

CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS
PALO VERDE NUCLEAR GENERATING STATION
PLANTS NUMBER 1, 2, AND 3

Docket No. 528/529/530

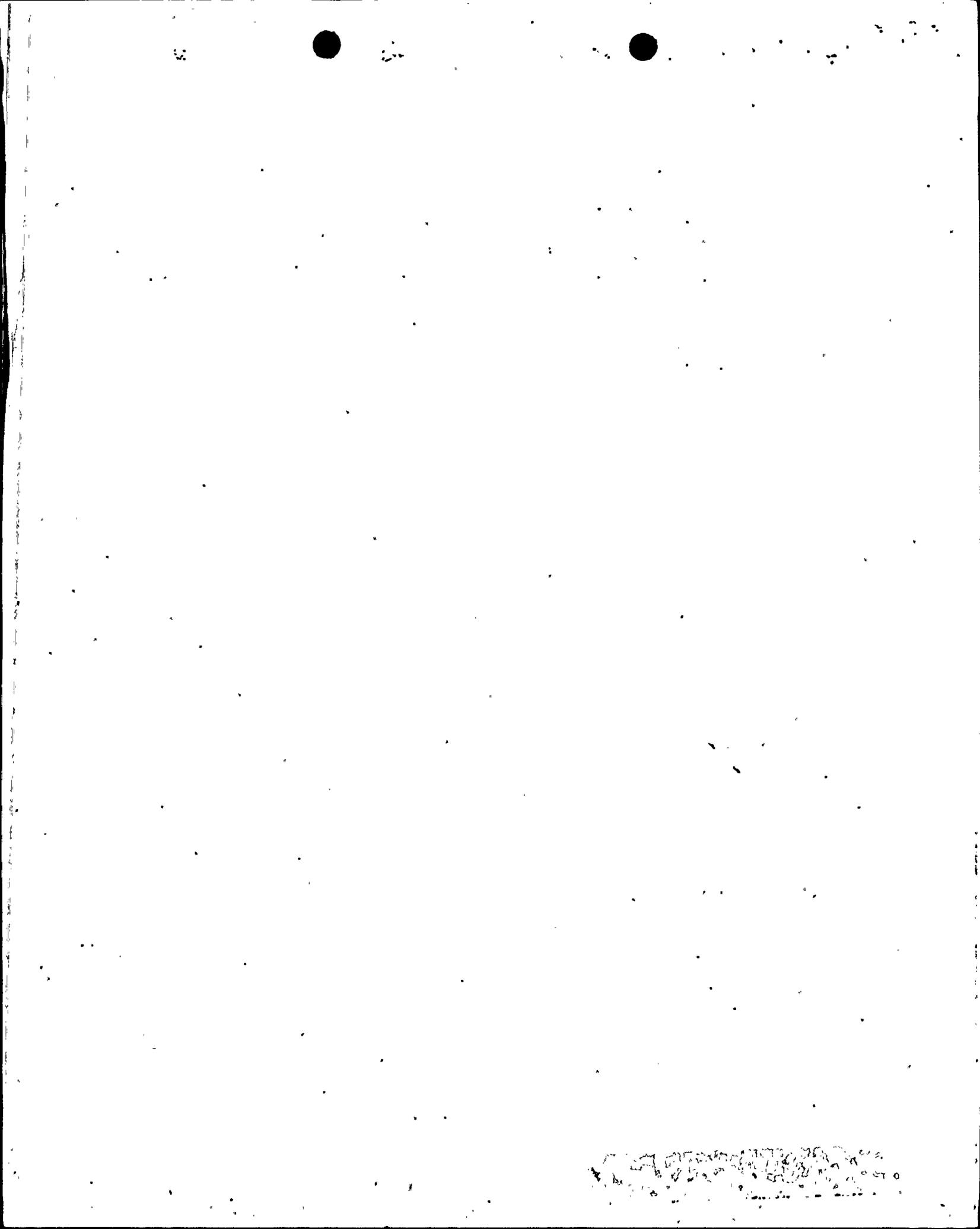
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ABSTRACT

