TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR POWER STATION UNITS 1, 2, AND 3

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Prepared by

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

Author: C. Bomberger

FRC Group Leader: I. H. Sargent

Prepared for

Nuclear Regulatory Commission
Washington, D.C. 20555

Lead NRC Engineer: A. Singh

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Prepared by:	Reviewed by:	Approved by:
Principal Author	Project Manager	Department Director
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Franklin Research Center
A Division of The Franklin Institute
The Benjamin Franklin Parkway, Phila., Pa 19103 (215) 448-1000

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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 Tennessee Valley Authority's Browns Ferry Nuclear Station Units 1, 2, and 3. This evaluation was performed with the following objectives:

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

1.2 GENERIC BACKGROUND

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

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

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

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

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

- 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 Tennessee Valley Authority (TVA), the Licensee for Browns Ferry Nuclear Plant Units 1, 2, and 3, requesting that the Licensee review provisions for handling and control of heavy loads at Browns Ferry Units 1, 2, and 3, 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 June 3, 1982, TVA provided a response [4] to this request. Based upon this information, a draft Technical Evaluation Report (TER) was prepared and informally transmitted to the Licensee for review and comment.

On October 28, 1982, a telephone conference call was held between the NRC and TVA to discuss the draft TER. In response to this telephone call, TVA provided additional information on January 25, 1983 [5], which has been incorporated into this final TER.

2. EVALUATION

This section presents a point-by-point evaluation of load handling provisions at Browns Ferry Units 1, 2, and 3 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 by all overhead load 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. 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. Browns Ferry Nuclear Plant Units 1, 2, and 3/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 Bldg. Crane	125/5	--	--	C	--	--	C	C	--	--
a. Reactor Well Shield Blocks	99.5	C	C	--	--	C	--	--	--	--
b. Equipment Pool Shield Plugs	50	C	C	--	--	C	--	--	--	--
c. Drywell Head	65	C	C	--	R	--	--	--	--	--
d. Reactor Head	105	C	C	--	R	--	--	--	--	C
e. Steam Dryer	45	C	C	--	R	--	--	--	--	C
f. Refueling Slot Shield Plugs	5.5	C	C	--	--	C	--	--	--	--
g. Refueling Canal Shield	12	C	C	--	--	C	--	--	--	--
h. Moisture Separator	70	C	C	--	R	--	--	--	--	C
i RPV Head Insulation	4	C	C	--	--	C	--	--	--	--
j. Skip Box Loaded	1.25	C	C	--	--	C	--	--	--	--
k. RPV Service Platform	7	C	C	--	--	C	--	--	--	--
l. Equipment Pool Covers	1.5	C	C	--	--	C	--	--	--	--

C = Licensee action complies with NUREG-0612 Guideline.
R = Licensee has proposed revisions or modifications which are consistent with the 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
m. MG Sets	7.5	C	C	--	--	C	--	--	--	--
n. Tensioner Carousel with 4 tensioners	1	C	C	--	--	C	--	--	--	--
o. Spent Fuel Cask	67	C	C	--	--	C	--	--	C	--
p. Surge Tank Plug	2.1	C	C	--	--	C	--	--	C	--
q. Portable Jib Crane	1	C	C	--	--	C	--	--	C	--
r. New Fuel Assemblies	0.5	C	C	--	--	C	--	--	C	--
s. Fuel Pool Gates	2	C	C	--	--	C	--	--	C	--
t. New Fuel Storage Vault Covers	4.25	C	C	--	--	C	--	--	C	--
u. RWCU Demin Vault Plugs and Vessel Head	6	C	C	--	--	C	--	--	C	--
v. Control Rod Storage Rack	0.5	C	C	--	--	C	--	--	C	--

Table 2.1 (Cont.)

