# CONTROL OF HEAVY LOADS AT NUCLEAR POWER PLANTS
Susquehanna Steam Electric Station
Unit 2
(Phase I)
Docket No. [50/388]

Author
S. L. Friederichs

Principal Technical Investigator
T. H. Stickley

Published
September 1983

EG&G Idaho, Inc.
Idaho Falls, Idaho 83415

Prepared for the
U.S. Nuclear Regulatory Commission
Under DOE Contract No. DE-AC07-76ID0 1570

FIN No. A6457

## 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 Susquehanna Steam Electric Station, Unit 2.

## EXECUTIVE SUMMARY

Based on the information provided Susquehanna Steam Electric Station Unit 2 is in compliance with the intent of the requirements of NUREG 0612.

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# Control of Heavy Loads at Nuclear Power Plants
# Susquehanna Steam Electric Station
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## 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 Susquehanna Steam Electric Station, Unit 2. 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 applicant 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 Pennsylvania Power & Light Company, the applicant for Susquehanna Steam Electric Station, Unit 2 requesting that the applicant review provisions for handling and control of heavy loads at SSES No. 2, 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 22, 1983, Pennsylvania Power & Light Company provided the initial response [4] to this request.

## 2. EVALUATION AND RECOMMENDATIONS

### 2.1 Overview

The following sections summarize Pennsylvania Power & Light Company's review of heavy load handling at Susquehanna Steam Electric Station, Unit 2 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. Pennsylvania Power & Light Company's review of the facilities does not differentiate between the two units so it is assumed that both units are of identical design. The applicant has indicated the weight of a heavy load for this facility (as defined in NUREG-0612, Article 1.2) as 1000 pounds.

### 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's Statements

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

The applicant has also identified numerous other cranes that have been excluded from satisfying the criteria of the general guidelines of NUREG-0612. These are indicated in Table 2.2. These various overhead handling systems were reviewed by the applicant with regard to criterion NUREG 0612 and were excluded based on plant specific conditions of plant shutdown or because the loads were not greater than 1000 lbs. The applicant also stated that a heavy load was considered to be any load in excess of 1000 lbs. This was the most realistic weight limit to evaluate because many cranes monorails and hoists were rated in units of 1/4, 1/2 or 1 ton units. In addition the weight of some loads was estimated and a convenient unit (1/2 ton) was conservatively used for relatively small loads. The applicants introductory remarks in the submittal indicate that the main objective in responding to NUREG 0612 is to insure that all handling of overhead loads at SSES No. 2 is accomplished in a safe and efficient manner by providing operators with proper training, operating procedures and the equipment safeguards necessary, and by insuring that as many overhead operations as possible are performed along defined safe load paths. When loads are to be handled in the vicinity of new or spent fuel or nuclear safety related equipment, the ultimate objectives are to insure

1. radioactive release, as a result of a potential load drop is less than the requirements of 10 CFR Part 100.

2. damage to fuel will not result in $K_{eff}$ of greater than .95.

3. damage to the reactor pressure vessel will not result in uncovered fuel

4. damage to equipment will not result in loss of safe shutdown capability to remove decay heat.

PP&L review of the overhead load handling systems consisted of a physical walk down of all cranes, monorails, and hoists in the reactor building, visual inspections to verify that loads with large physical dimensions could be safely moved within defined load paths without impacting safe shutdown equipment in the event of a load drop, and by reviews of the affected drawings with cross checks of the SSES equipment index. Consideration was also devoted to the lateral movement of loads due to deflections caused by the possibility of loads striking structural members. Where cranes or monorails travel over hatches or access ways, the lower areas were visually inspected for the potential impact of a load drop.

Table 3 of the submittal, [4] lists the "cranes requiring Detailed Review", the heavy loads associated with each handling system from which a load drop could potentially impact safety-related equipment or fuel. The table includes crane identification, crane location, (building and elevation), load identification and weight, safety related equipment that could be impacted, and hazard elimination category.