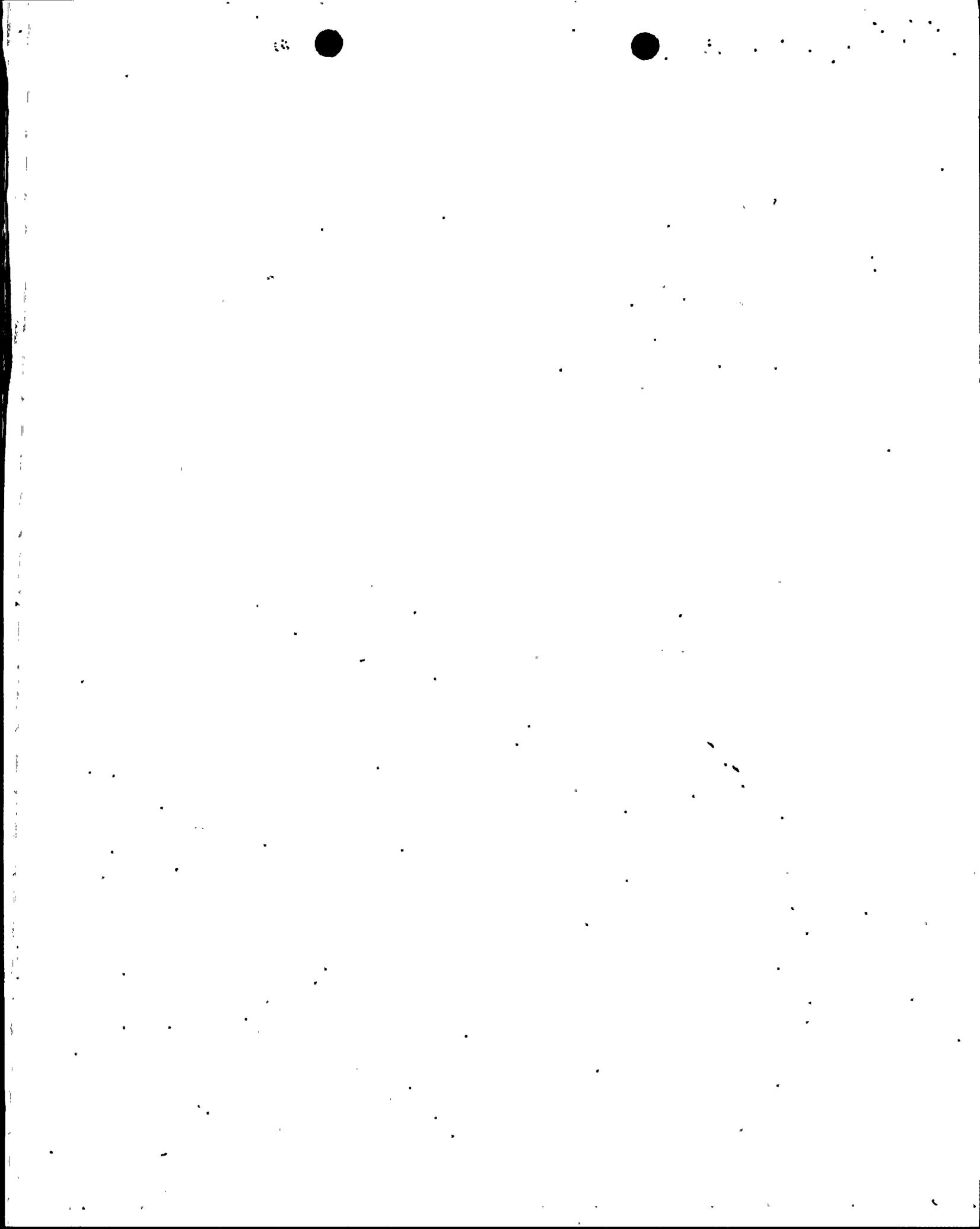
The Nuclear Regulatory Commission (NRC) has requested that all nuclear plants either operating or under construction submit a response of compliancy with NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." EG&G Idaho, Inc. has contracted with the NRC to evaluate the responses of those plants presently under construction. This report contains EG&G's evaluation and recommendations for Palo Verde Nuclear Generating Station 1, 2, and 3 (PVNGS).

EXECUTIVE SUMMARY

PVNGS does not totally comply with the guidelines of NUREG-0612. In general, compliance is insufficient in the following areas:

- o Satisfactory action on Guidelines 1, 2, and 6 has been promised but not completed.
- o Arizona Public Service Company has not satisfactorily responded to Guidelines 3, 4, and 5.

