CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 AND 3
(PHASE I)

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ABSTRACT

The Nuclear Regulatory Commission (NRC) has requested that all nuclear plants either operating or under construction submit a response of compliancy with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." EG&G Idaho, Inc., has contracted with the NRC to evaluate the responses of those plants presently under construction. This report contains EG&G's evaluation and recommendations for San Onofre Nuclear Generating Station Units 2 and 3.

EXECUTIVE SUMMARY

Based on the information provided San Onofre Nuclear Generating Station Units 2 and 3 are consistent with the intent of the Requirements of NUREG 0612.

CONTENTS

TABLES

TECHNICAL EVALUATION REPORT
FOR
SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 AND 3
(PHASE I)

1. INTRODUCTION

1.1 Purpose of Review

This technical evaluation report documents the EG&G Idaho, Inc., review of general load handling policy and procedures at San Onofre Nuclear Generating Station Units 2 and 3. This evaluation was performed with the objective of assessing conformance to the general load handling guidelines of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants" [1], Section 5.1.1. This constitutes Phase I of a two phase evaluation. Phase II assesses conformance to Sections 5.1.2, 5.1.3, 5.1.5, and 5.1.6 of NUREG-0612 and will be documented in a separate report.

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 applicants, requesting information concerning the control of heavy loads near spent fuel.

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

In order to upgrade measures for the control of heavy loads, the staff developed a series of guidelines designed to achieve a two-phase objective using an accepted approach or protection philosophy. The first portion of the objective, achieved through a set of general guidelines identified in NUREG-0612, 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 through 5.1.5 is to ensure that, for load handling systems in areas where their failure might result in significant consequences, either (a) 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 (b) 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:

- Provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to assure reliable operation of the handling system;

- Define safe load travel paths through procedures and operator training so that, to the extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment;

- Provide 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.

1.3 Plant-Specific Background

On December 22, 1980, the NRC issued a letter [3] to Southern California Edison Company, the applicant for the San Onofre Nuclear Generating Station, requesting that the applicant review provisions for handling and control of heavy loads at San Onofre 2 and 3, evaluate these provisions with respect to the guidelines of NUREG-0612, and provide certain additional information to be used for an independent determination of conformance to these guidelines. On July 7, 1981, Southern California Edison provided the initial response [4] to this request. Additional information was provided by the applicant on April 30, June 30, August 3, and August 25, 1982 [5,6,7,8].

2. EVALUATION AND RECOMMENDATIONS

2.1 Overview

The following sections summarize Southern California Edison's review of heavy load handling at San Onofre 2 and 3 accompanied by EG&G's evaluation, conclusions and recommendations to the applicant for bringing the facilities more completely into compliance with the intent of NUREG-0612. The applicant has identified the weight of a heavy load for this facility (as defined in NUREG-0612, Article 1.2) as approximately 1,500 lbs.

2.2 Heavy Load Overhead Handling Systems

This section reviews the applicant's list of overhead handling systems which are subject to the criteria of NUREG-0612 and a review of the justification for excluding overhead handling systems from the above mentioned list.

2.2.1 Scope

"Report the results of your review of plant arrangements to identify all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal (taking no credit for any interlocks, technical specifications, operating procedures, or detailed structural analysis) and justify the exclusion of any overhead handling system from your list by verifying that there is sufficient physical separation from any load-impact point and any safety-related component to permit a determination by inspection that no heavy load drop can result in damage to any system or component required for plant shutdown or decay heat removal."

A. Summary of Applicant Statements

The applicant's review of overhead handling systems identified the cranes and hoists shown in Table 2.1 and 2.2 as those which handle heavy loads in the vicinity of irradiated fuel or safe shutdown equipment.

As indicated in Table 2.2 the applicant has determined that cranes (11) - (21), and (23) are "free of any interaction with safe shutdown equipment" so these cranes have been excluded from satisifying the criteria of the general guidelines of NUREG-0612. Cranes (8), (9), (10) and (22) have also been excluded as the safe shutdown components in the vicinity of these systems are "completely redundant" and a single load drop could only damage a single component. The applicant has stated that operating procedures will require any safety related equipment potentially affected by a heavy load lift of cranes (8), (9), (10) and (22) be declared out of service prior to the lift.