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane - Test and Inspection	Guideline 7 Crane Design	Interim Measure 1 Technical Specifications	Interim Measure 6 Special Attention
2. Self Propelled Truck Crane	--	--	--	C	--	--	C	C	--	--
a. Reactor Building Exhaust Fans	17001b	C	C	--	--	C	--	--	--	--
b. CCW Pumps	20.35	C	C	--	--	C	--	--	--	--
c. CCW Pump Motors	24.35	C	C	--	--	C	--	--	--	--
d. Fire Pumps	25301b	C	C	--	--	C	--	--	--	--
e. RHR Service Pumps	1.7	C	C	--	--	C	--	--	--	--
3. Hook Type Manual Chain Hoist (47B and 47C)	4	--	--	C	--	--	C	C	--	--
a. Core Spray Pump Motor	2.6	C	C	--	--	C	--	--	--	--
b. CRD Pump Motor	1.25	C	C	--	--	C	--	--	--	--
c. Batch Shield Blocks	0.75	C	C	--	--	C	--	--	--	--

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 handling systems to be subject to the criteria of NUREG-0612:

- o reactor building crane (Units 1, 2, and 3)
- o two-operator, self-propelled, full-revolving, truck-type, rubber-tired, diesel-powered truck crane (yard)
- o 4-ton, hook-type, manual chain hoist (Units 1, 2, and 3).

The Licensee also provided an extensive list of more than 100 overhead load handling systems which have been excluded on the basis that a load drop would not result in damage to any system required for plant shutdown or decay heat removal for one of the following reasons:

1. There is sufficient physical separation of the overhead handling system from any system or component required for safe shutdown or decay heat removal.
2. The system or component over which the load is carried is out of service while the load handling system is used.
3. The load weighs less than 1000 lb and is not considered to be a heavy load. This weight is a conservative estimate of a fuel assembly and its handling device.

In a subsequent submittal [5], the Licensee provided additional information to substantiate exclusion of the following:

- o 3-ton jib crane: The Licensee made a commitment to initiate a design change report by June 1, 1983 requiring a stop to be installed to prevent the 3-ton jib crane from swinging into the critical electrical panels within its area of coverage.
- o 7.5-ton electric wire rope hoist: The Licensee confirmed that sufficient physical separation exists to preclude any safety impact on an 18-inch EECH header shown within the hoist area of coverage on drawings 47W200-6 and 47W200-13.

b. Evaluation and Conclusion

The Licensee's exclusion of above-mentioned systems and numerous others from compliance with NUREG-0612 is acceptable on the basis of TVA's justifica-

tions and additional commitment to incorporate a stop on the 3-ton jib crane to prevent its swing into the critical electrical panels within its area of coverage.

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 Conclusion

The Licensee stated that loads, safe load paths, and handling procedures for the reactor building crane are contained in Browns Ferry Mechanical Maintenance Instruction (MMI) 119.

Safe load paths for the truck crane are shown in Browns Ferry drawings 37W300-1, 47W220-1, and 47W220-2.

The 4-ton manual chain hoist (47B/C) is used over hatches to remove various equipment from lower floors to the elevation-565 floor as shown on Browns Ferry drawing 44N330. When operating over the hatches shown on Browns Ferry drawings 47W220-6, -7, -13, and -14 during unit operation, the hoist must not lift heavy loads over the core spray pumps and piping.

In a subsequent submittal [5], the Licensee made a commitment to complete the following actions:

1. MMI-119 will be revised by June 1, 1983 to require the person in charge of each heavy load lift to walk the predetermined load path for the benefit of the crane operator and the flagman.

2. MMI-119 will be revised by June 1, 1983 to require plant operational review committee (PORC) approval for any deviation from a safe load path which will require a heavy load to be lifted over spent fuel or functional safe shutdown equipment.

b. Evaluation

Drawings indicate that the Licensee identified safe load paths for the reactor building crane and safe load areas for the 24-ton truck crane and the various hoists. In addition, these load paths and areas are defined in plant procedures contained in MMI-119.

