPC on April 1, 1982 [5], November 30, 1983 [6], and May 21, 1984 [7] has been incorporated into this technical evaluation.

2. EVALUATION

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

2.1 GENERAL GUIDELINES

The NRC has established seven general guidelines which must be met in order to provide the defense-in-depth approach for the handling of heavy loads. These guidelines consist of the following criteria from Section 5.1.1 of NUREG-0612:

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

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

Table 2.1. Vermont Yankee/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 Cranes	110/7	--	--	C	--	--	C	C	C	--
Reactor Vessel Head	54	C	C	--	R	--	--	--	--	C
Drywell Head	44	C	C	--	R	--	--	--	--	C
Dryer	22	C	C	--	R	--	--	--	--	C
Shroud Head/ Steam Separator	33	C	C	--	R	--	--	--	--	C
Shield Blocks	71.5	C	C	--	--	C	--	--	--	--
New Fuel Storage Vault Plugs (3)	3	--	C	--	--	C	--	--	--	--
Fuel Pool Gate	1	--	C	--	--	C	--	--	--	--
Refueling Slot Plugs	6	--	C	--	--	C	--	--	--	C
Vessel Head Insulation	4.5	--	C	--	--	C	--	--	--	C
Spent Fuel Shipping Cask	110	--	C	--	--	--	--	--	--	--

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

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
Filter-Demineralizer Hatch	8	--	C	--	--	C	--	--	--	--
Contaminated Eqmt. Storage Area Hatches	2.5	--	C	--	--	C	--	--	--	--
Head Strongback	4	--	C	--	--	C	--	--	--	C
Stud Tensioner Monorail	3.5	--	C	--	--	C	--	--	--	C
Cattle Chute	14	C	C	--	-	C	--	--	--	--
Dryer/Separator Storage Pool Plugs	43.5	C	C	--	R	C	--	--	--	--
Load Block	6	--	C	--	--	C	--	--	--	--
HP Water Blaster	2.5	--	C	--	--	C	--	--	--	--
Vessel Service Platform	5	--	C	--	--	C	--	--	--	C

2.1.1 Heavy Load Overhead Handling Systems

a. Summary of Licensee Statements and Conclusions

The Licensee's review of overhead handling systems identified the reactor building crane as the only crane to handle heavy loads in the vicinity of irradiated fuel or safe shutdown equipment and therefore be subject to the criteria of NUREG-0612.

The Licensee also identified numerous other cranes and hoists that were excluded from compliance with the criteria of NUREG-0612 general guidelines. These handling systems include the following:

1. reactor recirculation pump monorail
2. CRD pump monorails
3. refueling platform hoist and refueling floor jib crane
4. turbine building bridge crane
5. reactor feedwater pump monorails
6. recirculation motor generator sets monorail
7. diesel generator monorails
8. HPCI equipment monorail
9. RCIC equipment monorail
10. various maintenance monorail hoists.

The Licensee stated that the reactor recirculation pump monorail (1), located over the recirculation pumps and motors, can be used only when the plant is shut down and operating in the decay heat removal mode. This monorail is used only for removing and reinstalling recirculation pump motors and pump parts and can not impact on piping, cabling, or instrument lines associated with safe shutdown functions. Similarly, separate CRD pump monorails (2), located over each CRD pump, service a CRD pump which has previously been removed from service. There is no other safe shutdown equipment which may be affected and sufficient separation exists between CRD pumps to prevent any damage resulting from a load drop.

The refueling platform hoist and refueling floor jib crane (3) are being downgraded by the Licensee from a capacity of 1000 lb to the weight of a single fuel assembly (700 lb) and are being clearly marked to so indicate. In the event that loads greater than 700 lb must be lifted, the Licensee stated that a safety evaluation will be prepared to assure that NUREG-0612 criteria

are complied with, although the reactor building crane auxiliary hook could be used for such a lift.

The turbine building crane (4), used primarily for moving large turbine generator components during maintenance or overhaul, has been excluded from compliance with NUREG-0612 on the basis that there is no safety-related equipment within the travel limits of this crane, with the exception of a portion of a diesel generator room. The Licensee stated that this room has been designated as a storage area and heavy loads are not permitted to be carried over this area.