B. EG&G Evaluation

Evaluation of the relationship between crane coverage and the location of safety equipment is based on the information supplied by the Applicant.

The applicant's statements concerning the exclusion of cranes (8), (9), (10) and (22) of Table 2.2 are acceptable based on the measures taken to assure that potentially affected equipment is declared out of service prior to load handling.

TABLE 2.1. NONEXEMPT HEAVY LOAD HANDLING SYSTEMS--SAN ONOFRE 2 AND 3

	Handling System	Capacity (tons)	Location
(1)	Polar Crane	205/30	Containment
(2)	Cask Handling Crane	125/10	Fuel Handling Bldg.
(3)	Turbine Gantry Crane	225/60	Turbine Bldg.
(4)	New Fuel Handling Crane	5	Fuel Handling Bldg.
(5)	AFW Pump Bridge Crane	5	Condensate Storage Tank Bldg.
(6)	CCW Pump Monorail	3	Safety Equipment Bldg.
(7)	SI Pump Monorails	4	Safety Equipment Bldg.

TABLE 2.2. EXEMPT HEAVY LOAD HANDLING SYSTEMS--SAN ONOFRE 2 AND 3

	Handling System	Capacity (tons)	Location	Exclusion
(8)	Jib Cranes 1, 2, 3, and 4	5	Auxiliary Bldg.	Redundancy
(9)	Diesel Bldg. Cranes	3	Diesel Bldg.	Redundancy
(10)	Charging Pump Monorails	5	Auxiliary Bldg.	Redundancy
(11)	Turbine Feed Pump Crane	15	Turbine Bldg.	Noninteraction
(12)	Seaweed Removal Jib Crane	4	Intake Structure	Noninteraction
(13)	Hot Machine Shop Crane	3	Radwaste Area	Noninteraction
(14)	Truck Bay Crane	25	Auxiliary Bldg.	Noninteraction
(15)	Truck Bay Crane	1	Auxiliary Bldg.	Noninteraction
(16)	Cartridge Filter Removal Crane	1	Radwaste Area	Noninteraction
(17)	Condenser Waterbox Removal Crane	10	Turbine Bldg.	Noninteraction
(18)	Waste Gas Compressor Removal Crane	2	Auxiliary Bldg.	Noninteraction
(19)	Blowdown Filter Removal Crane	1	Turbine Bldg.	Noninteraction
(20)	Crud Tank Filter Block Removal Crane	3	Radwaste Area	Noninteraction
(21)	Crud Tank Vent Filter Block Removal Crane	3	Radwaste Area	Noninteraction
(22)	Turbine Gantry Crane Side Boom	10	Turbine Bldg.	Redundancy
(23)	MSIV Jib Cranes	4	Safety Equip. Bldg.	Noninteraction

C. EG&G Conclusions and Recommendations

Based on the information provided, EG&G concludes that the applicant has included all applicable hoists and cranes in their list of handling systems which must comply with the requirements of the general guidelines of NUREG-0612.

2.3 General Guidelines

This section addresses the extent to which the applicable handling systems comply with the general guidelines of NUREG-0612 Article 5.1.1. EG&G's conclusions and recommendations are provided in summaries for each guideline.

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:

A. Guideline 1--Safe Load Paths

B. Guideline 2--Load Handling Procedures

C. Guideline 3--Crane Operator Training

D. Guideline 4--Special Lifting Devices

E. Guideline 5--Lifting Devices (not specially designed)

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

G. 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 succeeding paragraphs address the guidelines individually.

2.3.1 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 Applicant Statements

Inside containment, restricted areas and safe load paths have been defined to assure that crane operations are conducted in a safe manner. Limit switches prevent crane operation in restricted areas unless the crane hooks are completely retracted. A by-pass is provided which limits the drive systems to 20% of rated speeds.

Near the spent fuel pool, critical load paths have been prescribed to assure that loads carried by the cask handling crane travel parallel to the pool in an E-W direction. The direction of travel precludes tilting of the cask toward the spent fuel pool in the event of a cask drop where the edge of the cask storage pool is struck. The paths are enforced by administrative controls, critical path limit switches, and physical barriers.