Although the Licensee has not indicated that load paths will be marked, this objective of providing visual aid for the operator and flagman is accomplished by having the person in charge of the lift walk the predetermined load path to ensure that the path is clear prior to the start of the lift. However, the Licensee should ensure that the duties of the path walker and the flagman are clearly defined in appropriate procedures.

Further, the method proposed to implement the review and approval of safe load path deviations is consistent with the intent of NUREG-0612.

c. Conclusion and Recommendations

Browns Ferry Units 1, 2, and 3 comply with Guideline 1 of NUREG-0612 contingent upon Licensee verification that proposed changes in MMI-119 have been acceptably implemented and that the duties of the flagman with regard to safe load handling are defined in appropriate procedures.

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 load path; and other special precautions."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that handling procedures for the reactor building crane are contained in MMI-119. Handling procedures for the truck crane will

be developed and implemented to meet the requirements of the interim guidelines delineated in NUREG-0612. Administrative controls for the 4-ton manual chain hoist will be invoked to ensure that safe handling operations are maintained over these hatches during unit operation. In a subsequent submittal, the Licensee made a commitment to incorporate administrative controls for the truck crane and the 4-ton manual chain hoist into MMI-119 by June 1, 1983 and to provide the information on this change by June 30, 1983.

b. Evaluation

MMI-119 provides procedural controls consistent with NUREG-0612 for the movement of heavy loads on the refueling floor by the reactor building crane. Further, the Licensee's commitment to implement administrative controls for the loads handled by the truck crane and the 4-ton manual hoist meets the intent of Section 5.1.1(2) of NUREG-0612.

c. Conclusion and Recommendation

Development of safe load paths at Browns Ferry Units 1, 2, and 3 is consistent with Guideline 2 of NUREG-0612 contingent upon implementation of acceptable administrative controls for the truck crane and the 4-ton manual chain hoist.

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' [6]."

a. Summary of Licensee Statements and Conclusions

The Licensee stated that qualification requirements for reactor building crane operators are in Browns Ferry Standard Practice BF 4.3, "Crane Operator Qualification and Authorization," which implements the requirements of ANSI B30.2-1976.

Operators for the truck crane are journeyman operators from the International Unit of Operating Engineers, Local 320. The Licensee stated in a

subsequent submittal that, by June 1, 1983, a review will be performed to determine compliance with ANSI B30.5 with regard to truck crane operator training and qualification.

Qualification of operators of hand-powered chain hoists is not required.

b. Evaluation

Crane operator training, qualification, and conduct described in BF 4.3 is consistent with the intent of Section 5.1.1(3) of NUREG-0612. Further, although operator training outlined in ANSI B30.2-1976 is not required for such handling systems as the truck crane and the 4-ton manual chain hoist, the Licensee should ensure that indoctrination and training covering Browns Ferry administrative controls for these load handling systems are in effect and that this program complies with applicable requirements of ANSI B30.5, "Crawler, Locomotive, and Truck Cranes"; and ANSI B30.16, "Overhead Hoists (Underhung)."

c. Conclusion

Training and qualification of crane operators at Browns Ferry Units 1, 2, and 3 is performed in a manner consistent 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 [7], 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4500 kg) or More for Nuclear Materials.' 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 (stactic load) of the load and of the intervening components of the special handling device."

a. Summary of Licensee Statements and Conclusions

The following special lifting devices have been identified by the Licensee to be subject to compliance with the criteria of this guideline:

- o spent fuel cask rotator
- o spent fuel cask redundant link assembly
- o reactor pressure vessel (RPV) head strongback
- o steam dryer/moisture separator sling.

For each of these devices, a detailed comparison was made between the design, fabrication, and acceptance testing of each device and the applicable criteria of ANSI N14.6-1978. Design margins for the cask rotator, cask redundant link assembly, and the dryer/separator sling are in compliance with ANSI criteria of 3 on yield strength and 5 on ultimate strength. Design margins for the RPH head strongback are in compliance with one exception, the cruciform structure, which has a design margin of 4.8 on ultimate. The Licensee stated that this is adequately compensated for by a requirement that the device have a design margin of 4 for all components on yield strength.

