(DRAFT)

TECHNICAL EVALUATION REPORT

CONTROL OF HEAVY LOADS (C-10)

TOLEDO EDISON COMPANY
DAVIS-BESSE NUCLEAR POWER STATION UNIT 1

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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.

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1. INTRODUCTION

1.1 PURPOSE OF REVIEW

This technical evaluation report documents an independent review of general load-handling policy and procedures at Toledo Edison Company's Davis-Besse Nuclear Power Station Unit 1. 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.

The approach used to develop the staff guidelines for minimizing the potential for a load drop was based on defense-in-depth, and the intent of the guidelines is to ensure that licensees of all operating nuclear power plants perform the following:

1. provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to ensure 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 December 22, 1980, the NRC issued a letter [3] to Toledo Edison, the Licensee for Davis-Besse Nuclear Power Station, requesting that the Licensee review provisions for handling and control of heavy loads at Davis-Besse Unit 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. Toledo Edison responded to this request on February 1, 1982 [4].

2. EVALUATION AND RECOMMENDATIONS

This evaluation of load handling at Davis-Besse Unit 1 is divided into two categories. These categories deal separately with the general guidelines of Section 5.1.1 and the recommended interim measures of Section 5.3 of NUREG-0612. Applicable guidelines are referenced in each category. Conclusions and recommendations are provided in the summary for each guideline.

2.1 GENERAL GUIDELINES

The NRC has established seven general guidelines which must be followed 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 handling systems and procedures 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 an independent evaluation of this verification are contained in the succeeding paragraphs.

2.1.1 Overhead Heavy Load Handling Systems

a. Summary of Licensee S. ments and Conclusions

The Licensee has . d all overhead handling systems in use at Davis-Besse Unit 1 and . ified those systems which must be addressed within

the scope of NUREG-0612 on the basis that they could carry heavy loads over the core, over spent fuel, or over safety-related equipment. These handling systems are listed in Table 2.1.

Determination of those systems which have been excluded from compliance has also been completed by the Licensee. Identification of excluded systems as well as the reasons for exclusion are provided in Table 2.2.

b. Evaluation and Conclusion

The Licensee's evaluation of overhead handling systems and the determination of those systems which must comply with NUREG-0612 is consistent with the intent of NUREG-0612. Exclusion of handling systems from NUREG-0612 compliance is acceptable if: (1) no equipment required for safe shutdown is located in close proximity; (2) the handling systems are used for sole-purpose lifts, do not carry loads over other safety-related equipment, and are used only when the respective components have been placed out of service; or (3) handling of components over safety-related equipment is performed only after the plant has been safely shut down and in accordance with Technical Specifications or existing administrative procedures. However, for those handling systems excluded because components are handled only after achieving safe shutdown, the Licensee should ensure that adequate restrictions exist in plant procedures or technical specifications to prohibit load handling when the plant is not shut down.

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."

Table 2.1 Handling Systems Subject to NUREG-0612 Compliance

- Containment polar crane/auxiliary hoist
- Reactor service crane
- Containment equipment jib cranes
- Spent fuel shipping cask crane/auxiliary hoist
- Component cooling pump monorails
- Intake structure gantry crane

Table 2.2 Handling Systems Excluded from Compliance with NUREG-0612

A. Excluded on the basis that no safe shutdown equipment is located in proximity:

- Turbine building handling systems
- Water treatment building handling systems
- Circulating water pump house handling systems
- Miscellaneous auxiliary building handling systems
- East ECCS pump room monorail
- Startup feed pump monorail
- Containment spray pump monorails
- High pressure injection pump monorails
- Letdown cooler heat exchanger monorail
- Monorail for equipment hatch and decay heat coolers
- Makeup pump monorails
- Refueling canal rail removal jib crane
- Main station exhaust fan motor monorails

B. Excluded on the basis that handling systems are sole-purpose, do not carry loads over other safety-related equipment, and are only used when the respective components have been placed out of service in accordance with plant procedures or specifications:

- Auxiliary feed pump monorails
- Emergency diesel generator monorails
- Battery room monorails

C. Excluded on the basis that component handling over safety-related equipment is performed only after the plant has been safely shut down:

- Pressurizer heater bundle monorail
- Control rod drive maintenance jib crane

a. Summary of Licensee Statements and Conclusions

The Licensee stated that, due to the large number of handling systems, defining load paths is neither required nor prudent for the many different load handling situations that are encountered at Davis-Besse Unit 1. Since use of defined load paths would unnecessarily restrict plant operations and maintenance activities, all possible load handling situations that could be encountered have been identified and assigned handling class designations, roughly in order of potential safety significance. Safe load paths and procedural requirements have been defined for each safety class. Load handling classes and their respective handling requirements are listed in Table 2.3, and loads contained in each handling class are listed in Table 2.4. These handling classes, by procedure, limit lift height and time over areas of concern for the most critical loads (Handling Class 1), define areas over which loads shall not be carried (Handling Class 2), or define safe load paths that follow, to the extent practical, structural floor members, using the minimum practical lift height (Handling Class 3).

Handling Class 1 loads are of principal interest because of their weight, which must be carried directly over the spent fuel, the reactor vessel, or safe shutdown equipment. Steps have been included in handling procedures for these loads to minimize both the amount of time and the height at which these loads are carried directly over the vessel.

For Handling Class 2 loads, no physical or design restrictions prevent these loads from being carried over the reactor vessel; therefore, a procedural restriction has been added to the appropriate procedure to prohibit movement of these loads directly over the reactor vessel when spent fuel is in the vessel (Region A of Figure 1).