Critical load paths in the vicinity of other safe shutdown components will be controlled by operating procedures to assure that safe shutdown equipment exposure will be held to a minimum. These procedures will include restricted areas for cranes and hatch placement requirements for monorail systems.

Maintenance procedures will assure that permanent or temporary markings are used to indicate the safe load paths for all heavy loads lifted by plant cranes that fall within the NUREG-0612 guidelines.

Load handling procedures require that deviations from the designated paths will require written approval by the plant safety review committee or its designated representative. Such approval shall be required for monorail lifts when the load is wider than the specified safe load path. Overriding or bypassing of interlocks and protective devices will require the authorization of the Maintenance Supervisor.

Drawings clearly identifying all crane locations and safe load paths will be maintained onsite while the facility is operational.

B. EG&G Evaluation

The applicant's response states that safe load paths have been developed for all applicable heavy loads.

C. EG&G Conclusions and Recommendations

San Onofre 2 and 3 are consistent with the intent of the criteria of Guideline 1.

2.3.2 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. 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 Applicant Statements

Procedures are being developed consistent with the scheduled operation date to govern handling of the various heavy loads, and to meet the requirements of NUREG-0612. The procedures will be implemented by October 1, 1982 and retained on file in an up-to-date condition while the facilities are operational.

B. EG&G Evaluation

The applicant has stated that procedures are being developed that are consistent with the requirements of NUREG-0612.

C. EG&G Conclusions and Recommendations

San Onofre 2 and 3 are consistent with the intent of the criteria of Guideline 2 as the procedures being developed will include NUREG-0612 requirements.

2.3.3 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' [9]."

A. Summary of Applicant Statements

"Procedures for the qualification and training of crane operators are being developed consistent with the scheduled operating date and will meet the provisions of ANSI B30.2-1976." The procedures will require requalification of all operators at 18 month intervals. Training, qualification and requalification documentation will be retained on file. The initial qualification and training sequence will be completed by May 1, 1983.

B. EG&G Evaluation

The applicant has stated that procedures are being developed that are consistent with the requirements of NUREG-0612.

C. EG&G Conclusion and Recommendations

San Onofre 2 and 3 are consistent with the intent of the criteria of Guideline 3 as the procedures being developed will include NUREG-0612 requirements.

2.3.4 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 Weighting 10,000 Pounds (4500 kg) or More for Nuclear Materials' [10]. 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) or the load and of the intervening components of the special handling device."

A. Summary of Applicant Statements

The applicant identifies two special lifting devices used to move heavy loads over an open reactor vessel. Both of these devices were designed prior to the existence of both ANSI N14.6-1978 and NUREG-0612. Based on this chronology the applicant explains that documentation is unavailable to verify compliance with two Sections (4.2, and 4.3) of ANSI N14.6 concerning design and fabrication details. In addition, the applicant lists five other Sections (1.0, 2.0, 3.4, 3.5, and 3.6) that are not considered pertinent to the "load handling reliability" of the devices. The applicant also does not consider Section 6, as none of the loads lifted using the 2 lifting rigs have been determined to be critical loads based on the definition of critical loads contained in ANSI N14.6.

The applicant evaluates the lifting devices based on the remaining Sections (3.1, 3.2, 3.3, 4.1, and 5) and lists the following exceptions to the ANSI N14.6 standard:

(1) The special lifting devices have not been load tested to 150% of the maximum operating load as specified in Section 5.2.1, but they have "successfully lifted loads equivalent to 125% of their rated load with no signs of deformation or overstress... Based on the procedures which assure against overloading, inspections to detect against incipient failures or deformation and dedicated usage, the fact that none [of the lifting devices] were initially load tested to 150% of the rated load is judged to have no significant effect on the lifting devices current load handling reliability."

(2) "Plant procedures do not now specify a visual inspection by maintenance or other nonoperating personnel at intervals not to exceed three months in length as required by Section 5.3.7... Between usage, these rigs are stored in a specific location under controlled environment. The devices are inspected by qualified personnel at specific intervals. This will include a visual, dimensional and NDE inspection prior to each use, unless the device has received such inspections within the last 12 months. In any event, a visual examination prior to each use will be performed. Based on this controlled use, storage, handling and inspections, the equivalency in load-handling reliability provided by Section 5.3.7 is demonstrated."