The Licensee stated that initial load tests were performed for the cask rotator and the dryer/separator sling which satisfy the ANSI criteria for 150% load tests. In addition, the cask redundant link assembly will be load tested to 150%. For the head strongback, however, a rated load test was performed to 130% only, followed by nondestructive examination (NDE) of all load bearing welds. Further testing to 150% is not considered to be necessary by the Licensee due to infrequent and specified uses of this device.

Regarding programs to ensure continuing compliance of these devices, the Licensee stated that annual load tests of these devices are impractical. Therefore, periodic visual and NDE inspections will be performed as allowed by ANSI N14.6-1978, Section 5.3.1(2). Visual inspections will be performed prior to each use, whereas NDE will be performed at longer intervals (5 or 10 years, to be selected); longer inspection intervals are believed warranted by the Licensee due to the limited frequency of use of these devices.

b. Evaluation

Although not in strict compliance with the criteria of ANSI N14.6-1978, the detailed comparison which has been performed by the Licensee clearly demonstrates that design and fabrication of these devices was performed in a manner consistent with the standard, design margins adequately satisfy the standard, and it is evident that these devices will provide a high degree of load handling reliability. Further, performance of (or commitment to perform) substantial overload tests adequately provides proof of workmanship during fabrication of these devices. Programs that will be implemented to ensure continuing compliance also appear to be satisfactory based upon the Licensee's commitment to comply with Section 5.3.1(2) of ANSI N14.6-1978. It is also agreed that relaxation of the periodicity of NDE beyond one year is reasonable based on the reduced service of these devices.

c. Conclusion and Recommendation

Design, fabrication, and programs for continuing compliance of special lifting devices at Browns Ferry Units 1, 2, and 3 are 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 guideline of ANSI B30.9-1971, 'Slings' [8]. 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 all slings used with load handling systems subject to NUREG-0612 criteria are inspected and tested in accordance with Browns Ferry MMI-102 (Rigging Equipment Program) which implements the requirements of ANSI B30.9-1971. Dynamic loads are not considered to be a

problem for loads handled by the reactor building crane. Maximum fuel load hoisting speeds are 5.33 fpm (main hoist) and 22.6 fpm (auxiliary hoist). In addition, the crane control system is a GE stepless, DC adjustable, cottage drive system which assures smooth acceleration and deceleration and further reduces dynamic loading of the slings.

b. Evaluation

Browns Ferry Units 1, 2, and 3 satisfy the requirements of this guideline to a large degree on the basis that current procedures for the selection and use of slings are in accordance with ANSI B30.9-1971. Further, it is agreed that dynamic sling loading considerations may be disregarded for this crane due to the relatively slow hoisting speeds and the smooth operating characteristics of the crane control system.

c. Conclusion

Selection and use of slings at Browns Ferry Units 1, 2, and 3 is performed in a manner consistent with Guideline 5.

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

a. Summary of Licensee Statements and Conclusions

The Licensee stated that inspection, testing, and maintenance requirements for the reactor building crane are contained in Browns Ferry MMI-117, which implements the requirements of ANSI B30.2-1976.

ANSI B30.2-1976 is not applicable for inspection, testing, and maintenance of the truck crane. These requirements are imposed by ANSI B30.5-1968 (Crawler, Locomotive, and Truck Cranes), and implemented in Browns Ferry MMI-130. Periodic inspections are performed by the TVA Power Services shop crane inspection team in accordance with the requirements of MMI-130.

Inspection and test requirements for the 4-ton manual chain hoist are contained in Browns Ferry MMI-102 which complies with ANSI B30.16-1973, "Overhead Hoists (Underhung)."