The principal concern regarding loads in Handling Class 3 is the potential for these loads to impact equipment required to maintain safe shutdown. Based on a cursory review, the area that could contain safe shutdown equipment is indicated in Figure 2 as Region B. For Class 3A loads, no specific load paths are judged to be necessary on the basis of preliminary evaluations of the

Table 2.3. Load Handling Classes and Safe Load Path Actions

Heavy Load Handling Situations	Safe Load Path/Procedural Actions Required
Handling Class 1: Load must be carried directly over spent fuel, the reactor vessel, or safe shutdown equipment (i.e., there are no intervening structures such as floors).	Procedurally limit time and height that load is carried over the area of concern. Advise Shift Supervisor of lift.
Handling Class 2: Load could be carried directly over spent fuel, the reactor vessel, or safe shutdown equipment, i.e., load can be handled during the time when spent fuel or the reactor vessel is exposed or safe shutdown equipment is required to be operable and there are no physical means (such as interlocks or mechanical stops) available to restrict load movement over these objects.	Procedurally define an area over which loads shall not be carried so that, if load is dropped, it will not result in damage to spent fuel or operable safe shutdown equipment or compromise reactor vessel integrity. Advise Shift Supervisor of lift.
Handling Class 3: Load can be carried over spent fuel or safe shutdown equipment, but the fuel or equipment is not directly exposed to the load drop, i.e., intervening structures such as floors provide some protection.	See 3A and 3B below.
Handling Class 3A: Preliminary evaluation indicated that intervening structures protect spent fuel or safe shutdown equipment.	No load travel path is required at this time. General precautions limiting load travel height are prudent. Advise Shift Supervisor of lift.
Handling Class 3B: Preliminary evaluation cannot conclusively demonstrate that intervening structures will protect fuel or safe shutdown equipment.	Define safe load paths that follow, to the extent practical, structural floor members. Limit load travel height to to minimum height practical. Advise Shift Supervisor of lift.
Handling Class 4: Load cannot be carried over spent fuel or over safe shutdown equipment when such equipment is required to be operable, i.e., design or operational limitations prohibit movement.	No safe load path required.

Table 2.4. Heavy Load Handling Classifications

Handling Classifications	Heavy Load	Weight (tons)
1	Reactor plenum assembly	59.5
1/3B	Reactor vessel head (RVH)	115
1/3B	Internals indexing fixture	14
1/3B	Plenum assembly lifting rig	9.3
1/3B	Automatic reactor inspection system	16
1/3A	A-beam D-ring grating supports	6
1/3	D-ring grating sections	-
1/3	Steam generator removable	-
1/3B	Reactor missile shields	47.3
2/3B	Polar crane load block	-
2/3	Steel working platform	2
2/3B	20-in steam generator snubbers	3.5
2/3A	Irradiated specimen cask	3
2/3A	Letdown coolers	2.5
2/3A	Equipment hatch covers	5-16
2/3A	Core flooding tank hatch covers	4
2/3A	Motor removal hatches	2.5
2/3B	Plenum assembly stand	3
2/3A	Core support barrel stand	3.3
2/3A	RVH lifting rig	6
2/3A	Reactor coolant pump (RCP)	42
2/3B	RCP rotating element	2
4	RCP motor	51
4	Core support assembly	112
1	Component cooling water pumps	2.7
1	Component cooling water pumps	2.4
2	Pool divider gates	4
1/2/3A	Service water pumps (SWP)	3.9
1/2/3A	SWP motors	4.3
1/2/3A	Circulating water makeup pump	2.9
1/2 3A	Makeup pump motor	1.8
1/2/3A	Roof top hatch covers	1.4