(3) "There are several components whose inspection in accordance with all of the requirements of Section 5.3.1 (2) on an annual frequency is impractical. These components are those that require disassembly not normally performed or removal of protective coatings. The proposed inspection of all critical load bearing components, including exceptions for these rigs, will be indicated in maintenance procedures."

"Dynamic loads were determined in accordance with CMAA-70 Specifications, i.e., 0.5% of the load per foot per minute of hoisting speed." Load cells are utilized to detect and prevent load hangups.

Both rigs "will be subjected, prior to use during each refueling outage, to necessary visual, dimensional, and nondestructive examination."

Three other lifting rigs, the Core Support Barrel Lift Rig, Turbine Rotor Lifting Beam and Contaminated Extension Yoke Assembly, were excluded from consideration as "none of the loads lifted by these lifting rigs is carried over fuel in the vessel, spent fuel or operable safe shutdown equipment."

B. EG&G Evaluation

Section 2.1 of NUREG-0612 specifies the allowable offsite radioactive release applicable to heavy loads as 25% of the guideline exposures outlined in 10 CFR Part 100.

The applicant's exception to Section 5.2.1 of ANSI N14.6 is acceptable as the use of a test load of 125% of the maximum operational load instead of 150% should not unduly compromise the demonstration of reliability of these lifting devices.

The applicant's method of dynamic load calculation is acceptable.

EG&G finds the applicant's exception concerning visual inspection frequencies to be reasonable and acceptable.

The applicant takes exception to the requirements of yearly inspections on some components of the Reactor Head Lifting Guide and the upper Guide Structure Lifting Rig, defined by the requirements of ANSI N14.6-1978 Section 5.3.1(2). The exceptions are taken because

(1) Inspection of the components requires disassembly of equipment not normally disassembled, and/or the removal of protective coatings.

(2) The use, storage and handling of these rigs is controlled.

(3) Both rigs will be subjected to necessary visual dimensional and non-destructive exams prior to use during each refueling outage if an exam has not been conducted in the previous 12 month period.

(4) The planned operating periods between refuelings is about 18 months and therefore there is limited use of these rigs during this period.

EG&G therefore judges the exceptions taken to the annual inspections as reasonable and acceptable.

The core support Barrel Lift Rig, the Turbine Rotor Lifting Beams, and the contaminated extension yoke assembly were excluded from consideration as none of the loads lifted by these lifting rigs is carried over fuel in the vessel, spent fuel or operable safe shutdown equipment.

C. EG&G Conclusions and Recommendations

San Onofre 2 and 3 are consistent with the intent of the criteria of Guideline 4 as the exceptions requested are reasonable and do not compromise the intent of the guideline.

2.3.5 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' [11]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

A. Summary of Applicant Statements

With regard to the lifts identified, which utilize slings, plant procedures will require that sling selection, use, and marking will be in accordance with ANSI B30.9 and NUREG-0612 Section 5.1.1(5). Rated loads identified for each sling will be based on the sum of the static and maximum dynamic load. Dynamic loads have been determined in accordance with CMAA-70 specifications, i.e., the dynamic load 'shall be taken as 1/2% of the load per foot per minute of hoisting speed.' The maximum hoist speeds are for the polar and turbine gantry cranes, and at no load would be 15 fpm. This would result in a maximum dynamic load of 7-1/2% of the lifted load. Therefore, the plant procedures will specify that, as a minimum, sling selection be based on 110% of the lifted load.

B. EG&G Evaluation

The applicant's response indicates that the selection of slings will be based on the criteria of ANSI B30.9 and NUREG-0612 per plant procedures. As stated previously the applicant's method of dynamic load determination is acceptable. Sling selection based on 110% of the lifted load is consistent with this guideline per the SYNOPSIS OF ISSUES ASSOCIATED WITH NUREG 0612.

C. EG&G Conclusions and Recommendations

San Onofre Units 2 and 3 are consistent with the intent of the criteria of Guideline 5.

