

(DRAFT)

TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS

METROPOLITAN EDISON COMPANY
THREE MILE ISLAND UNIT 1

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1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report documents the Franklin Research Center (FRC) review of general load-handling policy and procedures at Metropolitan Edison's Three Mile Island Unit One (TMI-1) Nuclear Power 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 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 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 portion of the objective, achieved through a set of general guidelines identified in NUREG-0612, Article 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, Articles 5.1.2-5, is to ensure that for load-handling systems in areas where their failure might result in significant consequences either (1) features are provided, in addition to those required for all load-handling systems, to ensure that the potential for a load drop is extremely small (e.g., a single-failure-proof crane) or (2) conservative evaluations of load-handling accidents indicate that the potential consequences of any load drop are acceptably small. Acceptability of accident consequences is quantified in NUREG-0612 into four accident analysis evaluation criteria.

The approach used to develop the staff guidelines for minimizing the potential for a load drop was based on defense in depth and is summarized as follows:

1. provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to assure reliable operation of the handling system
2. define safe load travel paths through procedures and operator training so that, to the extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment
3. provide mechanical stops or electrical interlocks to prevent movement of heavy loads over irradiated fuel or in proximity to equipment associated with redundant shutdown paths.

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

1.3 PLANT-SPECIFIC BACKGROUND

On June 26, 1980, the NRC issued a letter [3] to Metropolitan Edison, the Licensee for TMI-1, requesting that the Licensee review provisions for

handling and control of heavy loads at TMI-1, 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 February 17, 1981, Metropolitan Edison provided the initial response [4] to this request.

2. EVALUATION AND RECOMMENDATIONS

FRC's evaluation of load handling at TMI-1 is divided into two categories. These categories deal separately with the general guidelines of Article 5.1.1 and the recommended interim protection measures of Article 5.3 of NUREG-0612. Applicable guidelines are referenced in each category. FRC's conclusion and recommendations are provided in the summary for each guideline.

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:

- o Guideline 1 - Safe Load Paths
- o Guideline 2 - Load Handling Procedures
- o Guideline 3 - Crane Operator's Training
- o Guideline 4 - Special Lifting Devices
- o Guideline 5 - Lifting Devices (not specially designed)
- o Guideline 6 - Cranes (Inspection, Testing, and Maintenance)
- o Guideline 7 - Crane Design.

These seven guidelines should be satisfied 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 FRC's evaluation of this verification are contained in the succeeding paragraphs.

2.1.1 Safe Load Paths [Guideline 1, NUREG-0612, Article 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

Lifting operations involving handling of heavy loads at TMI-1 are performed with the intent to conform with "safe load path" criteria. Load handling procedures and equipment layout drawings are currently being amended to identify safe load paths. When these changes are completed, load handling in the reactor building will comply with safe load path criteria of physical markings, procedures, and drawings. In the fuel handling building, "prohibitive zone" markings have been identified in lieu of safe load paths to identify areas where handling of heavy loads is prohibited in accordance with design studies for the cask drop analysis [5]. Efforts are in progress to redesign the affected areas of the fuel handling building.

Current procedures require that before any overhead heavy load handling (greater than 1 ton) can occur in the reactor or fuel handling building which may adversely affect the ability to maintain the reactor in a cold shutdown condition or which could be handled over or in close proximity to fuel, the following must be performed or satisfied: (1) radiation work permit completed; (2) as-low-as-reasonably-achievable (ALARA) and quality assurance (QA) reviews completed; and (3) approved maintenance procedures issued.

b. FRC Evaluation

Metropolitan Edison's stated intentions with respect to safe load paths in the reactor building are acceptable concerning marking of safe load paths, development of standard procedures, and revision of equipment layout drawings to indicate the safe load paths. Metropolitan Edison's position on the use of "prohibited zones" in the fuel handling building, however, is not a viable alternative to the safe load paths defined in Section 5.1.1(1) of NUREG-0612.

Although the concept of "prohibited zones" is acceptable from the standpoint of preventing load drops in the vicinity of spent fuel storage, it

does not satisfy the intent of the NRC guideline, i.e., to provide specific pathways for the movement of heavy loads through the use of procedures, physical markings, and suitable drawings, thus minimizing the risk of damage by moving heavy loads to the extent practical along structural floor members.