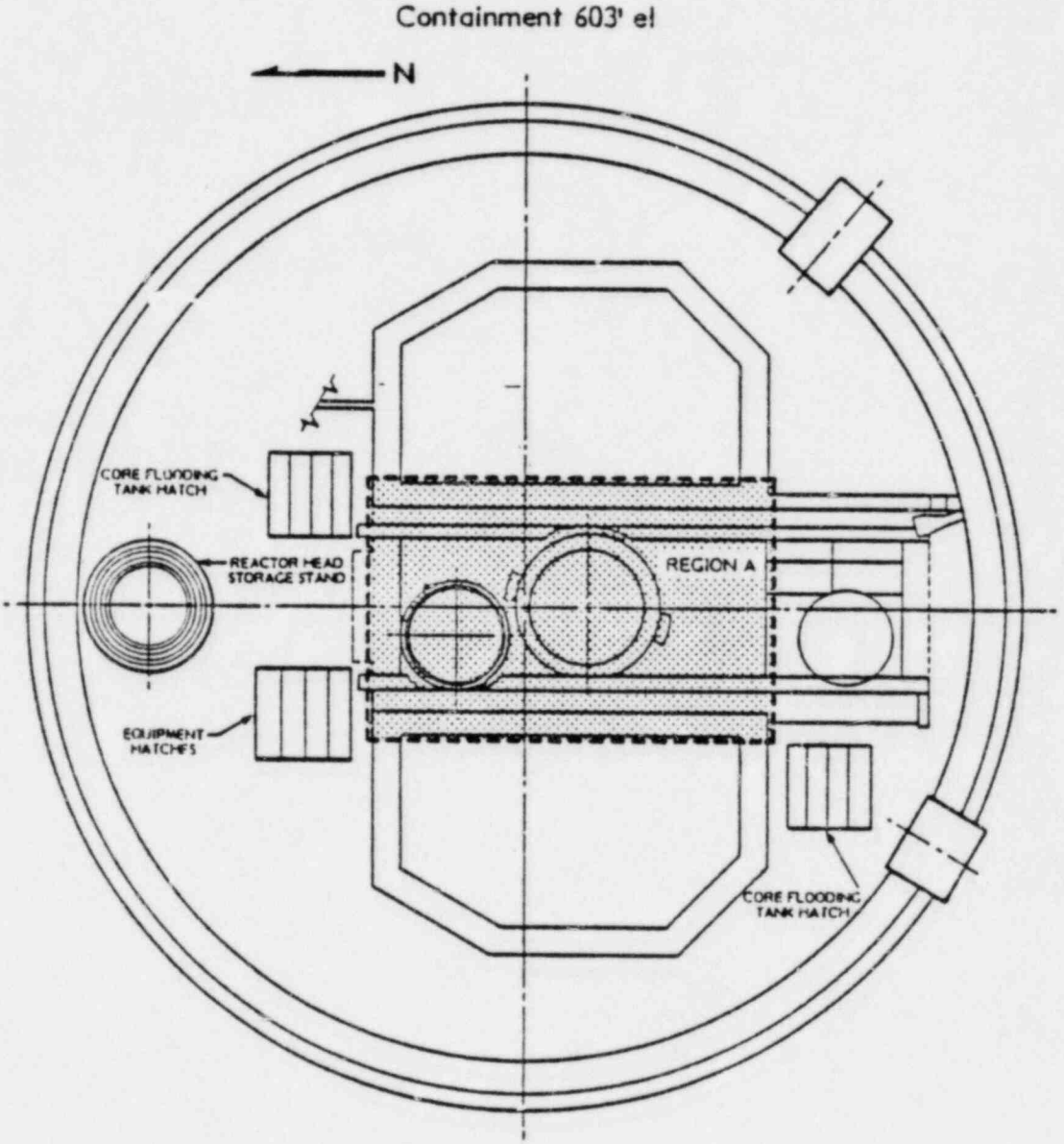

Figure 1. Restricted Region for Class 2 Loads in Containment

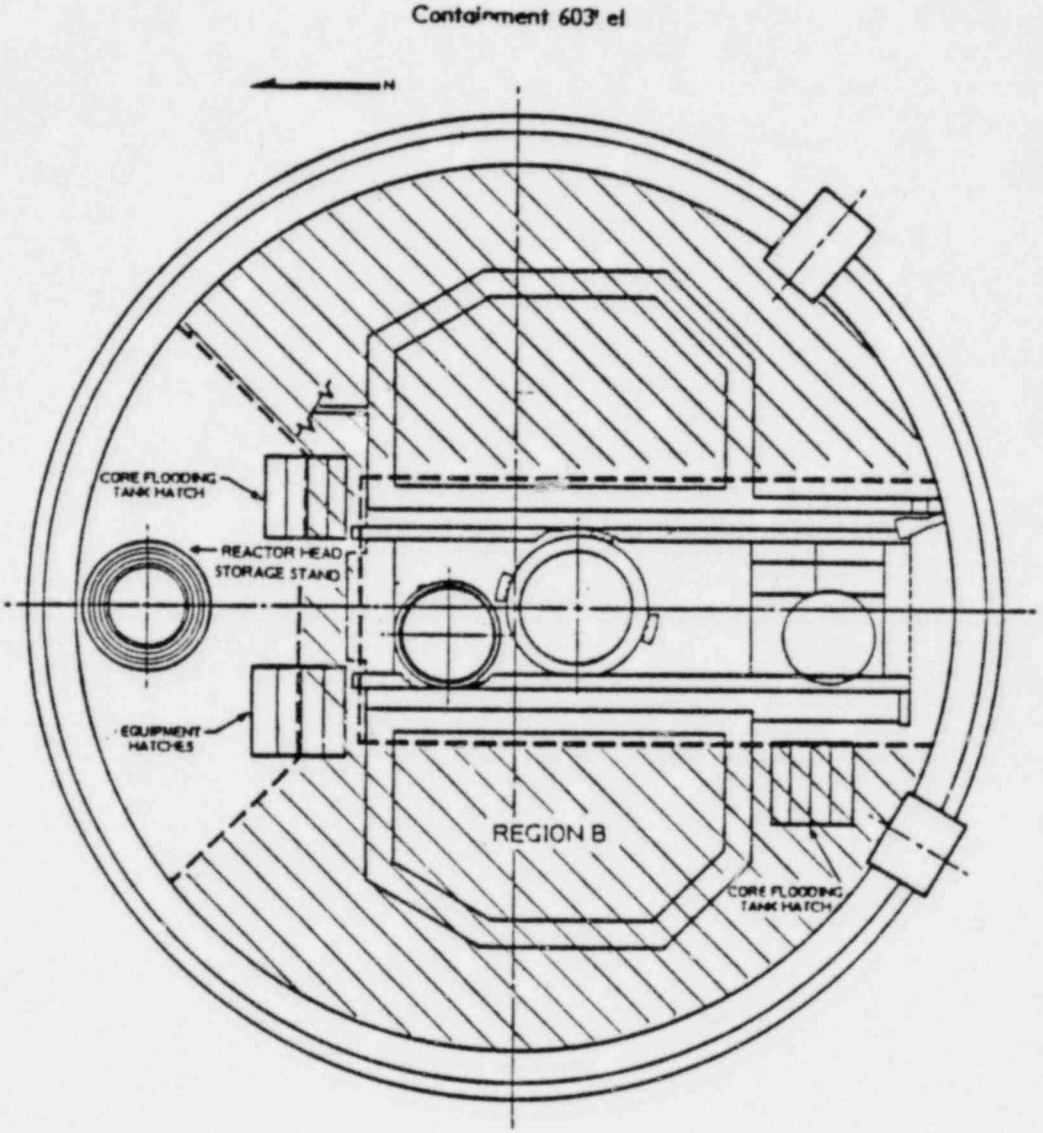

Figure 2. Area Where Load Drop Could Damage Safe Shutdown Equipment

potential for damage to equipment below the refueling floor. Procedures will require only that these loads be carried at the minimum height necessary above the refueling floor to accomplish the lift. All Class 3B loads will be carried to the minimum height necessary.