The main report contains recommendations which will aid in bringing the above items into compliance with the appropriate guidelines.

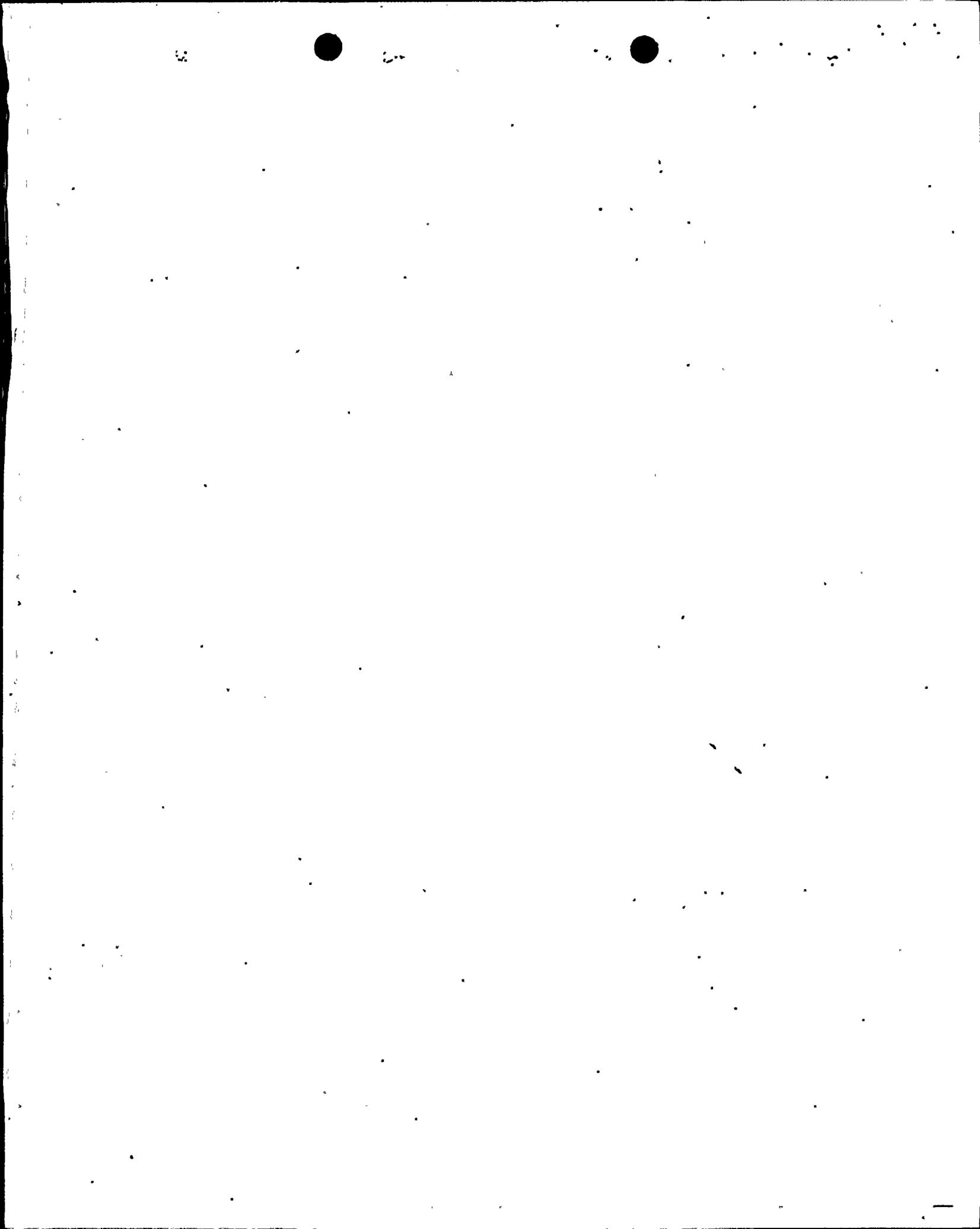


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TECHNICAL EVALUATION REPORT
FOR
PALO VERDE NUCLEAR GENERATING STATION (PVNGS)

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 PVNGS. 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.