In addition, the Licensee has not addressed the requirement that safe load paths for the movement of heavy loads be selected so as to follow, to the extent practical, structural floor members and beams for either the reactor or the fuel handling building.

The Licensee did not address the need for review and approval of deviations from defined safe load paths, when incorporated into load handling procedures (see Section 2.1.2). Interim measures employed to control load handling operations provide for supervisory review of ad hoc maintenance procedures.

c. ERC Conclusion and Recommendation

TMI-1 partially complies with Guideline 1. The Licensee's intentions for implementation of safe load paths in the reactor building comply with the criteria of Guideline 1. When the safe load paths are implemented, records should be readily available for review by the NRC staff. TMI-1's use of "prohibited zones" in the fuel handling building does not comply with the safe load path criteria. Safe load paths should be identified and Guideline 1 implemented in the fuel handling building. The Licensee has provided no information to verify that safe load paths have been selected with due consideration for the location of structural floor members and beams in either the reactor or the fuel handling building. The Licensee should verify that existing load paths and those to be selected satisfy this criteria. Review and approval of deviations from defined load paths, when incorporated in procedures, should be addressed within the scope of Guideline 2.

2.1.2 Load Handling Procedures [Guideline 2, NUREG-0612, Article 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...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 formal program is being developed to provide the required procedures for the control of heavy loads at TMI-1 and will be implemented in the form of a "Station Lifting and Handling Control Manual." This manual will contain applicable procedures for handling various heavy loads in the reactor and fuel handling buildings, as well as addressing training, safety, QA, and maintenance procedures. Part of the Control Manual will be maintenance procedure MP 1408, "Lifting and Handling Control Procedure," which is currently under review and specifically states that "written procedures are required in the handling of critical loads." Critical loads are defined by the Licensee as those loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. In addition, MP 1408 requires that "normal periodic inspections shall be supplemented with special visual, non-destructive examination, and dynamic load tests prior to use on critical loads if required."

Table 2.1 provides a list of heavy loads at TMI-1 and the current status of implementation of handling procedures for each heavy load. It is noted that procedures which have been implemented do not specify the safe load paths as required by Guideline 1, "Safe Load Paths."

b. FRC Evaluation

The Licensee's discussion of load handling procedures does not specify whether current procedures or those to be implemented as part of the "Station Lifting and Handling Control Manual" satisfy the criteria listed in Guideline 2. The Licensee has noted that procedures that have been implemented do not define safe load paths as required by Guideline 1.

Table 2.1

<u>Identification of Heavy Load</u>	<u>Weight (tons)</u>	<u>Procedure Status</u>
PWR - Refueling Building		
1. Spent fuel shipping cask	15	Prior to 6-30-82
2. Pool divider gates	2	Prior to 6-30-82
3. Fuel transfer canal door	2	Implemented (MP 1504-4, 1506-8)
4. Missile shields	5-10	Prior to 6-30-82
5. New fuel shipping containers	3.5-4	Implemented (MP 1505-3)
6. Failed fuel container	1	Prior to 6-30-82
7. Fuel transfer carriage	1.5	Implemented (MP 1505-3)
8. Irradiated specimen shipping cask	--	Prior to 6-30-82
9. Resin cask	12	Prior to 6-30-81
10. Plant equipment (>1 ton)	-	Prior to 6-30-81
PWR - Containment Building		
1. Reactor vessel head	157	Implemented (MP 1504-7, 1506-2)
2. Upper internals (plenum)	62	Implemented (MP 1504-8, 1506-1)
3. In-service inspection tools	1-3	Not identified
4. Reactor coolant pumps	35	Prior to 6-30-82
5. Missile shields	5.5	Prior to 6-30-82

c. FRC Conclusion and Recommendation

IMI-1 does not comply with Guideline 2. Safe load paths are not identified in current procedures. Inadequate information is available on the load-handling procedures that have been implemented or are currently being written to determine if the remaining criteria of Guideline 2 have been met. The Licensee should review procedures that have been implemented, and those to be implemented in the "Station Lifting and Handling Control Manual," and verify that they contain the information required by this guideline prior to any lifts involving the respective loads. In addition, the Licensee should verify that deviations from specified safe load paths will be approved by the plant safety review committee (or equivalent).