In a subsequent submittal, the Licensee stated that:

- Browns Ferry electrical maintenance instruction EMI-2 currently provides an adequate electrical checkout of the reactor building crane
- Rope reeving checks are currently required in frequent inspections by Division Procedure Manual DPM N74M15. Browns Ferry MMI-117 will be revised to reflect this requirement by June 1, 1983.

b. Evaluation

Crane inspection, testing, and maintenance at Browns Ferry Units 1, 2, and 3 are consistent with the guidance in NUREG-0612 in that MMI-117 is based on ANSI B30.2-1976. The Licensee indicated that MMI-117 is being revised to incorporate frequent inspection requirements for rope reeving and that electrical checkout of the reactor building crane is adequately covered by EMI-2.

In addition, the use of ANSI B30.5 and ANSI B30.16 inspection, testing, and maintenance requirements for the yard crane and the 4-ton manual chain hoist meets the intent of NUREG-0612.

c. Conclusion

Inspection, testing, and maintenance of cranes at Browns Ferry Units 1, 2, and 3 is consistent with Guideline 6 of NUREG-0612 based on the Licensee's verification of compliance with ANSI B30.2, ANSI B30.5, and ANSI B30.16.

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' [9]. 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 stated that a review of the reactor building crane design indicates that the crane meets the requirements of CMAA-70 (1975) and ANSI B30.2.

The truck crane was not analyzed in accordance with CMAA-70 and ANSI B30.2 because these standards address the design of multiple girder, overhead, and gantry cranes. Purchase specifications of this crane required that all applicable parts of ANSI B30.5-1976 be met.

b. Evaluation

Crane design for the Browns Ferry reactor building crane and the yard truck crane meets the intent of NUREG-0612 based on compliance to CMAA-70/ANSI B30.2 and ANSI B30.5, respectively.

c. Conclusion

Design of cranes at Browns Ferry Units 1, 2, and 3 is consistent with Guideline 7 of NUREG-0612.

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 are 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(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

Review indicates that Browns Ferry Technical Specifications Section 5.5.C prohibits loads in excess of 1000 lb from being carried over spent fuel in the spent fuel pool.

b. Conclusion

Browns Ferry Units 1, 2, and 3 comply with this interim protection measure.

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 Section 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 a special review for this interim measure was performed during the implementation of interim guidelines for the reactor building crane and is currently in MMI-119.

b. Evaluation and Conclusion

Browns Ferry Units 1, 2, and 3 comply with the criteria of Interim Protection Measure 6 on the basis of the Licensee's verification that specific requirements are completed.

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 Browns Ferry Units 1, 2, and 3. 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 Browns Ferry Units 1, 2, and 3 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 ACTIONS

The NRC staff has established (NUREG-0612, Section 5.3) certain measures that should be initiated to provide reasonable assurance that handling of heavy loads will be performed in a safe manner until final implementation of the general guidelines of NUREG-0612, Section 5.1 is complete. Specified measures include the implementation of a technical specification to prohibit the handling of heavy loads over fuel in the storage pool; compliance with

Guidelines 1, 2, 3, and 6 of NUREG-0612, Section 5.1.1; a review of load handling procedures and operator training; and a visual inspection program, including component repair or replacement, as necessary, of cranes, slings, and special lifting devices to eliminate deficiencies that could lead to component failure. Evaluation of information provided by the Licensee indicates that these actions either have been satisfactorily implemented or will be implemented in a timely manner at the Browns Ferry plant.

4. REFERENCES

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3. NRC
Letter to Tennessee Valley Authority
Subject: Request for Review of Heavy Load Handling at Browns Ferry Nuclear Plant Units 1, 2, and 3
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4. D. S. Kammer (TVA)
Letter to D. B. Vassallo (NRC)
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5. D. S. Kammer (TVA)
Letter to D. B. Vassallo (NRC)
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6. American National Standards Institute
"Overhead and Gantry Cranes"
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"Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4500 kg) or More for Nuclear Materials"
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9. Crane Manufacturers Association of America, 1975
"Specifications for Electric Overhead Traveling Cranes"
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