TABLE 2.1 NON EXEMPT HEAVY LOAD-HANDLING SYSTEM SUSQUEHANNA STEAM ELECTRIC STATION UNIT 2

| Crane ID | Crane Type | Heavy Loads Handled | Load Weight |
|---|---|---|---|
| 2H 201<br>2H 203<br>2H 214 | Refueling bridge<br>(Reactor Building Elevation 818') | Fuel | 1000 lbs |
| 2H 205 | Recirculation pump<br>Hoist (24 tons capacity)<br>(Reactor Building Elevation 719') | Recirculation pump<br>Recirculation pump stator<br>Recirculation pump rotor | 27,200 lbs<br>21,860 lbs<br>10,315 lbs |
| 2H 206A<br>2H 206B | Equipment access<br>Door with personnel lock<br>Hoist (16 tons each capacity)<br>(Reactor Building Elevation 719') | Access door | 64,000 lbs |
| 2H 208A<br>2B 208B | RHR Heat Exchangers<br>Hoists (12 tons each)<br>(Reactor Building Elevation 683') | RHR Heat Exchanger | 48,000 lbs |
| 2H 209 | HPCI, RCIC and RHR pump and Turbine Hoist<br>(12 ton capacity)<br>(Reactor Building Elevation 683') | Core Spray Pump Motor<br>Core Spray Pump Rotor<br>Core Spray Pump Stator<br>Core Spray Pumps<br>High Pressure Coolant Injection Pump<br>HPCI Booster Pump<br>HPCI Gear Reducer<br>HPCI Stop Valve<br>HPCI Turbine Upper Head Case<br>HPCI Turbine Rotor<br>Reactor Core Isolation Cooling Pumps<br>Reactor Core Isolation Cooling Turbine<br>Residual Heat Removal Pump<br>RHR Pump Motor<br>RHR Pump Rotor<br>RHR Pump Stator | 6,330 lbs<br>1,379 lbs<br>2,700 lbs<br>7,115 lbs<br>6,200 lbs<br>3,900 lbs<br>1,260 lbs<br>2,900 lbs<br>7,500 lbs<br>1,400 lbs<br>5,275 lbs<br>3,490 lbs<br>20,650 lbs<br>18,020 lbs<br>4,690 lbs<br>6,960 lbs |
| 2H 210 | Core Spray Pumps and RBCCW Heat Exchanger Hoist<br>(12 ton capacity)<br>(Reactor Building Elevation 683') | RBCCW Heat Exchanger<br>Core Spray Pump<br>Core Spray Pump Motor<br>Core Spray Pump Rotor<br>Core spray pump Stator | 24,715 lbs<br>7,115 lbs<br>6,330 lbs<br>1,379 lbs<br>2,700 lbs |

TABLE 2.1 (continued)

| Crane ID | Crane Type | Heavy Loads Handled | Load Weight |
|---|---|---|---|
| 2H 213 | Reactor Building Crane | | |
| | Auxiliary Hoist (5 ton capacity)<br>(Reactor Building Elevation 818') | Head Holding Pedestal | 1,450 lbs |
| | | Dryer/Separator Sling | 3,500 lbs |
| | | Stud Tensioner | 1,500 lbs |
| | | Vessel Head Strongback | 6,500 lbs |
| | | Jib Crane | 5,200 lbs |
| | | Hatch Covers | 6,000 lbs |
| | | Support Beams | 3,000 lbs |
| | Main Hoist (125 tons)<br>(Reactor Building Elevation 818') | Reactor Cavity Shield Blocks | 71.5-98.5 tons |
| | | Dry Well Head | 104.5 tons |
| | | Reactor Head Insulation | 18.2 tons |
| | | Reactor Head | 91.8 tons |
| | | Steam Dryer | 40.0 tons |
| | | Steam Separator | 73.3 tons |
| | | Fuel Pool Plugs | 12.0 tons |
| | | Water Tight Gates | 3.0-4.5 tons |
| | | Equipment Pool Plugs | 63.0 tons |
| | | Reactor Head Carousel | 5.0 tons |
| | | Service Platform | 6.5 tons |
| 2H 215 | Equipment Shaft Crane<br>(24 tons capacity)<br>(Reactor Building Elevation 799') | Miscellaneous | 48,000 lbs |
| 2H 216 | Truck Bay Jib Crane<br>(2 tons capacity)<br>(Reactor Building Elevation 670') | Miscellaneous | 4,000 lbs |
| 2H 218<br>2H 219 | Reactor Building<br>Concrete Shielding<br>Block Hoists<br>(Capacity not indicated)<br>(Reactor Building Elevation 719) | Concrete Shield<br>Block | 20,000 lbs |
| 1H XXX | Floor Plug Hoist<br>(Capacity Not indicated)<br>Reactor Building Elevation 818') | Resin Bed Shield Covers | 30,500 lbs |
| | | Equipment Access Plugs | 27,200 lbs |