1.2 Generic Background

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

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

In order to upgrade measures for the control of heavy loads, the staff developed a series of guidelines designed to achieve a two-phase objective using an accepted approach or protection philosophy. The

first portion of the objective, achieved through a set of general guidelines identified in NUREG-0612, 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 (1) features are provided, in addition to those required for all load handling systems, to ensure that the potential for a load drop is extremely small (e.g., a single-failure-proof crane) or (2) conservative evaluations of load handling accidents indicate that the potential consequences of any load drop are acceptably small. Acceptability of accident consequences is quantified in NUREG-0612 into four accident analysis evaluation criteria.

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

- o Provide sufficient operator training, handling system design, load handling instructions, and equipment inspection to assure reliable operation of the handling system
- o Define safe load travel paths through procedures and operator training so that, to the extent practical, heavy loads are not carried over or near irradiated fuel or safe shutdown equipment
- o Provide 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 Arizona Public Service Company (APS), the licensee for PVNGS requesting that the licensee review provisions for handling and control of heavy loads at PVNGS, evaluate these provisions with respect to the guidelines of NUREG-0612, and provide certain additional information to be used for an independent determination of conformance to these guidelines. On June 25, 1981, APS provided the initial response [4] to this request.

2. EVALUATION AND RECOMMENDATIONS

2.1 Overview

The following sections summarize Arizona Public Service's (APS) review of heavy load handling at Palo Verde Nuclear Generating Station (PVNGS) accompanied by EG&G's evaluation, conclusions, and recommendations to the licensee for bringing the facilities more completely into compliance with the intent of NUREG-0612. APS's review of the facilities does not differentiate among the three units so it is assumed that the three units are of identical design. The licensee has indicated the weight of a heavy load for this facility (as defined in NUREG-0612, Article 1.2) as 2240 pounds.

2.2 Heavy Load Overhead Handling Systems

This section reviews the licensee'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 Licensee Statements

The licensee's review of overhead handling systems identified the cranes and hoists shown in Exhibit A-1 of the

submittal as those which handle heavy loads in the vicinity of irradiated fuels or safe shutdown equipment.

Equipment excluded has been listed and the exclusion specifically justified. In most cases the exclusion is justified because they are contained in their own reinforced concrete structure.

B. EG&G Evaluation

From a study of the drawings provided, EG&G concludes that APS has done a thorough assessment of the load handling systems at PVNGS.

C. EG&G Conclusions and Recommendations

Based upon the information presented, EG&G concludes that the licensee 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 Licensee Statements

The text and Exhibit A-2 of the submittal identify those devices requiring safe load path designation. Safe load paths, however, have been designated only for the cask handling crane in the Fuel Building. Other equipment will be assigned safe load paths at a later date. These projected safe load paths will be in compliance with NUREG-0612.

B. EG&G Evaluation

APS has stated that load paths will be developed per Section 5.1.1⁽¹⁾, NUREG-0612 before fuel load, November 1982, and they will be incorporated into the PVNGS Equipment Maintainability Data Manual and shown on equipment location drawings as safe load paths. Marking safe load paths in the plant has not been addressed. Neither has deviation from defined load paths been addressed.

C. EG&G Conclusions and Recommendations

EG&G concludes that PVNGS does not comply with Guideline 1.

PVNGS may comply with Guideline 1 by taking the following action, before fuel loading:

- (1) Designate the required safe load paths and define them in approved procedures.
- (2) Mark the safe load paths in the handling areas by marking on the floor or by some other acceptable process.
- (3) Address load paths where limited by monorail systems and jib cranes.
- (4) Describe the method of control of deviations from approved safe load paths.

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 Licensee Statements

PVNGS Evaluation: A tabulation of heavy loads to be handled by each crane listed has been tabulated in Table B-1 of the submittal. The table lists the cranes by load identification, load weight, its designated lifting device, if applicable. No procedures have been written at this time, but procedures will be written and approved prior to the handling of these loads per the guidelines of NUREG-0612, Section 5.1.1(2).

B. EG&G Evaluation

APS has stated that the required procedures will be written prior to the handling of these loads. No further evaluation is possible.

C. EG&G Conclusions and Recommendations

EG&G concludes that PVNGS does not comply with Guideline 2.

PVNGS may comply with Guideline 2 by taking the following actions, before fuel loading:

Develop.

(1) ~~provide~~ the required procedures

(2) ~~Complete the above procedures~~ and have them available for possible NRC audit.