2.1.3 Crane Operator Training [Guideline 3, NUREG-0612, Article 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 states that a formal training program with both classroom and practical factors training in "Overhead and Gantry Cranes" is being developed and that the records of all personnel assigned to operate cranes have been reviewed to determine their qualifications for operating the cranes. Programs are in progress to provide exact compliance with the standard, including physicals for crane operator personnel and creation of a training record on each crane operator for easy reference and updating.

b. FRC Evaluation

Crane operator training and qualification programs being developed satisfy the criteria of Guideline 3, on the basis of Metropolitan Edison's verification that the program is based on ANSI B30.2-1976. No information is available to determine that appropriate provisions for ensuring that identified standards for operator conduct during load handling operations are in effect.

c. FRC Conclusion and Recommendation

TMI-1 partially complies with Guideline 3. Training and qualification programs being developed by TMI-1 satisfy the intent of ANSI B30.2-1976. When the programs are completed, program records should be readily available for review and inspection by the NRC staff. The Licensee should implement suitable programs to monitor or ensure proper operator conduct. These programs may consist of review of operator conduct during training and qualification, surveillance or monitoring of operators during actual load handling by plant safety or quality assurance personnel, supervision of load handling by selected senior crane or plant supervisors, or other suitable alternatives which the Licensee may propose. When implemented, this program and appropriate records should be readily available for review and inspection by the NRC staff.

2.1.4 Special Lifting Devices [Guideline 4, NUREG-0612, Article 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'[7]. 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 [NUREG-0612, Guideline 5.1.1(4)]."

a. Summary of Licensee Statements and Conclusions

Metropolitan Edison has stated that "strict compliance to required standards exists when lifting any load which contains radiological material or is around, over, or in any way in the vicinity which may adversely affect the ability to maintain the reactor in a cold shutdown condition or which could be handled over or in close proximity to fuel."

b. FRC Evaluation

Information provided by Metropolitan Edison is vague and does not specify whether special lifting devices comply with the guidelines of ANSI N14.6 or if special lifting device design stresses are based on static and dynamic loading.

c. FRC Conclusion and Recommendation

TMI-1 does not comply with the criteria of Guideline 4. The Licensee should identify all special lifting devices associated with the heavy loads listed in Table 2.1, verify that they satisfy the guidelines of ANSI N14.6, and verify that the stress design is based on static and dynamic loadings.

2.1.5 Lifting Devices (not specially designed) [Guideline 5, NUREG-0612, Article 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' [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' that produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

a. Summary of Licensee Statements and Conclusions

Metropolitan Edison's response for lifting devices not specially designed is the same as that for specially designed lifting devices (see Guideline 4, Section 2.1.4).

b. FRC Evaluation

The Licensee has not identified general purpose lifting devices used to handle heavy loads at TMI-1. The Licensee has not verified that these lifting devices are installed and used in accordance with the guidelines of ANSI B30.9

*For the purpose of selecting the proper sling, loads imposed by the SSE need not be included in the dynamic loads imposed on the sling or lifting device."

using the "static load" identified in Guideline 5. No information is available from the Licensee on any slings requiring marking due to restrictions as a result of static load criteria.

c. FRC Conclusion and Recommendation

TMI-1 does not comply with Guideline 5. The Licensee has not stated that the guidelines of ANSI B30.9 have been applied to lifting devices which are not specially designed. The Licensee should verify that slings conform to the guidelines of ANSI B30.9. The Licensee should also ensure that measures are implemented to identify and mark those slings which may be restricted to certain uses due to limitations in static load ratings.

2.1.6 Cranes (Inspection, Testing, and Maintenance) [Guideline 6, NUREG-0612, Article 5.1.1 (5)]

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

a. Summary of Licensee Statements and Conclusions

Chapter 2-2 of ANSI B30.2 has been invoked and reviewed by Metropolitan Edison at TMI-1. Implementation of the requirements of this standard is in progress in all applicable areas and is to be completed prior to reactor operation.

b. FRC Evaluation

Metropolitan Edison's crane inspection, testing, and maintenance program, which is being implemented at TMI-1, is considered to satisfy the criteria of

Guideline 6, on the basis of the Licensee's verification that the program is based upon ANSI B30.2.

c. FRC Conclusion and Recommendation

TMI-1 complies with Guideline 6. Metropolitan Edison is implementing a program based on the guidelines of ANSI B30.2 to be completed prior to reactor operation. When the program is complete, program records should be readily available for review and inspection by the NRC staff.