TABLE 2.2 EXEMPT HEAVY LOAD-HANDLING SYSTEMS SUSQUEHANNA STEAM ELECTRIC STATION UNIT 2

| Crane ID | Location (1) Building | Location (1) Elevation | Hazardous Target (2) | H-E Category (3) |
|---|---|---|---|---|
| 2H 204 | Reactor Building | 719' | None | B |
| H 207A, B | Drywell | 719' | Recirc. pump | A |
| 2H 211 | Reactor Building | 818' | Fuel | B |
| 2H 212 | Reactor Building | 818' | Fuel | B |
| 2H 217 | Suppression Pool | 683' | Various | A |
| 2H 239-242 | Reactor Building | 739' | Main Steam Isolation Valves | A |
| 2H 243 | Reactor Building | 719' | None | B |
| 2H 402A, B | Drywell | 752' | Feedwater Isolation Valves | A |
| 2H 403, 4 | Drywell | 738' | Main Steam Relief Valves | A |
| 2H 406-422 | Drywell | 738' | Main Steam Relief Valves | A |

Notes:

1. Only cranes in Unit 2 reactor building are considered for this report. Buildings common to both units were covered in the Unit 1 reports. These are Radwaste, Diesel Generator, ESSW pumphouse, and Circulating Water Pumphouse).

2. Hazardous targets are items if impacted by a load drop, could contribute to one of the adverse consequences as listed in Section 5.1 of NUREG 0612.

3. Hazardous Elimination Categories

   A. These load handling Systems are only used doing a shutdown.

   B. The capacity of this load handling system is 1000 lbs or less.

B. EG&G Evaluation

PP&L's evaluation is similar to the submittal for Unit 1, PP&L has provided the results of their review and identify any potentially hazardous load handling operations which will require special procedures or equipment modifications to insure the intent of NUREG 0612 is met. The review appears to be adequate.

C. EG&G Conclusions and Recommendations

Since there is no information to the contrary, 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:

- Guideline 1--Safe Load Paths
- Guideline 2--Load-Handling Procedures
- Guideline 3--Crane Operator Training

- o Guideline 4--Special Lifting Devices
- o Guideline 5--Lifting Devices (not specially designed)
- o Guideline 6--Cranes (Inspection, Testing, and Maintenance)
- o Guideline 7--Crane Design.

These seven guidelines should be satisfied for all overhead handling systems and programs in order to handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent-fuel pool, or in other areas where a load drop may damage safe shutdown systems. The 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's Statements

The applicant states "Plant Staff engineers have reviewed the load handling systems for the purpose of identifying safe load paths relative to safety equipment and spent fuel. Figures 1 thru 10 were marked to indicate the safety related equipment, spent fuel and paths chosen. These paths were defined for handling systems, that fall under the area of concern with respect to NUREG 0612, and were of the

bridge crane type. Monorails were excluded from this analysis, since load movement is dedicated by the monorails itself. Safe load paths will be clearly marked on the refueling deck prior to initial fuel loading."