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

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

A. Summary of Applicant Statements

"Procedures for the inspection, testing, and maintenance of the Polar, Turbine Gantry and Cask Handling crane will be developed to satisfy the criteria in ANSI B30.2-1976, Chapter 2-2.

The criteria in ANSI B30.2 are not easily applied to such handling systems as monorails, jib cranes and hand-driven hoists. Accordingly, ANSI B30.11-1973, 'Monorail Systems and Underhung Cranes' and ANSI B30.16-1973, 'Overhead Hoists' will be used in developing the inspection, test, and maintenance procedures for the New Fuel Handling, the Safety Injection Pump and the CCW Pump, and the Auxiliary Feedwater Pump underhung crane."

B. EG&G Evaluation

The applicant has stated that procedures complying with the criteria are being developed for three of the cranes. Implementation of these procedures will satisfy compliance for these cranes.

The applicant stated that procedures are also being developed for the remaining four cranes using ANSI standards more easily applied to the particular systems than ANSI B30.2. Section 2.1, Item 3e of Enclosure 3 of the NRC's December 22, 1980, letter to applicants [3] requested "where any exception is taken to [ANSI B30.2-1976, Chapter 2-2], sufficient information should be provided to demonstrate the equivalency of proposed alternatives." EG&G feels that the indicated standards are acceptable equivalents.

The applicant has taken exception to the inspection frequencies given in ANSI B30.2 as allowed by the guideline for only the jib cranes (see Table 2.1).

C. EG&G Conclusions and Recommendations

San Onofre 2 and 3 are consistent with the intent of the criteria of Guideline 6 as procedures under development are designed to meet the intent of the guideline.

2.3.7 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 Traveling Cranes' [12]. 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 Applicant Statements

Evaluations were performed on the handling system designs using the design criteria in applicable current standards.

The Polar Cranes, Cask Handling Cranes and Turbine Gantry Cranes were all built prior to the issuance of both ANSI B30.2-1976 and CMAA 70-1975. For all these cranes "the design specification called for compliance with the then

current version of CMAA-70 October 1971, which is essentially equivalent to the 1975 version of CMAA-70. Our approach in evaluating these cranes was to identify sections relevant to load drop prevention in ANSI B30.2 1976, determine if the requirements in those sections were more stringent than those of CMAA-70, and then establish whether the crane design satisfied these requirements."

The New Fuel Handling Monorail System consists of a bridge crane interlocked to a monorail. Only the monorail portion needed to be evaluated since it is used to remove the gate in the spent fuel pool. "Since the design requirements of CMAA-70 were not applicable to all portions of the system, the design requirements of MMA-73, 'Specification for Underhung Cranes and Monorail Systems,' were also specified, with MMA-73 to take precedent in areas of conflict with CMAA-70. No exceptions to CMAA-70 and MMA-73 design standards were taken."

The Auxiliary Feedwater Pump Underhung Crane, Safety Injection Pump Monorails and Component Cooling Water Pump Monorail were all designed and fabricated to similar standards. "Since the criteria in ANSI B30.2-1976 and CMAA-70 are not directly applicable to underhung cranes, monorails and their hoists, the designs of these handling systems were compared to the criteria in applicable standards, i.e., ANSI B30.11, 'Monorail Systems and Underhung Cranes, 1973,' and ANSI B30.16 'Overhead Hoists, 1973.' All monorail hoists were proof tested at 150% of rated load prior to delivery as part of the manufacturer's standard practice."

CMAA-70 or ANSI B30.2.0-1976 are not directly applicable to jib cranes. However, our evaluation, based on a comparison of the information found on the structural drawings and the requirements of CMAA-70, shows that these cranes comply with the structural guidelines of this document."

B. EG&G Evaluation

For the Polar Crane, Cask Handling Crane, and Turbine Gantry Crane, the design criteria of CMAA 70-1971 and the applicable load drop sections of ANSI B30.2-1976 are acceptable, as the intent of the guideline is met.