The reactor feedwater pump monorails (5) and the recirculation motor generator sets monorail (6) have been excluded as there is no safety-related equipment or equipment required for safe shutdown in the immediate vicinity of either handling system.

For the diesel generator (7), HPCI (8), and RCIC (9) monorails, the Licensee stated that each system is a special purpose handling device, normally used during the performance of maintenance when the respective system is out of service. Additional administrative controls will be established to preclude unauthorized use of these monorails.

For remaining handling systems (10), the Licensee stated that sufficient physical separation exists between load impact points and safety-related components so that a load drop would be of no consequence to safe shutdown.

b. Evaluation and Conclusion

VYNPC's identification of load handling systems which are subject to compliance with NUREG-0612, as well as those which may be excluded, is consistent with NUREG-0612 guidance.

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 stated that maintenance procedures for assembly and disassembly of the reactor vessel will be revised to define safe load paths for the following major loads:

- o reactor cavity shield blocks
- o dryer/separator pool shield blocks
- o fuel pool gate shield blocks
- o drywell head
- o reactor vessel head
- o steam dryer
- o steam separator
- o cattle chute.

A refuel floor layout will be marked to indicate the safe load paths for the loads identified above, and will be incorporated into the maintenance procedures. The tag man directing the crane operator's movement will use this layout to assure that safe load paths are adhered to. A copy of the drawing will also be placed in the cab of the reactor building crane for reference purposes. Assembly and disassembly procedures will also be revised to require review and approval by the maintenance supervisor, senior maintenance engineer, or maintenance engineer for any deviations from established safe load paths.

b. Evaluation

Commitment by the Licensee to identify safe load paths for the major loads carried by the reactor building crane meets the intent of this guideline. Further actions to ensure that the load paths are followed by using suitable visual reinforcement (tag man) also satisfy the guideline's intent. Finally, requirements to ensure that deviations from formally established load paths will receive an appropriate technical review are also satisfactory.

c. Conclusion

Development of safe load paths at the Vermont Yankee plant is consistent with Guideline 1.

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

A detailed list of heavy loads and the procedures governing the handling of each load was supplied by the Licensee, who further stated that these handling procedures (O.P.'s 1200, 1201, and 2200) presently contain the following:

- precautions and prerequisites
- identification of proper handling equipment
- training and qualification requirements for crane operators
- sling selection criteria
- required crane inspections prior to load handling
- supervision of lift by a designated individual
- steps in order to perform the lift

In addition, the Licensee stated that other procedures will be revised to more explicitly identify those items listed above.

b. Evaluation and Conclusion

Development and implementation of procedures at the Vermont Yankee plant is consistent with the criteria of Guideline 2.

2.1.4 Crane Operator Training [Guideline 32, 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

Current procedures were reviewed by the Licensee against the provisions of ANSI B30.2-1976, Chapter 2-3. A number of minor changes were found necessary for the current Vermont Yankee program to satisfy the requirements of the standard. In addition, the Licensee stated that a new procedure with qualification records has been developed in order to formalize the program for crane operator training.

b. Evaluation

The Vermont Yankee plant satisfies this guideline on the basis of their comparison of current operator training with requirements and identification of necessary revisions in order to comply with Chapter 2-3 of ANSI B30.2-1976.

c. Conclusion and Recommendation

Qualification and training of crane operators at the Vermont Yankee plant is performed in a manner consistent with Guideline 3 on the basis of the Licensee's verification that when minor revisions are completed, the operator training program will comply with ANSI B30.2-1976, Chapter 2-3.

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

Two special lifting devices identified by the Licensee have been evaluated in accordance with the criteria of ANSI N14.6-1978. These special lifting devices are (1) the dryer and separator sling assembly and (2) the head strongback. The spent fuel shipping cask lifting yokes are the only other lifting devices of concern; however, details of each yoke lifting device design must be submitted to the NRC prior to any cask handling operations and are therefore not addressed in this response.