Although the reactor service crane is subject to NUREG-0612 compliance, no heavy loads have been identified for this crane. Similarly, the containment equipment jib cranes are not yet operational, and handling classes have not yet been established for loads to be handled.

For the component cooling pump monorails, provisions have been made to limit the maximum height to which these loads are carried. The spent fuel crane handles the pool divider gates, which are prohibited from movement over spent fuel in the pool. The Licensee adds that movement of spent fuel offsite is not anticipated for more than 10 years.

In the intake structure, safety-related components (service water system) can be directly exposed to heavy load drops; therefore, the handling procedure has been revised to include specific prohibitions against leaving a Class 1 load suspended for more than a short period of time over or partially raised in a hatchway. Further revisions will be made to include a requirement to move the load from the hatch as soon as practical.

Finally, each heavy load lift will be supervised by a designated individual who will be responsible for enforcing procedural requirements. Deviations from these procedures require prior approval of the plant superintendent.

b. Evaluation

The Licensee's response has been evaluated with respect to the NRC's objective, as discussed in Section 1.2 of this evaluation, which is to achieve a defense-in-depth approach for the handling of heavy loads. Two distinct phases of implementation are to be accomplished to achieve this goal:

- first phase - overall improvement of procedures, training, maintenance, and verification of crane and lifting device design, as well as establishment of safe travel paths which avoid irradiated fuel and safe shutdown equipment, as means to ensure reliable operation of handling systems.

- second phase - implementation of additional safeguards by satisfying single-failure-proof crane criteria; or installation of mechanical or electrical interlocks; or performance of analyses that substantiate the Licensee's contention that damage to irradiated fuel will not exceed limits for criticality or release of radioactivity, or that damage to redundant or dual safe shutdown systems will not result in loss of required safety functions.

The intent of the first phase of NUREG-0612 is to ensure that all cranes operating in the vicinity of irradiated fuel or safe shutdown equipment meet the requirements of the general guidelines (Section 5.1.1) with no regard or credit given for system redundancy, mechanical or electrical interlocks, administrative procedures, or single-failure-proof cranes. The intent of Guideline 1 is to ensure the existence of preconceived and defined load paths, developed by knowledgeable engineering staff familiar with overall plant arrangement and equipment functions, so that the direction of load movements is not the responsibility of individual crane operators or maintenance supervisors who may not be knowledgeable of various functions or locations of safety-related equipment.

The Licensee's method of identifying handling classes and differentiating the relative safety significance of the identified loads is consistent with this guideline. In addition, those loads categorized under Handling Class 3B (including 1/3B and 2/3B loads) meet the intent of this guideline on the basis that load paths have been defined for movement of these loads. Drawings should be provided by the Licensee to verify the extent of the load paths.

Those loads categorized under any combination of remaining Classes 1, 2, and 3A, however, do not meet the intent of this guideline. For Class 1 and Class 2 loads, use of administrative procedures only to control lift height and time or to define exclusion areas does not satisfy the need to provide preconceived load paths determined on the basis of an independent engineering analysis. For Class 3A loads, the Licensee's position that load paths are not required on the basis of a "conservative preliminary evaluation" is not consistent with the criteria of NUREG-0612. As discussed previously, such an evaluation may be performed during implementation of the second phase of NUREG-0612, but does not exempt the Licensee from compliance with the

first phase by establishment of load paths. It is noted, however, that the majority of the Class 3A loads are generally small, their movement associated with miscellaneous maintenance actions, or (as in the case of the letdown coolers) they are not likely to be moved routinely. Therefore, it is recognized that development of individual load paths for each of these loads may be an unnecessary procedural burden. It is recommended that the Licensee develop one or more general-purpose or preferred handling paths, to be marked at the discretion of the Licensee, which would avoid irradiated fuel and safety-related equipment to the greatest extent practical. Loads would then be moved initially by the most direct route to one of the preferred load paths for further movement about the plant. Such an approach would meet the intent of this guideline for Class 3A loads.

No information has been provided to verify that load paths that have been defined are incorporated into general arrangement drawings and clearly marked on the floor. The Licensee may use alternatives to floor markings that provide suitable visual aids and assist the operator in keeping the load on the load path. Such visual aids may consist of rope, tape, temporary stanchions, or a supervisor directing load movement from the handling floor along the preconceived load path.

Licensee procedures for dealing with deviations from procedures are consistent with requirements of this guideline.

c. Conclusion and Recommendations

Davis-Besse Unit 1 partially complies with Guideline 1. Load paths have been designated for those loads in Handling Class 3B; however, the Licensee should forward drawings that identify and define the extent of these load paths. To fully comply with this guideline, the remaining actions should be taken by the Licensee:

1. For remaining Class 1, 2, and 3A loads, develop one or more general-purpose or preferred load paths which allow movement of loads in areas of concern.

2. Incorporate load paths into general arrangement drawings and provide suitable visual aids to the operators when transporting loads.