EG&G agrees that ANSI B30.2 and CMAA-70 are not directly applicable to some of the cranes in Table 2.1. Thus the usage of MMA-73 and CMAA-70 as design criteria for the New Fuel Handling Monorail is acceptable. EG&G feels that ANSI B30.11 and ANSI B30.16 meet the intent of ANSI B30.2 Chapter 2-1 and that specification MMA-73 now published as ANSI MH27.1-1981 is an acceptable equivalent to CMAA-70. Therefore the design criteria applied to the Auxiliary Feed Water Pump Bridge Crane, the component cooling water pump, and the Safety Injection pump monorails is acceptable.

C. EG&G Conclusion and Recommendation

San Onofre 2 and 3 are consistent with the intent of the criteria of Guideline 7.

2.4 Interim Protection Measures

The NRC staff has established (NUREG-0612, Article 5.3) that six 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. Four of these six interim measures 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:

- Heavy load technical specifications

- Special review for heavy loads handled over the core.

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

2.4.1 Interim Protection Measure 1--Technical Specifications

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

A. Summary of Applicant's Statements

Not applicable.

B. EG&G Evaluation

Not applicable.

C. EG&G Conclusions and Recommendations

Not applicable.

2.4.2 Interim Protection Measures 2, 3, 4, and 5 - Administrative Controls

"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 Applicant's Statements

Summaries of applicant's statements are contained in discussions of the respective general guidelines in Sections 2.3.1, 2.3.2, 2.3.3, and 2.3.6, respectively.

B. EG&G Evaluations, Conclusions, and Recommendations

EG&G evaluations, conclusions, and recommendations are contained in discussions of the respective general guidelines in Sections 2.3.1, 2.3.2, 2.3.3, and 2.3.6.

2.4.3 Interim Protection Measure 6--Special Review for Heavy Loads Over the Core

"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: (a) 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; (b) 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; (c) appropriate repair and replacement of defective components; and (d) verify that the crane operators have been properly trained and are familiar with specific procedures used in handling these loads, e.g., hand signals, conduct of operations, and content of procedures."

A. Summary of Applicant's Statements

Not applicable.

B. EG&G Evaluation

Not applicable.

C. EG&G Conclusion

Not applicable.

3. CONCLUDING SUMMARY

3.1 Applicable Load Handling Systems

Based upon the information submitted, the list of cranes and hoists supplied by the applicant as being subject to the provisions of NUREG-0612 is adequate (see Section 2.2.1).

3.2 Guideline Recommendations

Consistency with the seven NRC guidelines for heavy load-handling (Section 2.3) has been demonstrated at San Onofre 2 and 3. This conclusion is represented in tabular form in Table 3.1.

Guideline	Recommendation
1. (Section 2.3.1)	The applicant is consistent with the requirements of this guideline.
2. (Section 2.3.2)	The applicant is consistent with the requirements of this guideline.
3. (Section 2.3.3)	The applicant is consistent with the requirements of this guideline.
4. (Section 2.3.4)	The applicant is consistent with the requirements of this guideline.
5. (Section 2.3.5)	The applicant is consistent with the requirements of this guideline.
6. (Section 2.3.6)	The applicant is consistent with the requirements of this guideline.
7. (Section 2.3.7)	The applicant is consistent with the requirements of this guideline.

TABLE 3.1. SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 AND 3/NUREG-0612 COMPLIANCE MATRIX

Heavy Loads	Weight or Capacity (tons)	Guideline 1 Safe Load Paths	Guideline 2 Procedures	Guideline 3 Crane Operator Training	Guideline 4 Special Lifting Devices	Guideline 5 Slings	Guideline 6 Crane-Test and Inspection	Guideline 7 Crane Design
(1) Containment Polar Crane	205/30	--	--	C	--	--	C	C
Reactor Vessel Head	190	C	C	--	C	--	--	--
Reactor Head Cable Support Structure	35	C	C	--	--	C	--	--
CEDM Cooling Duct	11	C	C	--	C	--	--	--
Upper Guide Support	73	C	C	--	C	--	--	--
Core Support Barrel	76	C	C	--	C	--	--	--
CRDM Missle Shield Blocks	22.5	C	C	--	--	C	--	--
Pool Seal Ring	9	C	C	--	C	--	--	--
Head Stud Tensioners	1.1	C	C	--	--	C	--	--
Reactor Coolant Pump Motor	58	C	C	--	--	C	--	--
(2) Cask-Handling Crane	125/10	--	--	C	--	--	C	C
Irradiated Fuel Shipping Cask	125	C	C	--	C	--	--	--
Spend-Fuel Pool Gate	1.8	C	C	--	--	C	--	--
Hatch Cover	6	C	C	--	--	C	--	--
(3) Turbine Gantry Crane	225/60	--	--	C	--	--	C	C

C = Applicant action complies with NUREG-0612 Guideline.
NC = Applicant action does not comply with NUREG-0612 Guideline.
-- = Not applicable.