The Licensee stated that the two special lifting devices of concern were designed by General Electric Company (GE) prior to the existence of ANSI N14.6-1978; therefore, a number of sections are difficult to apply in retrospect, and insufficient documentation is available to assure that all subparts of these sections were met. These sections include the following:

- o Designers Responsibilities (3.1)
- o Design Considerations (3.3)
- o Fabrication (4)

However, information that is available indicates that sound engineering practices by the fabricator and inspector were enforced by the designer to ensure that the designer's intent was accomplished. Further, the Licensee stated that several other sections of ANSI N14.6-1978 are not pertinent to load handling reliability of the devices and have not been addressed, including the following sections:

- o Scope and Definitions (1 and 2)
- o Design Consideration to Minimize Decontamination Efforts (3.4)
- o Coatings (3.5)
- o Lubricants (3.6)

Section 6 (Special Lifting Devices for Critical Loads) has not been evaluated by the Licensee because none of the loads lifted have been determined to be "critical loads."

Based upon the above considerations, detailed evaluation by the Licensee of the two designated special lifting devices was limited to Sections 3.1.3, 3.2.1.1, 3.2.3, and 5 of the ANSI standard. The head strongback and the dryer/separator sling assembly were both evaluated in accordance with ANSI N14.6-1978 critical design criteria and were subjected to stress analyses since the designer had not supplied such analyses for these devices. The lifting devices were also evaluated in accordance with American Institute of Steel Construction (AISC) specifications to determine compliance with the most widely used structural code as well as with ANSI criteria. Loads used were static loads of the major components increased by an impact factor of 15%. Results of these analyses are summarized in Tables 2.2 and 2.3.

The Licensee noted that the exact wire rope used was not specified in drawings; research performed indicates that galvanized wire rope with a fiber core was used on the dryer/separator sling. This rope has been used to conservatively determine the wire rope safety factors in Table 2.3.

Comparison of both devices with Section 5 identified the need for certain changes in Vermont Yankee plant procedures to meet the intent of ANSI inspection and testing requirements. Specifically, Section 5.3 (Testing to Verify Continuing Compliance) states that an annual load test to 150% be performed or, as an alternative, the lifting device be subjected to dimensional testing and visual and nondestructive inspection of major load carrying welds and critical areas. Because a load test to 150% of the maximum capacity is not practical, a detailed one-time inspection was performed of each lifting device using nondestructive testing techniques such as ultrasonic, magnetic particle, liquid penetrant, and visual where appropriate. Although some inferior craftsmanship was noted, it was determined to be cosmetic only and no structural weaknesses were detected. Therefore, based upon this inspection, a 10-year reinspection period is justified and has been established. In addition, operating personnel will conduct a thorough visual examination of the devices prior to each use for indications of damage or deformation. If major repairs or alterations are performed, the device will be subjected to the 150% load, followed by inspections specified in Section 5.3.2 of ANSI N14.6-1978.

Table 2.2. Head Strongback - Factors of Safety

Component	AISC	ANSI (Yield)	ANSI (Ultimate)
Minimum Requirement	1.00	3.00	5.00
Lifting Arms (Bending)	2.12	3.18	6.15
Lifting Arms (Shear)	4.06	5.25	5.85
Weld Flange to Web	2.81	-	9.37
Anchor Shackles	3.54*	-	21.20
2-1/2" Turnbuckles	2.37*	-	11.90
2-3/4" Turnbuckles	2.41*	-	12.10
Lifting Lugs (Tension)	8.30	13.50	(large)
Hook Pin (Bending)	12.70	21.20	(large)

*Denotes factor of safety with respect to manufacturer's Safety Working Load.