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

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

a. Summary of Licensee Statements and Conclusions

The Licensee has identified numerous procedures in use or being developed for the various NUREG-0612 cranes. These procedures include the following:

Polar Crane
SP 1104.46 "Polar Crane System Procedure"
SP 1504.01 "Reactor Vessel Closure Head Removal and Replacement"
SP 1505.01 "Reactor Internals Removal and Replacement"

Component Cooling Water Pump Monorail
(to be developed)

Spent Fuel Cask Crane
SP 1104.50 "Spent Fuel Cask Crane Operating Procedure"

Intake Gantry Crane
SP 1104.53 "Intake Gantry Crane System Procedure"

b. Evaluation

Although the Licensee has identified several procedures in use or being developed, insufficient information has been provided to verify that these procedures contain the information recommended by this guideline, including identification of equipment, inspection and acceptance criteria, steps and proper sequence, safe load path, and other special precautions.

c. Conclusion

A conclusion with respect to this guideline must be deferred until the Licensee submits sufficient information to determine compliance with this guideline.

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

"Crane operators should be trained, qualified, and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [5]."

a. Summary of Licensee Statements and Conclusions

The Licensee states that procedures for the qualification and training of crane operators are contained in Davis-Besse Administrative Directive AD 1844.06 which requires that crane operators be qualified to criteria essentially identical to the provisions of ANSI B30.2-1976, Chapter 2-3. This general directive is implemented at Davis-Besse Unit 1 by training/examining prospective operators and documenting successful qualification on specific qualification cards for each crane. Training and examination of prospective operators is performed by designated instructors.

These procedures and practices were reviewed against the provisions of ANSI B30.2-1976, Chapter 2-3. A number of minor changes were made by the Licensee to the procedures and the qualification card process to ensure that all items pertinent to operator training, qualification, and conduct were adequately addressed. No exceptions to ANSI B30.2-1976 are taken by the Licensee.

b. Evaluation

Programs implemented by the Licensee satisfy the criteria of this guideline on the basis that no exceptions are taken with Chapter 2-3 of ANSI B30.2-1976.

c. Conclusion

Davis-Besse Unit 1 complies with this guideline.

2.1.5 Special Lifting Devices [Guideline 4, NUREG-0612, Section 5.1.1(4)]

"Special lifting devices should satisfy the guidelines of ANSI N14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers

Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials' [6]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants, certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is 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

The Licensee has identified four special lifting devices used in lifts over the reactor vessel, including the following:

1. Head and internals handling fixture
2. Turnbuckle pendants and head lifting pendants
3. Internal handling adapter, pendants, and spreader ring
4. Internals indexing fixture pendants.

The missile shield lifting harness has also been identified as a special lifting device; however, necessary information has not yet been retrieved for this device. In addition, no cask or lifting device has yet been selected for spent fuel equipment.

For the four lifting devices identified above, a detailed comparison of ANSI N14.6-1978 was limited to Sections 3.2 and 5 for the following reasons:

a. All of the devices described above were designed by Babcock and Wilcox prior to the existence of ANSI N14.6-1978. In this regard, there are a number of sections in the standard that are difficult to apply in retrospect. These sections are those entitled Designer's Responsibilities (Section 3.1); Design Considerations (Section 3.3); Fabricator's Responsibilities (Section 4.1); Inspector's Responsibilities (Section 4.2); and Fabricator's Considerations (Section 4.3). These sections have not been reviewed item by item for the purpose of identifying and justifying exceptions.

b. Certain sections of ANSI N14.6-1978 are judged as not pertinent to the load handling reliability of the devices and have not been addressed for the purpose of identifying and justifying exceptions. These sections are Section 1.0, Scope; Section 2.0, Definitions; Section 3.4, Design Considerations to Minimize Decontamination Effects in Special Lifting Device Use; Section 3.5, Coatings; and Section 3.6, Lubricants.

c. Section 6 of ANSI N14.6-1978 is applicable to lifting devices used for critical loads as defined in Section 2 of the standard. None of the loads lifted by the lifting devices identified above have as yet been determined to be critical loads. Such determination would require an analysis of the consequences of various load drops. Since such analyses have not yet been performed, and are not required to be performed until the 9-month report to the NRC, it is premature to designate certain loads as critical loads and, accordingly, to apply the requirements of Section 6 of ANSI N14.6-1978 to their designated lifting devices.

As a result of this detailed comparison to Sections 3.2 and 5 of ANSI N14.6-1978, as supplemented by NUREG-0612, the Licensee states that these devices comply with the standards, with certain exceptions:

Exception 1: Section 5.3.7 of ANSI N14.6-1978 specifies that visual inspections by maintenance or non-operating personnel be performed at intervals of three months or less. Since these devices are stored in a specific location under a controlled environment and are not subject to any other uses, the Licensee believes that current procedures requiring inspections (visual, dimensional, and NDE) prior to each use are sufficient to meet the intent of these standards.

Exception 2: There are several load-bearing members of the lifting devices for which inspection in accordance with Section 5.3.1(2) on an annual frequency is impractical. These members require disassembly not normally performed or removal of paint, and the Licensee has proposed performing these inspections at 5-year intervals, on the basis of controlled usage, storage, and handling of the devices. Further, it is only for certain types of inspections that longer intervals are proposed for some members; these same members will be inspected more frequently by techniques other than NDE.