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' [6]."

A. Summary of Licensee Statements

APS has stated that exceptions taken to ANSI B 30.2-1976 with respect to operator training, qualifications, and conduct will be reported to the NRC prior to fuel load (November 1982).

B. EG&G Evaluation

This statement permits exception to all of Chapter 2-3 of ANSI B 30.2-1976. Guideline 3 requires general compliance with Chapter 2-3 of ANSI B 30.2-1976.

C. EG&G Conclusions and Recommendations

EG&G concludes that PVNG is not in compliance with Guideline 3. APS should commit to compliance with Chapter 2-3 of ANSI B 30.2 and supply justification for any exceptions taken.

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 Weighing 10,000 Pounds (4500 kg) or More for Nuclear Materials' [7]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the

standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) or the load and of the intervening components of the special handling device."

A. Summary of Licensee Statements

APS listed five lifting devices, the descriptions of which sound like special lifting devices, and stated the specifications to which they were built.

B. EG&G Evaluation

APS did not address compliance with ANSI N 14.6-1978 or compare their specifications with that standard and Guideline 4 of NUREG-0612.

C. EG&G Conclusions and Recommendations

APS is not in compliance with Guideline 4 at PVNGS.

In order to comply APS should analyze the special lifting devices and submit a response making a point by point comparison of the specifications for these items with the requirements of ANSI N 14.6-1978 and Guideline 4.

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' [8]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in

terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

A. Summary of Licensee Statements

APS indicated that two of the five lifting devices mentioned in 2.3.4 A are compatible with ANSI B 30.9-1971.

B. EG&G Evaluation

The devices' mentioned in 2.3.5 A do not seem to fall under ANSI B 30.9-1971, although no drawings or descriptions are provided. In view of the lack of information, an evaluation is not possible. APS has not really addressed Lifting Devices (Not Specially Designed).

C. EG&G Conclusions and Recommendations

APS should analyze their operations ^{AND RESPOND TO} ~~the~~ requirements 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 Licensee Statements

"PVNGS Evaluation: At the present time, APS has not established procedures for crane inspection, testing and maintenance. Prior to fuel load, November, 1982, APS will have written procedures for the overhead heavy load handling systems listed in Section 2.1.3, of this report. The procedures will follow the requirements of ANSI B 30.2-1976, Chapter 2-2 as discussed in NUREG-0612, Section 5.1.1.(6). Where any exception is taken to the standard, sufficient information will be provided to demonstrate the equivalency of proposed alternatives."

B. EG&G Evaluation

Future actions can be evaluated only on a conditional basis. When implemented, the actions described will probably meet the requirement of Guideline 6.

C. EG&G Conclusions and Recommendations

In order to comply with Guideline 6, APS should:

- (1) SUBMIT THE EXCEPTION, TAKEN TO CHAPTER 2-2 OF ANSI B30.2 FOR REVIEW AND EVALUATION
- (2) Retain the procedures at the site for possible NRC audit.

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' [9]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

A. Summary of Licensee Statements

"PVNGS Evaluation: Cranes and overhead heavy load handling systems listed in Exhibit A-2 comply with the guidelines of CMAA specification 70 and ANSI B30.2-1976, Chapter 2-1 and the verification of their design is shown in Exhibit F-4."

B. EG&G Evaluation

Copies of crane purchase specifications (included in Exhibit F-4) show that CMAA 70 and ANSI B 30.2 were required standards.

C. EG&G Conclusion and Recommendation

PVNGS is in compliance with Guideline 7.

3. CONCLUDING SUMMARY

3.1 Applicable Load Handling Systems

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

3.2 Guideline Recommendations

Compliance with the seven NRC guidelines for heavy load handling (Section 2.3) are partially satisfied at PVNGS. This conclusion is represented in tabular form as Table 3.1. Specific recommendations to aid in compliance with the intent of these guidelines are provided as follows:

<u>Guideline</u>	<u>Recommendation</u>
1. Section 2.3.1	a. Designate safe load paths and define them in approved procedures.
	b. Mark the safe load paths in the handling areas by marking the floor or by some other acceptable means.
	c. Address load paths where limited by monorail systems and jib cranes.

Guideline

2. Section 2.3.2

3. Section 2.3.3

Recommendation

d. Describe the method of control of deviations from approved safe load paths.

e. Complete the above before fuel loading.