Table 2.3. Dryer and Separator Sling - Factors of Safety

Component	AISC	ANSI (Yield)	ANSI (Ultimate)
Minimum Requirement	1.00	3.00	5.00
Socket Pin (Bending)	2.71	3.61	5.76
Bell Housing (Bending in 3/8" Plate)	2.33	3.81	5.72
Bell Housing (Bending in 1" Plate over W6x15)	2.39	3.90	5.86
Cross Beam W5x16 (Axial Compression)	10.40	(large)	(large)
Cross Beam W5x16 (Bending)	3.90	6.38	7.19
Lifting Lugs (Bending Extensions)	5.59	9.10	(large)
2-1/2" Turnbuckles	2.99*	-	14.90
1-1/2" Wire Rope	-	-	8.20
Hook Box (Bending in Cross Plates)	6.94	11.36	(large)
Hook Box (Tension)	9.82	16.10	(large)
Hook Pin (Bending)	10.40	17.30	(large)

*Denotes factor of safety with respect to manufacturer's Safety Working Load.

b. Evaluation

It is acknowledged that a strict interpretation of compliance of existing special lifting devices with the criteria of ANSI N14.6-1978 cannot be made. Therefore, the Licensee's response is consistent with the intent of this guideline in addressing only those sections which are directly related to load handling reliability of the lifting devices. Further, the following sections are neither pertinent nor contain requirements which affect load handling reliability, including Scope (Section 1), Definitions (2), Design Considerations to Minimize Decontamination Efforts (3.4), Coatings (3.5), Lubrication (3.6), Inspector's Responsibilities (4.2), and Fabrication Considerations (4.3). In addition, Section 6 (Special Lifting Devices for Critical Loads) need not be included in this review since none of the loads identified by the Licensee has been determined to be a "critical load."

The Licensee stated that detailed comparison of the dryer/separator sling assembly and the head strongback was limited to Sections 3.1.3, 3.2.1.1, 3.2.3, and 5 of ANSI N14.6-1978. A review of design information provided indicates that both lifting devices satisfy the design criteria of ANSI N14.6-1978 in that all stress design factors are greater than 3 for yield strength and greater than 5 for ultimate strength. The Licensee also demonstrated that these special lifting devices satisfactorily accommodate dynamic loads while maintaining acceptable stress design margins.

Proposed Licensee inspections are acceptable to verify continuing compliance in accordance with Section 5.3.1(2). Programs to verify continuing compliance at the Vermont Yankee plant are consistent with this guideline on the basis of the Licensee's commitment to revise existing inspection and test requirements to conform to Section 5 of ANSI N14.6-1978.

Although an initial load test has not been performed, the detailed inspection that has been performed by the Licensee provides reasonable assurances of the fabrication and workmanship of the original devices. No evidence of structural weaknesses or defects in critical welds combined with knowledge of actual design stress margins is consistent with the intent of performing the original load test. Further, based upon results of this

inspection, it is agreed that the nondestructive examination inspection interval may be relaxed; however, the Licensee should ensure that visual inspections are performed prior to each period of use.

c. Conclusion

Design of special lifting devices at the Vermont Yankee plant, as well as implementation of inspection for continuing compliance, is consistent with the criteria of Guideline 4.

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 stated that special and general purpose slings are covered by criteria, added to load handling procedures, that meet the intent of ANSI B30.9-1971 for sling selection and use as well as inspection and maintenance. VYNPC also identified the service platform sling, which is a 3-leg wire rope sling used to hoist the service platform into place over the reactor vessel flange. This sling has also been evaluated against the criteria of ANSI B30.9-1971 for design, inspection, and maintenance and found to comply with no deviations or exceptions.

b. Evaluation

Procedures containing criteria for selection and use of slings at the Vermont Yankee plant, including the service platform sling, are acceptable on the basis of the Licensee's statement that these procedures meet the intent of ANSI B30.9-1971.

Review of available information (Whiting Corp. Drawing No. U70921) indicates that the maximum hoist speeds of the reactor building cranes are relatively slow (main hoist-5.5 fpm; auxiliary hoist-17 fpm). Therefore, dynamic loads which are imparted to the slings are reasonably small and need not be included with the static load or in selection and use of the slings.

c. Conclusion

Selection and use of slings at the Vermont Yankee plant satisfies Guideline 5 criteria.