Exception 3: Exception is taken to the requirements of Section 5.3.3 of ANSI N14.6-1978, which requires that special lifting devices be load-tested according to Section 5.2.1 to 150% of the maximum load following any incident in which any load-bearing components of the special lifting device may have been subjected to stresses substantially in excess of those for which it was qualified by previous testing, or following an incident that may have caused permanent distortion of load-bearing parts. Since distortion may have already occurred due to the overload, it seems more prudent and practical to perform an overall dimensional inspection and nondestructive examination of all load-bearing parts to determine whether the device is still acceptable or whether parts should be repaired or replaced. If repair, replacement, or modification is needed as evidenced by the inspection and examinations, then the device will be subjected to the load-testing at 150% rating, followed again by a dimensional examination and non destructive examination. This alternative achieves the same objective as Section 5.3.3 of the standard.

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 (3.2 and 5) directly related to the load handling reliability of the lifting devices. It is assumed from the Licensee's response as well as the exceptions that have been noted that no exceptions are taken with the design safety margins of 3 on yield strength and 5 on ultimate strength for the four lifting devices reviewed. Although the following sections do not contain issues directly related to load handling, they do contain important information regarding the reliability of the special lifting devices which the Licensee may want to record or include in the appropriate inspection and maintenance procedures and is provided for reference purposes only. These items are included in the following sections:

Section 3.1:

a. limitations on the use of the lifting devices (3.1.1)
b. identification of critical components and definition of critical characteristics (3.1.2)
c. signed stress analyses which demonstrate appropriate margins of safety (3.1.3)
d. indication of permissible repair procedures (3.1.4)

Section 3.3:

a. consideration of problems related to possible lamellar tearing (3.3.1)
b. design shall assure even distribution of the load (3.3.4)
c. retainers fitted for load carrying components which may become inadvertently disengaged (3.3.5)
d. verification that remote actuating mechanisms securely engage or disengage (3.3.6)

Section 4.1:

a. verify selection and use of material (4.1.3)
b. compliance with fabrication practice (4.1.4)
c. qualification of welders, procedures, and operators (4.1.5)
d. provisions for a quality assurance program (4.1.6)
e. provisions for identification and certification of equipment (4.1.7)
f. verification that materials or services are produced under appropriate controls and qualifications (4.1.9).

Detailed evaluation of special lifting devices at Davis-Besse Unit 1 has been limited to Sections 3.2 and 5 of ANSI N14.6-1978; evaluations of the four special lifting devices identified satisfy the requirements of this guideline for these sections based on the Licensee's statement that the lifting devices comply with the standards, with exceptions noted.

For those exceptions noted by the Licensee, proposed actions for Exception 1 (periodic inspections by maintenance or non-operating personnel) meet the intent of this guideline and are consistent with NUREG-0612 guidance for inspection of cranes (Guideline 6). Insufficient information, however, has been provided to allow an evaluation of Exception 2 with respect to the intent of the ANSI standard. The Licensee has proposed deferring certain inspections to 5-year intervals on the basis that NDE inspections would require disassembly not normally performed or removal of paint, although inspections by other techniques will be performed on shorter intervals. Tables provided by the Licensee do not adequately identify those load-bearing components that would be affected by deferral of these inspections. In addition, while acknowledging that difficulties may arise due to component disassembly or paint removal, these reasons alone do not provide sufficient justification to modify the periodicity of the required examinations.

For Exception 3, the Licensee's proposal to perform only nondestructive and dimensional examinations to identify deformations or overstressed members in lieu of the combination of load test and examination specified by Section 5.3.3 is not equivalent to the requirements of ANSI N14.6-1978. Any overstress condition would probably result from an uncontrolled event and, as such, the amount and duration of the stress applied in excess of the rated load would be unknown. The purpose of the 150% load test is judged to be to reverify a structural safety margin following an unknown, but excessive, stress condition. Therefore, the Licensee should perform the 150% load test of the lifting devices, as specified in ANSI N14.6-1978, following any substantial overloading of a special lifting device. This test can be made following the inspection proposed by the Licensee. Obviously if the inspection established that no overload substantially in excess of that for which the device has been qualified had occurred, no load test should be necessary.

c. Conclusion and Recommendations

Special lifting devices at Davis-Besse Unit 1 substantially comply with Guideline 4 on the basis that four of the lifting devices noted have been found to comply with Sections 3.2 and 5 of ANSI N14.6-1978. To fully comply, however, additional action is necessary:

1. Evaluate the missile shield lifting harness in accordance with ANSI N14.6-1978.

2. Provide additional information and evidence to justify Exception 2.

3. Perform 150% load test of special lifting devices as specified in ANSI 14.6, Section 5.7.1.

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

"Lifting devices that are not specially designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, 'Slings' [7]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' 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

The Licensee states that, with the exception of the spent fuel shipping cask, other loads identified by the Licensee are lifted with slings selected, inspected, and maintained in accordance with ANSI B30.9-1971.

b. Evaluation

Procedures for use of slings at Davis-Besse Unit 1 partially satisfy the recommendations of this guideline on the basis that they comply with ANSI B30.9-1971. However, no information has been provided to verify that dynamic load factors have been factored into selection, use, and marking of slings in accordance with this guideline.

c. Conclusion and Recommendations

Davis-Besse Unit 1 partially complies with Guideline 5. To fully comply, the Licensee should verify that (a) selection of slings includes consideration of the maximum dynamic loads, (b) slings are suitably marked, and (c) slings restricted in use to only certain cranes are clearly marked to so indicate.

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 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

Davis-Besse preventive maintenance and surveillance test programs provide for crane inspection, testing, and maintenance. The preventive maintenance program outlines a schedule of preventive maintenance per Administrative Directives AD 1844.00, Maintenance, and AD 1844.01, Preventive Maintenance. Periodic Test Procedure PT-5199.02, Station Crane Periodic Test, provides for station crane surveillance. Administrative Directive 1844.04 specifies crane lubrication guidelines. Crane lubrication data are kept in the plant lubrication manual.