DEVELOPE

a. ~~Finish~~ the required procedures, before fuel loading.

b. ~~Complete the above procedures~~ and have them available for possible NRC audit.

a. Commit to compliance with Chapter 2-3 of ANSI B 30.2 and supply justification for any exceptions taken, before fuel loading.

Guideline

Recommendation

4. Section 2.3.4

- a. Analyze the special lifting devices and submit a response, making a point-by-point comparison of the specification for these items with the requirements of ANSI N 14.6 and Guideline 4.

5. Section 2.3.5

- a. APS should analyze their operation in the light of the requirements of Guideline 5 and respond appropriately.

6. Section 2.3.6

- a. ~~Take the action described in~~ ~~2.3.6~~ ~~by~~ ~~submitting~~ ~~for~~ ~~review~~ ~~and~~ ~~evaluation~~ ~~of~~ ~~the~~ ~~exceptions~~ ~~to~~ ~~the~~ ~~specification~~ ~~in~~ ~~ANSI~~ ~~B30.2~~ ~~FOR~~ ~~REVIEW~~ ~~AND~~ ~~EVALUATION~~ ~~of~~ ~~the~~ ~~exceptions~~ ~~to~~ ~~the~~ ~~specification~~ ~~in~~ ~~ANSI~~ ~~B30.2~~ ~~FOR~~ ~~REVIEW~~ ~~AND~~ ~~EVALUATION~~

- b. Retain the procedures at the site for possible NRC audit.

7. Section 2.3.7

- a. Complies with Guideline 7.

3.3 Interim Protection

EG&G's evaluation of information provided by the licensee indicates that the following actions are necessary to ensure that the six NRC staff measures for interim protection at PVNGS are met:

<u>Interim Measure</u>	<u>Recommendation</u>
Interim measures were not addressed	EG&G recommends that APS commit to bringing PVNGS into compliance with the NUREG-0612 Guidelines before fueling. If this is not accomplished, it will be necessary to address interim measures.

4. REFERENCES

1. NUREG-0612
Control of Heavy Loads at Nuclear Power Plants
NRC
2. V. Stello, Jr. (NRC)
Letter to all licensees. Subject: Request for Additional Information
on Control of Heavy Loads Near Spent Fuel
NRC, 17 May 1978
3. USNRC
Letter to Arizona Public Service Co. Subject: Control of Heavy Loads
NRC, 22 December 1980
4. Arizona Public Service Company
Letter to Director of Nuclear Reactor Regulation.
Subject: Palo Verde Nuclear Generating Station, Units 1, 2, and 3
Dated June 25, 1981.
5. Arizona Public Service Company
Letter to Director of Nuclear Reactor Regulation (PVNGS)
Units 1, 2, and 3. (Amendments to 4. above) Dated August 18, 1981.
6. ANSI B30.2-1976
"Overhead and Gantry Cranes"
7. ANSI N14.6-1978
"Standard for Lifting Devices for Shipping Containers Weighing
10,000 Pounds (4500 kg) or more for Nuclear Materials"
8. ANSI B30.9-1971
"Slings"
9. CMAA-70
"Specifications for Electric Overhead Traveling Cranes"

TABLE 3.1. PALO VERDE NUCLEAR GENERATING STATION, UNITS 1, 2, and 3
NUREG-0612 COMPLIANCE MATRIX

Equipment Designation	Heavy Loads	Height 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
Containment building bridge crane	33 items listed, no weights specified	225/35	R	R	HC	HC	HC	R	C
Containment building RCP maintenance jib cranes	Reactor coolant pump motor no weight given	5	R	R	HC	HC	HC	R	C
Fuel building cask handling crane	Spent fuel casks	150/15	C	R	HC	HC	HC	R	C
Fuel building new fuel handling crane	No listing	10	R	R	HC	HC	HC	R	C
Fuel building spent fuel pool cooling pumps and heat exchanger	Spent fuel pool cooling pumps and heat exchangers	5	R	R	HC	HC	HC	R	C

C = Licensee action complies with NUREG-0612 Guideline.
 HC = Licensee action does not comply with NUREG-0612 Guideline.
 R = Licensee has proposed revisions/modifications designed to comply with NUREG-0612 Guideline.
 I = Insufficient information provided by the Licensee.