2.1.7 Crane Design [Guideline 7, NUREG-0612, Article 5.1.1(7)]

"The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' and of CMAA-70, 'Specifications for Electric Overhead Travelling Cranes' [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 area of crane design is currently under review by Metropolitan Edison. The crane manufacturer has indicated that the crane met the requirements of Electric Overhead Crane Institute (EOCI) specifications at the time of crane design (1968), which was at that time the equivalent of CMAA-70.

b. FRC Evaluation

No information was provided for FRC to evaluate the design of cranes in use at TMI-1. The fact that cranes were designed to the EOCI specification, the predecessor to specification CMAA-70, indicates that they will in a substantial portion satisfy this guideline.

c. FRC Conclusion and Recommendation

A conclusion with respect to this guideline must be deferred until completion of the evaluation currently in progress. Since the Licensee has indicated in preliminary review that EOCI specifications were met at the time

of crane design, the Licensee should address design requirements invoked by CMAA-70 which are more restrictive than those invoked in the EOCI standard (e.g., allowable compressive stress in structural members).

2.2 INTERIM PROTECTION MEASURES

The NRC has established six interim protection measures to be implemented at operating nuclear power plants to provide reasonable assurance that no heavy loads will be handled over the spent fuel pool and that measures exist to reduce the potential for accidental load drops to impact on fuel in the core or spent fuel pool. Four of the six interim measures of the report consist of general Guideline 1, Safe Load Paths; Guideline 2, Load Handling Procedures; Guideline 3, Crane Operator Training; and Guideline 6, Cranes (Inspection, Testing, and Maintenance). The two remaining interim measures cover the following criteria:

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

Licensee implementation and evaluation of these interim protection measures is contained in the succeeding paragraphs of this section.

2.2.1 Technical Specifications [Interim Protection Measure 1, NUREG-0612, Article 5.3.(1)]

"Licenses for all operating reactors not having a single-failure-proof overhead crane in the fuel storage pool area should be revised to include a specification comparable to Standard Technical Specification 3.9.7, 'Crane Travel - Spent Fuel Storage Building,' for PWR's and Standard Technical Specification 3.9.6.2, 'Crane Travel,' for BWR's, to prohibit handling of heavy loads over fuel in the storage pool until implementation of measures which satisfy the guidelines of Section 5.1 [of NUREG-0612]."

a. Summary of Licensee Statements and Conclusions

MI-1 Technical Specification 3.11.6 limits the movement of loads in excess of 3,000 pounds over the spent fuel pool by the following administrative controls: (1) the center of mass of loads is maintained below an elevation of 348 feet (surface edge of the spent fuel pool); or (2) the center

of mass is maintained at such a distance from the edge of the spent fuel pool that, should a load be released, the center of mass of the load would be at least six feet from the edge of any pool containing irradiated fuel.

Technical Specification 3.11.8 provides a waiver from the above technical specification to provide for movement of the pool divider gates to an appropriate storage location if criteria involving fuel assemblies (total number and cooling time) and redundant lifting devices are met.

b. FRC Evaluation

Current TMI-1 technical specifications do not prohibit the movement of heavy loads over the spent pool fuel. Existing technical specifications allow the pool divider gates to be carried over the spent fuel pool and appear to allow other heavy loads to be moved within the spent fuel pool. The use of redundant lifting devices for the pool divider gates, while providing some additional assurance that these loads will not be dropped, is not a suitable substitute for a single-failure-proof overhead crane.

c. FRC Conclusion and Recommendation

TMI-1 does not comply with this interim measure. Technical Specification 3.11.6 allows the handling of heavy loads within the spent fuel pool and Technical Specification 3.11.8 provides a waiver to allow handling of specific heavy loads over the fuel pool. The Licensee should make the necessary changes to the technical specifications to comply with this interim protection measure.

2.2.2 Administrative Controls [Interim Protection Measures 2, 3, 4, and 5, NUREG-0612, Articles 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 2.1.1, 2.1.2, 2.1.3, and 2.1.4.

b. FRC Evaluations, Conclusions, and Recommendations

FRC's evaluations, conclusions, and recommendations are contained in discussions of the respective general guidelines in Sections 2.1.1, 2.1.2, 2.1.3, and 2.1.4.