Table 3.1. (continued)

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
Low Pressure Turbine Rotor	218.5	C	C	--	C	--	--	--
Salt Water Cooling Pump Motor	3	C	C	--	--	C	--	--
Miscellaneous Loads	--	C	C	--	--	C	--	--
(4) New Fuel Handling Crane	5	--	--	C	--	--	C	C
Spent-Fuel Pool Gate	1.8	C	C	--	--	C	--	--
New Fuel Shipping Container	3.5	C	C	--	--	--	--	--
Hatch Cover	2	C	C	--	--	C	--	--
(5) AFW Pump Bridge Crane	5	--	--	C	--	--	C	C
AFW Pump Motor (Elec.)	4.9	C	C	--	--	C	--	--
AFW Pump (Elec.)	3.3	C	C	--	--	C	--	--
AFW Pump (Turbine)	2.5	C	C	--	--	C	--	--

C = Applicant action complies with NUREG-0612 Guideline.
NC = Applicant action does not comply with NUREG-0612 Guideline.
-- = Not applicable.

Table 3.1. (continued)

	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
(6)	CCW Pump Monorail	3	--	--	C	--	--	C	C
	CCW Pump Motor	3	C	C	--	--	C	--	--
	Hatch Cover	2.1	C	C	--	--	C	--	--
(7)	Safety Injection Pump Monorails	4	--	--	C	--	--	C	C
	HPSI Motor	2.9	C	C	--	--	C	--	--
	LPSI Pump	3.8	C	C	--	--	C	--	--
	LPSI Motor	2.8	C	C	--	--	C	--	--
	Containment Spray Pump	3.8	C	C	--	--	C	--	--
	Containment Spray Motor	2.8	C	C	--	--	C	--	--
	Hatch Cover	2.9	C	C	--	--	C	--	--

C = Applicant complies with NUREG-0612 Guideline.
NC = Applicant does not comply with NUREG-0612 Guideline.
-- = Not applicable.

3.3 Interim Protection

EG&G's evaluation of information provided by the applicant indicates that no action is necessary to ensure that the six NRC staff measures for interim protection at San Onofre are met since the plant is still under construction.

Interim Measure	Recommendation
N/A	N/A

3.4 Summary

The applicant's action is consistent with all seven of the NRC Guidelines for heavy load handling at San Onofre Nuclear Generating Station Units 2 and 3.

4. REFERENCES

1. NUREG-0612
"Control of Heavy Loads at Nuclear Power Plants"
NRC.

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

3. USNRC
Letter to Southern California Edison Company. Subject: NRC Request for Additional Information on Control of Heavy Loads Near Spent Fuel,
NRC, 22 December 1980.

4. K. P. Baskin (SCEC)
Letter to F. Miraglia (NRC). Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station Units 2 and 3
SCEC, July 7, 1981.

5. K. P. Baskin (SCEC)
Letter to F. Miraglia (NRC). Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station Units 2 and 3
SCEC, April 30, 1982.

6. K. P. Baskin (SCEC)
Letter to F. Miraglia (NRC). Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station Units 2 and 3
SCEC, June 30, 1982.

7. K. P. Baskin (SCEC)
Letter to F. Miraglia (NRC). Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station Units 2 and 3
SCEC, August 3, 1982.

8. K. P. Baskin (SCEC)
Letter to F. Miraglia (NRC). Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station Units 2 and 3
SCEC, August 25, 1982.

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

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

11. ANSI B30.9-1971
"Slings".

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

13. ANSI HM 27.1-1981
"Specifications for Underhung Cranes and Monorail Systems