B. EG&G Evaluation

EG&G has reviewed the applicant's response regarding safe load paths and the drawings provided, and considers the intent of guideline 1 of NUREG 0612 to have been satisfied.

PP&L has indicated the manner in which implementation of a temporary change to existing defined safe load paths is to be made and the method of obtaining approvals for this deviation.

C. EG&G Conclusions and Recommendations

Based on the information provided EG&G concludes that SSES No. 2 is in compliance with the intent of guideline 1 of NUREG 0612.

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's Statements

The applicant states "PP&L has prepared general operating procedures for overhead handling systems. These procedures include precautions and guidelines to be observed while operating the systems. In addition to crane operating procedures, PP&L has developed special handling procedures for major heavy loads. Such procedures supplement the general crane operating procedure by providing additional precautions, and a safe load path for the unique load.

Generic safe load paths have been incorporated into the Reactor Building Crane operating procedures. Work instructions for specific lifts include the safe load paths for the particular loads.

The safe load paths are recorded in "quality" procedures which fall under the auspices of AD-QA-101 "Procedure Program". The provisions of this procedure allow the implementation of a temporary change which involves signatures of the plant shift supervisor and one other member of the plant management prior to implementation and review by the plant operational Review Committee within 14 days of the implementation of the change."

Specific procedures have been written for the following loads

1. Reactor wall shield plugs

2. Drywell head

3. Vessel head

4. Steam dryer

5. Steam separator

6. Pool gates

7. Dryer/Separator pit shield plugs

8. Slot plugs

9. Vessel service platform

10. Vessel heat insulation

The reactor building crane operating procedure MT-99-001 includes a generic safe load path and general instructions for miscellaneous loads not covered by specific instructions. Included in the general procedure will be the transport of the replacement fuel racks, the crane load block and plant equipment.

Written procedures for the handling of the Spent Fuel Shipping Cask, and the Waste and Debris Cask have not yet been prepared since the casks have not yet been purchased.

B. EG&G Evaluation

The applicant has prepared a list of the load handling procedures which have been written. In this list is also indicted these loads which are to be handled within the scope of the Reactor building crane operating procedures. Generic safe load paths have been incorporated into the Reactor Building Crane operating procedures.

The applicant has adequately addressed the requirements of this guideline.

C. EG&G Conclusions and Recommendations

Based on the information provided, EG&G concludes that SSES No. 2 meets the intent of guideline 2 of NUREG 0612.

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 Applicant's Statements

The applicant states "We make no exceptions to ANSI B30.2-1976. The crane operator's training program was developed to meet the requirements of Chapter 2.3 of ANSI B30.2-1976 "Overhead and Gantry Cranes". A procedures has been written by plant staff mechanical maintenance section to formalize the program and furnish the necessary forms to document the training. All crane operators are qualified to this procedure."

B. EG&G Evaluation

Based on the applicant's statement the crane operator training program meets the intent of guideline 3 of NUREG 0612.

C. EG&G Conclusions and Recommendations

Based on the information submitted, EG&G concludes that SSES No. 2 has met the intent of guideline 3 of NUREG 0612.

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 Applicant's Statements

SSES No. 2 will employ the same special lifting devices which are used at Unit 1. Sling selections for loads which do not have special lifting devices will be governed by the same procedures as previously reviewed for Unit 1.

The applicant stated in his submittal for Unit 1 "Slings and Special Lifting Devices have not been procured for use at SSES except the strong back used for the RPV head and the lifting device for the dryer and separator.

These items have been designed and supplied by the NSSS vendor. Sufficient information is not yet available for determining full compliance with ANSI B30.9-1971: however the strong back for the RPV has been proof load tested to 125 tons, inspected by magnetic particle examination and used to move the RPV head for Unit 1, and the dryer/separator lifting device meets the proof loading requirements of ANSI B30.9-1971 and has been inspected by

magnetic particle examination. All other slings and/or lifting devices which will handle heavy loads that could impact safety-related equipment or fuel will be installed and used in accordance with guidelines of ANSI B30.9-1971. In selecting the proper sling, the load used will be the sum of the static and the maximum dynamic load (SSE will not be included in the dynamic load imposed in the sling or lifting device). The rating identification on the sling will 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 will be marked as to the cranes with which they may be used. Special lifting devices to be used with spent-fuel shipping containers will be designed, installed, and used in accordance with the guidelines of ANSI N14.6-1978."