2.2.3 Special Review for Heavy Loads Handled Over the Core [Interim Protection Measure 6, NUREG-0612, Article 5.3(6)]

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

a. Summary of Licensee Statements and Conclusions

TMI-1 review of procedures outlined in general Guideline 2 is considered to be performed in sufficient detail to be acceptable. Inspections performed in accordance with general Guidelines 4, 5, and 6 are sufficient to satisfy interim protection measures. Crane operator training programs outlined in general Guideline 3 are sufficient for this interim protection measure.

b. FRC Evaluation

TMI-1's review of procedures for movement of heavy loads over the core does not satisfy this interim measure. In addition to the procedures already required by Interim Protection Measure 3 of NUREG-0612, Section 5.3, these

interim actions specify that special attention be given to heavy loads over the core. TMI-1 has not provided a verification that such special attention has been identified beyond that required by Interim Protection Measure 3 and general Guideline 2. Licensee inspections and repairs of load bearing components are not defined sufficiently to satisfy the "special attention" required by these interim measures for handling of heavy loads. Similarly, the Licensee has not verified that operators receive the necessary training on specific procedures used for handling heavy loads over the core beyond that required by general Guideline 3.

c. FRC Conclusion

TMI-1 does not comply with the criteria of interim protection measure 6 in that the Licensee has not verified that any special attention or considerations have been made for handling heavy loads over the core. The Licensee should take appropriate action to satisfy the criteria or verify that special attention exists as identified by Interim Protection Measure 6.

3. CONCLUDING SUMMARY

This summary is provided to consolidate the conclusions and recommendations of Section 2 and to document FRC's overall evaluation of the handling of heavy loads at TMI-1. It is divided into two sections dealing with general provisions for load handling at nuclear power plants (NUREG-0612, Article 5.1.1) and the staff recommendation for interim protection, pending complete implementation of the guidelines of NUREG-0612 (NUREG-0612, Article 5.3). In each case, recommendations for additional Licensee action, and additional NRC staff action where appropriate, are provided.

3.1 GENERAL PROVISIONS FOR LOAD HANDLING

The NRC staff has established seven guidelines concerning provisions for handling heavy loads in the area of the reactor vessel, near stored spent fuel, or in other areas where an accidental load drop could damage safe shutdown systems. Compliance with these guidelines is necessary to ensure that load-handling system design, administrative controls, and operator training and qualification are such that the possibility of a load drop is very small and suitable for the critical functions and potential consequences of failures of cranes at nuclear power plants. These guidelines are partially satisfied at TMI-1. This conclusion is presented in tabular form as Table 3.1. Specific recommendations for achieving full compliance with these guidelines are provided as follows:

GuidelineRecommendation

- | | |
|---|---|
| 1 | <ul style="list-style-type: none"> a. Verify compliance with safe load path criteria upon implementation of revised procedures and layout drawings for the reactor building. b. Identify and establish safe load paths to be used in the fuel handling building. c. Verify that all safe load paths follow, to the extent practical, structural floor members and beams. |
|---|---|

Table 3.1. TMI-1/MUREG-0612 Compliance Matrix

	Weight or Capacity (tons)	Guideline 1 Safe Load Limits	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
Heavy Loads										
1. Fuel Handling										
Crane	110	--	--	R	--	--	R	I	--	--
Spent Fuel Shipping Cask	15	NC	NC	--	NC	--	--	--	NC	--
Pool Divider Gates	2	NC	NC	--	--	N	--	--	NC	--
Fuel Transfer Canal Door	2	NC	C	--	--	NC	--	--	NC	--
Missile Shields	5-10	NC	NC	--	--	NC	--	--	NC	--
New Fuel Shipping Container	3.5-4	NC	C	--	--	NC	--	--	NC	--
Failed Fuel Container	1	NC	NC	--	--	NC	--	--	NC	--
Fuel Transfer Carriage	1.5	NC	C	--	--	NC	--	--	NC	--
Irradiated Specimen Shipping Cask	1	NC	NC	--	--	NC	--	--	NC	--
Resin Cask	12	NC	NC	--	--	NC	--	--	NC	--
Plant Equip- ment (>1 ton)	--	NC	NC	--	--	NC	--	--	NC	--
2. Containment										
Polar Crane	185	--	--	R	--	--	R	I	--	--
Reactor Vessel Head	157	R	C	--	NC	--	--	--	--	NC
Upper Internals (Plenum)	62	R	C	--	NC	--	--	--	--	NC
Inservice In- spection Tools	1-3	R	NC	--	NC	--	--	--	--	NC
Reactor Cool- ant Pumps	35	R	NC	--	--	NC	--	--	--	NC
Missile Shields	5.5	R	NC	--	--	NC	--	--	--	NC

C = Licensee action complies with MUREG-0612 Guideline.