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 stated that a new procedure, "Maintenance and Inspection Procedure for the Reactor Building Crane" has been developed which contains requirements for inspection, testing, and maintenance. In addition, modifications were made to the crane operation procedure, R.P. 2200 "Operation of the Reactor Building and Turbine Building Bridge Cranes," to include appropriate operator inspections prior to movement. Therefore, the Licensee stated that, with these revisions and modifications, plant procedures meet the intent of ANSI B30.2-1976, Chapter 2-2.

b. Evaluation

The Licensee satisfies the criteria of this guideline on the basis that crane inspection, testing, and maintenance programs at the Vermont Yankee plant comply with ANSI B30.2-1976.

c. Conclusion

Inspection, testing, and maintenance of cranes at the Vermont Yankee plant are consistent 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 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 reactor building crane was modified in 1976 to satisfy the requirements of APCSB BTP 9-1 which subsequently became NUREG-0554. The modifications included replacement of the trolley with one that had dual load paths on the main hoist. The criteria in BTP 9-1 called for the crane to be designed and fabricated to a number of industry standards, including ANSI B30.2 and CMAA-70. On December 30 1975, Vermont Yankee submitted to the NRC a report entitled, "Reactor Building Crane Modification," that described how the criteria of BTP 9-1 were satisfied for this crane. This information was reviewed and approved by the NRC, as described in the staff's safety evaluation report transmitted by letter of January 28, 1977 from R. Reid (NRC) to R. Groce (Yankee Atomic). Based on this previous review, we believe that for the Vermont Yankee Reactor Building Crane it is not necessary to reevaluate the crane design since conformance with the criteria of ANSI B30.2, CMAA-70, and other provisions of BTP 9-1 was addressed in the previous review."

b. Evaluation

The Vermont Yankee plant satisfies the criteria of this guideline on the basis that current crane design satisfies ANSI B30.2-1976 and CMAA-70 standards and has been previously found by the NRC staff to satisfy APCSB Branch Technical Position 9-1.

c. Conclusion and Recommendation

Design of cranes at the Vermont Yankee plant meets the intent of 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 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 is 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."

a. Evaluation

As noted in VYNPC's response to Guideline 7 (2.1.8), the reactor building crane is a single-failure-proof crane which has been previously approved by the NRC. Therefore, no action is required for the Licensee to satisfy this interim protection measure.

b. Conclusion

The Vermont Yankee plant complies with Interim Protection Measure 1.

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

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

a. 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

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(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 stated that upon receipt of NRC Generic Letter 81-07[2], special attention was given to procedures, equipment, and personnel for the handling of heavy loads over the core. Deficiencies noted, primarily in the area of operator qualification, were corrected by training conducted in May, 1981.

b. Evaluation and Conclusion

The Vermont Yankee 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 the Vermont Yankee Nuclear Power 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 Vermont Yankee 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) that certain measures should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until final implementation of the general guidelines of NUREG-0612, Section 5.1 is complete. Specified measures include the implementation of a technical specification to prohibit the handling of heavy loads over fuel in the storage pool; compliance with

Guidelines 1, 2, 3, and 6 of NUREG-0612, Section 5.1.1; 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 measures have been properly implemented which ensure compliance with the staff's measures for interim protection at the Vermont Yankee plant.

4. REFERENCES

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

2. V. Stello, Jr. (NRC)
   Letter to all licensees. Subject: Request for Additional Information on Control of Heavy Loads Near Spent Fuel
   May 17, 1978

3. NRC
   Letter to Vermont Yankee Nuclear Power Corporation. Subject: NRC Request for Additional Information on Control of Heavy Loads Near Spent Fuel
   December 22, 1980

4. E. W. Jackson (VYNPC)
   Letter to D. G. Eisenhut (NRC). Subject: Control of Heavy Loads
   September 11, 1981

5. E. W. Jackson (VYNPC)
   Letter to D. G. Eisenhut (NRC). Subject: Control of Heavy Loads
   April 1, 1982

6. W. P. Murphy (VYNPC)
   Letter to D. B. Vassallo (NRC)
   Subject: Control of Heavy Loads
   November 30, 1983

7. W. P. Murphy (VYNPC)
   Letter to D. B. Vassallo (NRC)
   Subject: Control of Heavy Loads
   May 21, 1984

8. ANSI B30.2-1976
   "Overhead and Gantry Cranes"

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

10. ANSI B30.11-1971
    "Slings"

11. CMAA-70
    "Specifications for Electric Overhead Traveling Cranes"