B. EG&G Evaluation

SSES No. 2 will use the same special Lifting devices as used for SSES No. 1.

C. EG&G Conclusions and Recommendations

SSES No. 2 will use the same lifting devices as used for SSES No. 1. Since SSES No. 1 is in compliance with the intent of the guideline 4 of NUREG 0612, this compliance also applies for SSES No. 2.

## 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 Applicant's Statements

The applicant states that "the sling selection for loads which do not have special lifting devices will be governed by the same procedures as previously reviewed for SSES No. 1.." It is stated in reference 5, Section 2.3.5A for SSES No. 1 "ALL other slings (not covered in 2.3.4) and/or lifting devices which will handle heavy loads that could impact safety-related equipment or fuel will be installed and used in accordance with the guidelines of ANSI B30.9-1971. In selecting the proper sling, the load used will be the sum of the static and the dynamic load imposed on this sling or lifting device. The rating identification on the sling will 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 will be marked as to the cranes with which they may be used."

### B. EG&G Evaluation

PP&L indicates in reference 5 Section 2.3.5 B that the slings for general purpose rigging will be sized for a minimum 15% dynamic load. The information as presented in the submittal for this report and by reference 5 is sufficient to consider that PP&L has met the intent of guideline 5 of NUREG 0612.

C. EG&G Conclusions and Recommendations

Based on the information presented that lifting devices (Not Specially Designed) for SSES No. 1 will be same devices to be used at SSES No. 2, and since SSES No. 1 is in compliance with the values of this guideline, SSES 2 is considered to be in compliance with the intent of guideline 5 of NUREG 0612.

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's Statements

The applicant states "PP&L has developed a preventative maintenance program to include all cranes and hoists. This program will include requirements for inspection, testing and maintenance in accordance with the guidelines of chapter 2-2 of ANSI B30.2-1976 with the exception that tests and inspections will 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. The diesel building cranes (OH 501A, B, C and D) and the

reactor building crane (2H213) have been used during plant construction. The construction group has performed the necessary inspecting, testing, and maintenance requirements of Chapter 2-2 ANSI B30.21967."

B. EG&G Evaluation

The projected preventive maintenance program is in accordance with ANSI B30.2 1976 except that tests and inspections will 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. In these instances the change in inspections frequencies is acceptable.

PP&L states that those cranes used for construction were inspected tested and maintained by the construction organization in accordance with ANSI B30.2-1967.

C. EG&G Conclusions and Recommendations

Based on information provided, EG&G concludes that SSES No. 2 is in compliance with the intent of Guideline 6 of NUREG 0612.

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 Applicant's Statements

The applicant states "Design requirements for those cranes from which a load drop could impact safety related equipment or fuel, are in accordance with the Crane Manufacturers Association of America (CMAA) Specification 70 and ANSI B30.2. The reactor building crane (2H 213) and the diesel building cranes (OH 501A, B, C and D) are designed in accordance with CMAA-70 class C and ANSI B30.2-1967. The monorail hoists are designed in accordance with ANSI B30.16 and the jib crane in accordance with ANSI B30.2-1976 and CMAA-70.

B. EG&G Evaluation

The applicant states that monorail hoists are designed in accordance with ANSI B30.16. Guideline 7 states that 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. EG&G considers ANSI B30.16 as an acceptable equivalent to ANSI B30.2.

C. EG&G Conclusions and Recommendations

Based on the information received, EG&G concludes that SSES No. 2 is in compliance with the intent of Guideline 7 of NUREG 0612.