These procedures and practices were reviewed against the provisions of ANSI B30.2-1976, Chapter 2-2. Where areas of noncompliance with the standard were identified, revisions to procedures were developed. No exceptions to ANSI B30.2-1976 are taken.

b. Evaluation

Davis-Besse Unit 1 satisfies the requirements of this guideline on the basis that existing procedures have been reviewed and revised to comply with ANSI B30.2-1976, with no exceptions.

c. Conclusion

Davis-Besse Unit 1 complies 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 Travelling Cranes' [8]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

a. Summary of Licensee Statements and Conclusions

Specifications for cranes subject to NUREG-0612 compliance have been compared to CMAA-70 and to the additional safety requirements of ANSI B30.2-1976. Each of these cranes--the containment polar crane, the reactor service crane, the spent fuel shipping cask crane, and the intake structure gantry crane--was designed in accordance with Bechtel design specifications. These specifications required that each crane be designed in accordance with the minimum requirements for Class A cranes, except as the requirements are extended by the Bechtel specification, in which case the more stringent restriction governed. The Licensee noted that the Bechtel specification predates the 1975 revision to CMAA-70. As a result of the above comparison, the Licensee states that all four cranes have been found to comply with CMAA-70 and ANSI B30.2-1976, with two exceptions:

1. The Bechtel specifications place no additional requirements on welding other than the requirement of CMAA-70, which in turn references AWS D14.1 for welding. ANSI B30.2-1976 requires welding to be in accordance with AWS D1.1 as modified by AWS D14.1. With the exception of requirements for storage of low hydrogen welding rods included in AWS D1.1, there are no significant differences between AWS D1.1 and

AWS D14.1 that would affect load-handling reliability. Licensee review revealed that the manufacturer's shop practices provided for control of low hydrogen rods even though AWS D1.1 was not specifically used. Therefore, the welding requirements in effect were equivalent to the requirements of ANSI B30.2.

2. In regard to the tolerance on crane runway dimensions, CMAA-70 specifies that center-to-center distances on runway rails be within ±1/8 inch. For the polar crane, the equivalent center-to-center distance is the diameter of the circular track. The plant designer (Bechtel) and the polar crane manufacturer (Harnischfeger) have used a tolerance of ±1/2 inch. It is the Licensee's judgment that this deviation from the standard is not significant to load handling reliability in view of the fact that both Bechtel and Harnischfeger worked to the same dimensions.

b. Evaluation

Cranes at Davis-Besse Unit 1 satisfy the requirements of this guideline on the basis that they were designed and built to specifications which meet or exceed the criteria of CMAA-70 and ANSI B30.2-1976. The Licensee responses regarding exceptions indicate that (1) welding procedures used are equivalent to ANSI B30.2-1976 and meet the intent of this guideline and (2) deviation from the crane center-to-center runway tolerances is not significant to load handling reliability.

c. Conclusion

Davis-Besse Unit 1 complies with Guideline 7.

2.2 INTERIM PROTECTION MEASURES

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

1. Heavy load technical specifications

2. Special review for heavy loads handled over the core.

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

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

"Licenses for all operating reactors not having a single-failure-proof overhead crane in the fuel storage pool area should be revised to include a specification comparable to Standard Technical Specification 3.9.7, 'Crane Travel - Spent Fuel Storage 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. Evaluation

A review of technical specifications for Davis-Besse Unit 1 indicates that Technical Specification 3.9.7 prohibits movement of loads greater than 2430 lb over spent fuel assemblies in the spent fuel pool area.

b. Conclusion

Davis-Besse Unit 1 complies with Interim Protection Measure 1.

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

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

a. Evaluation

The specific requirements for load-handling administrative controls are contained in NUREG-0612, Section 5.1.1, Guidelines 1, 2, 3, and 6. The

Licensee's compliance with these guidelines has been evaluated in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7, respectively, of this report.

b. Conclusions and Recommendations

Conclusions and recommendations concerning the Licensee's compliance with these administrative controls are contained in Sections 2.1.2, 2.1.3, 2.1.4, and 2.1.7 of this report.

2.2.3 Special Review for Heavy Loads Handled 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 operation, and content of procedures."

a. Evaluation, Conclusion, and Recommendations

No information has been provided by the Licensee to determine if the special review described in this interim measure has been performed. Therefore, a determination of compliance must be deferred until the Licensee reports that this review is in progress or completed.

3. CONCLUDING SUMMARY

This summary is provided to consolidate the conclusions and recommendations of Section 2 and to document the overall evaluation of the handling of heavy loads at Toledo Edison Company's Davis-Besse Nuclear Power Station Unit 1. It is divided into two sections, one dealing with general provisions for load handling at nuclear power plants (NUREG-0612, Section 5.1.1) and the other with staff recommendations for interim protection, pending complete implementation of the guidelines of NUREG-0612 (NUREG-0612, Section 5.3). In each case, recommendations are made for additional Licensee action and, where appropriate, for additional NRC staff action.