NC = Licensee action does not comply with MUREG-0612 Guideline.

R = Licensee has proposed revisions/modifications designed to comply with MUREG-0612 Guideline.

I = Insufficient information provided by the Licensee.

GuidelineRecommendation

- 2
- a. Define safe load paths in all load-handling procedures and require that deviations from such paths be approved by the plant safety review committee.
 - b. Verify that load-handling procedures which have been implemented or those being written satisfy the remaining criteria of Guideline 2, i.e., identification of required equipment, inspections and acceptance criteria, steps and proper sequencing, and other special precautions.
- 3
- a. Verify that training and qualification programs comply with guideline criteria when implementation of ANSI B30.2-1976 is complete.
 - b. Implement a program for monitoring crane operator conduct or verify that such a program is currently in existence.
- 4
- a. Identify all special lifting devices associated with heavy loads listed in Table 3.1.
 - b. Verify that each special lifting device satisfies the guidelines of ANSI N14.6-1978.
 - c. Confirm that special lifting devices are designed to meet the stress design factor of Guideline 4.
- 5
- a. Verify that all lifting devices not specially designed are installed and used in accordance with the guidelines of ANSI B30.9-1971 or that an equivalent program exists to ensure that slings in use conform to those guidelines.
 - b. Identify and clearly indicate those slings that may be restricted to certain cranes due to limitations in static load ratings.
- 6
- (TMI-1 complies with this guideline.)
- 7
- a. The Licensee should further evaluate crane design to ensure that applicable criteria and guidelines of ANSI B30.2-1976 and CMAA-70 are satisfied.
 - b. Demonstrate equivalency for all actual design requirements where specific compliance with these standards is not provided.

3.2 INTERIM PROTECTION

The NRC staff has established (NUREG-0612, Article 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, Article 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. FRC's evaluation of information provided by the Licensee indicates that the following actions are necessary to ensure that the staff's measures for interim protection at TMI-1 are met:

<u>Interim Measure</u>	<u>Recommendation</u>
1	a. Revise technical specifications to include a prohibition against handling heavy loads over the stored fuel pool. b. Revise the technical specifications to preclude the waiver for moving the pool divider gates over the spent fuel pool or provide analyses to justify the waiver.
2,3,4	Implement the recommendations of Guidelines 1, 2, 3, and 4 identified in Section 3.1.
5	(TMI-1 complies with this interim protection measure.)
6	Demonstrate the required special attention identified in this interim measure for procedures, equipment, and personnel for the handling of heavy loads over the core.

3.3 SUMMARY

NRC's general guidelines and interim protection measures of NUREG-0612 have not been satisfied at TMI-1. Several programs being implemented comply with staff guidelines, in particular crane operator training and crane inspection, testing, and maintenance. Licensee action is required on the

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remaining general guidelines and interim actions to establish the necessary procedures and programs or to provide adequate justification to demonstrate compliance with NUREG-0612.

4. REFERENCES

1. NUREG-0612
Control of Heavy Loads at Nuclear Power Plants
NRC
2. V. Stello, Jr. (NRC)
Letter to all Licensees. Subject: Request for Additional Information on
Control of Heavy Loads Near Spent Fuel
NRC, 17 May 1978
3. D.G. Eisenhut (NRC)
Letter to H.D. Hukill (Met Ed). Subject: NRC Request for Additional
Information on Control of Heavy Loads Near Spent Fuel at TMI-1
NRC, 26 June 1980
4. H.D. Hukill (Met Ed)
Letter to D.G. Eisenhut (NRC). Subject: Response to NRC Request for
Additional Information on Control of Heavy Loads at TMI-1
Metropolitan Edison, 17 Feb 1981
5. Cask Drop Analysis for Fuel Handling Building
Metropolitan Edison Technical Data Report No. 142, Rev. 1.
Metropolitan Edison, 13 May 1980
6. ANSI B30.2-1976
Overhead and Gantry Cranes
7. ANSI N14.6-1978
Standard for Lifting Devices for Shipping Containers Weighing 10,000
Pounds (4500 kg) or More for Nuclear Materials.
8. ANSI B30.9-1971
Slings
9. CMAA-70
Specifications for Electric Overhead Travelling Cranes