## 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:

- o Heavy load technical specifications
- o 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. Plant is not operational.

B. EG&G Evaluation

Not applicable. Plant is not operational.

C. EG&G Conclusions and Recommendations

Not applicable. Plant is not operational.

### 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. Plant is not operational.

B. EG&G Evaluation

Not applicable. Plant is not operational.

C. EG&G Conclusion

Not applicable. Plant is not operational.

# 3. CONCLUDING SUMMARY

## 3.1 Applicable Load-Handling Systems

The list of cranes and hoists supplied by the applicant as being subject to the provisions of NUREG-0612 is apparently complete (see Section 2.2.1).

## 3.2 Guideline Recommendations

Compliance with the seven NRC guidelines for heavy load handling (Section 2.3) are satisfied at Susquehanna Steam and Electric Station, Unit 2. 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:

| Guideline | | Recommendation | |
|---|---|---|---|
| 1. | Section 2.3.1 | a. | Consistent with guideline 1. |
| 2. | Section 2.3.2 | a. | Consistent with guideline 2. |
| 3. | Section 2.3.3 | a. | Consistent with guideline 3. |
| 4. | Section 2.3.4 | a. | Consistent with guideline 4. |
| 5. | Section 2.3.5 | a. | Consistent with guideline 5. |
| 6. | Section 2.3.6 | a. | Consistent with guideline 6. |
| 7. | Section 2.3.7 | a. | Consistent with guideline 7. |

TABLE 3.1 SUSQUEHANNA STEAM ELECTRIC STATION UNIT 2 COMPLIANCE MATRIX

| Equipment Designation | 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. Refueling Bridge Crane (2H 201) (2H 203) (2H 204) | -- | Not Supplied | C | C | C | C | C | C | C |
| 2. Recirulation Pump Hoist (2H 205) | a. Recirulation pump 27,200 lbs<br>b. Recirculation pump stator--, 21,860 lbs<br>c. Recirculation pump rotor 10,315 lbs | 24 | C | C | C | C | C | C | C |
| 3. Equipment Access Door with Personnel Lock Hoist (2H 206A) | Access Door 64,000 lbs | 16 | C | C | C | C | C | C | C |
| (2H 206B) | | 16 | | | | | | | |
| 4. RHR Heat Exchanges Hoists (2H 208A) | RHR Heat Exchanger 48,000 lbs | 12 | C | C | C | C | C | C | C |
| (2H 208B) | | 12 | | | | | | | |
| 5. HPCI RCIC & RHR pump and turbine hoist (2H209) | a. Core spray pump Motor--6,330 lbs<br>b. Core spray pump Rotor--1,379 lbs<br>c. Core spray pump stator--2,700 lbs<br>d. Core spray pump 7,115 lbs | 12 | C | C | C | C | C | C | C |

TABLE 3.1 (continued)

| Equipment Designation | 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 |
|---|---|---|---|---|---|---|---|---|---|
| 5. (continued) | e. High pressure coolant injection pump--6,200 lbs | | | | | | | | |
| | f. HPCI Booste-pump 3,900 lbs | | | | | | | | |
| | g. HPCI gear reducer 1,260 lbs | | | | | | | | |
| | h. HPCI stop valve 2,900 lbs | | | | | | | | |
| | i. HPCI turbine upper head case 7,500 lbs | | | | | | | | |
| | j. HPCI turbine rotor--1,400 lbs | | | | | | | | |
| | k. Reactor core isolation cooling pump--5,275 lbs | | | | | | | | |
| | l. Reactor core isolation cooling turbine--3,490 lbs | | | | | | | | |
| | m. Residual heat removal pump 20,650 lbs | | | | | | | | |
| | n. RHR pump motor 18,020 lbs | | | | | | | | |
| | o. RHR pump rotor 4,690 lbs | | | | | | | | |

TABLE 3.1 (continued).