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 appropriately small for the critical functions and potential consequences of failures of cranes at nuclear power plants. These guidelines are partially satisfied at Davis-Besse Unit 1. This conclusion is presented in tabular form as Table 3.1. Specific recommendations for achieving full compliance with these guidelines follow:

Guideline	Recommendations
1	a. For remaining Class 1, 2, and 3A loads, develop one or more general purpose or preferred load paths which allow movement of loads in areas of concern.
	b. Incorporate load paths into general arrangement drawings and provide suitable visual aids to the operators when transporting loads.
2	Verify that procedures in use contain the information requested by this guideline, including identification of equipment, inspection

Table 3.1 Davis-Besse Unit 1/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. Polar Crane	180(25)	--	--	C	--	--	C	C	--	I
Reactor Plenum Assembly	59.9	P	I	--	P	--	--	--	--	I
Reactor Vessel Head (RVH)	165	P	I	--	P	--	--	--	--	I
Internals Indexing Fixture	14	P	I	--	P	--	--	--	--	I
Plenum Assembly Lifting Rig	9.2	P	I	--	P	--	--	--	--	I
Automatic Reactor Inspection Device	16	P	I	--	--	P	--	--	--	I
I-Beam D-Ring Grating Supports	6	NC	I	--	--	P	--	--	--	I
D-Ring Grating Sections	--	NC	I	--	--	P	--	--	--	I
Steam Generator Removable	--	NC	I	--	--	P	--	--	--	I
Reactor Missile Shields	47.2	P	I	--	I	--	--	--	--	I

C = Licensee action complies with the NUREG-0612 Guideline.
NC = Licensee action does not comply with the NUREG-0612 Guideline.
I = Insufficient information provided by the Licensee.
P = Licensee action is in partial compliance with the NUREG-0612 Guideline.
-- = Not applicable.

Table 3.1 (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
Polar Crane Load Block	--	P	I	--	--	P	--	--	--	I
Steel Working Platform	1	NC	I	--	--	P	--	--	--	I
20" S/G Snubbers	3.5	P	I	--	--	P	--	--	--	I
Irradiated Specimen Cask	3	NC	I	--	--	P	--	--	--	I
Letdown Coolers	2.5	NC	I	--	--	P	--	--	--	I
Equipment Hatch Covers	5-16	NC	I	--	--	P	--	--	--	I
CFT Hatch Covers	4	NC	I	--	--	P	--	--	--	I
Motor Removal Hatches	2.5	NC	I	--	--	P	--	--	--	I
Plenum Assembly Stand	3	P	I	--	--	P	--	--	--	I
Core Support Barrel Stand	3.2	NC	I	--	--	P	--	--	--	I
RVH Lifting Rig	6	NC	I	--	--	P	--	--	--	I
RCP Rotating Element	2	NC	I	--	--	P	--	--	--	I
RCP Motor	51	P	I	--	--	P	--	--	--	I
RCP	42	C	I	--	--	P	--	--	--	I
Core Support Assembly	112	C	I	--	--	P	--	--	--	I

Table 3.1 (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 4 Special Attention
2. Component Cooling Water Pump Monorail	3	--	--	C	--	--	C	C	--	--
CCW Pumps	2.7	P	I	--	--	P	--	--	--	--
CCW	2.4	P	I	--	--	P	--	--	--	--
3. Spent Fuel Cask Crane	140(20)	--	--	C	--	--	C	C	C	--
Pool Divider Gates	4	NC	I	--	--	P	--	--	C	--
4. Intake Gantry Crane	15	--	--	C	--	--	C	C	--	--
Service Water Pump (SWP)	3.9	NC	I	--	--	P	--	--	--	--
SWP Motor	4.3	NC	I	--	--	P	--	--	--	--
Circ Water Makeup Pump	2.9	NC	I	--	--	P	--	--	--	--
Makeup Pump Motor	1.8	NC	I	--	--	P	--	--	--	--
Rooftop Hatch Covers	1.4	NC	I	--	--	P	--	--	--	--

Table 3.1 (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
Dilution Pump	4.7	NC	I	--	--	P	--	--	--	--
Dilution Pump Motor	1.5	NC	I	--	--	P	--	--	--	--
Diesel Fire Pump	2.6	NC	I	--	--	P	--	--	--	--
Diesel Fire Pump Motor	1.8	NC	I	--	--	P	--	--	--	--
Screen Wash Pump	1.8	NC	I	--	--	P	--	--	--	--
Screen Wash Pump Motor	0.7	NC	I	--	--	P	--	--	--	--
5. Reactor Service Crane	5	--	--	--	--	--	--	--	--	--

Guideline	Recommendations
	and acceptance criteria, steps and proper sequence, safe load path definitions, and other special precautions.
3	(Davis-Besse Unit 1 complies with this guideline.)
4	a. Evaluate the missile shield lifting harness in accordance with ANSI N14.6-1978.
	b. Provide additional information and evidence to justify Exception 2.
	c. Perform the 150% load test of special lifting devices as specified in ANSI N14.6, Section 5.7.1.
5	Verify that (a) selection of slings includes consideration of the maximum dynamic loads, (b) slings are suitably marked, and (c) slings restricted in use to only certain cranes are clearly marked to so indicate.
6, 7	(Davis-Besse Unit 1 complies with these guidelines.)

3.2 INTERIM PROTECTION

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 the following actions are necessary to ensure that the staff's measures for interim protection at Davis-Besse Unit 1 are taken:

Interim Measure	Recommendation
1	(Davis-Besse Unit 1 complies with this interim measure.)
2, 3	Implement the recommendations concerning Guidelines 1 and 2 identified in Section 3.1.

Interim Measure	Recommendation
4, 5	(Davis-Besse Unit 1 complies with these interim measures.)
6	Implement the requirements of this interim protection measure.

3.3 SUMMARY

The NRC's general guidelines and interim protection measures established in NUREG-0612 have been partially satisfied at Toledo Edison's Davis-Besse Unit 1. Specifically, programs for crane operator training, crane inspection and design, and spent fuel pool area technical specifications satisfy the guidelines of NUREG-0612. Additional information and action are needed from the Licensee for compliance with the remaining general guidelines and interim protection measures.

4. REFERENCES

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