| Equipment Designation | 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 |
|---|---|---|---|---|---|---|---|---|---|
| 5. (continued) | p. RHR pump stator 6,970 lbs | | | | | | | | |
| 6. Core spray pumps and RBCCW heat exchanges Hoist (2H 210) | a. RBCCW heat exchanger 24,715 lbs | 12 | C | C | C | C | C | C | C |
| | b. Core spray pump 7,115 lbs | | | | | | | | |
| | c. Core spray pump motor--6,330 lbs | | | | | | | | |
| | d. Core spray pump rotor--1,379 lbs | | | | | | | | |
| | e. Core spray pump stator--2,700 lbs | | | | | | | | |
| 7. Reactor Building Crane (2H 213) | | | C | C | C | C | C | C | |
| Auxiliary Hoist | a. Head holding pedestal 1,450 lbs | 5 | | | | | | | |
| | b. Dryer/Separator Sling--3,500 lbs | | | | | | | | |
| | c. Stud Tensioner 1,500 lbs | | | | | | | | |
| | d. Vessel head strong back 6,500 lbs | | | | | | | | |
| | e. Jib crane 5,200 lbs | | | | | | | | |
| | f. Hatch Covers 6,000 lbs | | | | | | | | |

TABLE 3.1 (continued).

| Equipment Designation | 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 |
|---|---|---|---|---|---|---|---|---|---|
| 7. (continued) | g. Support beams 3,000 lbs | | | | | | | | |
| main hoist | | 125 tons | | | | | | | |
| | a. Reactor cavity shield blocks | 71.5-98.5 tons | | | | | | | |
| | b. Drywell head | 104.5 tons | | | | | | | |
| | c. Reactor head isolation | 18.2 tons | | | | | | | |
| | d. Reactor head | 91.8 tons | | | | | | | |
| | e. Steam Dryer | 40.0 tons | | | | | | | |
| | f. Steam separator | 73.3 tons | | | | | | | |
| | g. Fuel pool plugs | 12.0 tons | | | | | | | |
| | h. Water tight gates | 3.0-4.5 tons | | | | | | | |
| | i. Equipment pool plugs | 63.0 tons | | | | | | | |
| | j. Reactor head carousel | 15.0 tons | | | | | | | |
| | k. Service platform | 6.5 tons | | | | | | | |
| 8. Equipment Shaft Crane (2H 215) | Miscellaneous 4,800 lbs | 24 tons | C | C | C | C | C | C | C |
| 9. Truck Bay Jib Crane (2H 216 | Miscellaneous 4,000 lbs | 2 | C | C | C | C | C | C | C |

TABLE 3.1 (continued)

| 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 |
|---|---|---|---|---|---|---|---|---|---|
| 10. Reactor Building Concrete Shielding Block Hoists (2H 218) (2H 219) | Concrete Shield Blocks 20,000 lbs | Not Supplied | C | C | C | C | C | C | C |
| 11. Floor plug Hoist (1H XXX) | a. Resin Bed Shield Covers 30,500 lbs<br>b. Equipment Access plugs 27,200 lbs | Not Supplied | C | C | C | C | C | C | C |

## 3.3 Interim Protection

EG&G's evaluation of information provided by the applicant indicates that the following actions are necessary to ensure that the six NRC staff measures for interim protection at Susquehanna Steam Electric Station, Unit 2 are met:

| Interim Measure | Recommendation |
|---|---|
| Interim measures were not addressed. | Not applicable |

## 3.4 Summary

Not applicable.

## 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 Pennsylvania Power & Light Company. Subject: NRC Request for Additional Information on Control of Heavy Loads Near Spent Fuel, NRC, 22 December 1980.

4. N. W. Curtis (PP&L Co.) Letter to A. Schwencer (NRC) Subject: Susquehanna Steam Electric Station NUREG 0612--Unit 2 six-month response July 22, 1983 PLA-1752.

5. Control of Heavy Loads of Nuclear Power Plants Susquehanna Steam Electric Station, Unit 1, Phase I Docket No. 50/387 by T. H. Stickley dated April 1983.

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".