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SUBJECT: Forwards responses to draft technical evaluation rept re util submittals in response to NUREG-0612, "Control of Heavy Loads." Changes to insp of lifting devices, use of qualified operators & replacement of defective devices implemented.

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Carolina Power & Light Company

DEC 15 1982

Office of Nuclear Reactor Regulation
ATTN: Mr. Steven A. Varga, Chief
Operating Reacotrs Branch No. 1
United States Nuclear Regulatory Commission
Washington, D.C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
CONTROL OF HEAVY LOADS - NUREG-0612

Dear Mr. Varga:

In a letter dated May 10, 1982, you forwarded a copy of a draft Technical Evaluation Report (TER) regarding our submittals in response to "Control of Heavy Loads - NUREG-0612" for H. B. Robinson Unit 2 (HBR).

Members of the plant and general office staffs discussed this TER with representatives from the NRC and Franklin Research Center (FRC) via conference call on July 1, 1982.

The recommendations provided in the TER, along with our response to each recommendation are listed in the attached summary. Our response incorporates the clarifications provided by your staff during the conference call.

If you have any further questions regarding this matter, please contact a member of my staff.

Yours very truly,

S R Zimmerman /pjs

S. R. Zimmerman
Manager
Licensing & Permits

A033
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T. E. R. NUREG 0612 "CONTROL OF HEAVY LOADS"

SUMMARY

T.E.R. NUREG-0612 "CONTROL OF HEAVY LOADS"

Recommended Response to Franklin Research Recommendations

FRC Recommendation 2.1.1.c

"In order to fully comply with NUREG-0612, the Licensee should provide additional information to support the exclusion of the spent fuel pool filter monorail and hoist from the general guidelines of NUREG-0612."

CP&L Response

The spent fuel pool filter monorail is approximately 6' in length and is located directly over the filter it services. The monorail is equipped with a two (2) ton manually operated hoist for handling the spent fuel pool filter which is not a heavy load. Due to the length of monorail and the building configuration, there is no other equipment it could handle nor is there any safety-related equipment adjacent to it that could be damaged in the unlikely event of a load drop. In addition, the spent fuel pit filter can be isolated from the spent fuel pool cooling system by valving and is not required to maintain spent fuel pool cooling. Therefore, since there is no heavy load handled, no safety-related equipment that could be damaged, and it is not required to maintain spent fuel pool cooling, it has been excluded from the overhead handling systems listed in Section 2.1.1 of our Part I response.

FRC Recommendations 2.1.2.c.1 and 2.1.2.c.2

"Clearly mark safe load paths in areas where loads are handled," and "Verify that deviations from established load paths require written alternatives that are approved by the plant safety review committee."

CP&L Response

Safe load paths have been identified as indicated in our Part I response to Section 2.1(3)a. Load path drawings are referenced and attached to appropriate plant operating procedures. Procedures applicable to specific heavy loads were identified in the tabulation of heavy loads in Table 3-1 of our Part I response. Recommended load paths follow the safest and shortest routes with consideration given to going around fuel and safety related equipment, if possible.

As discussed in our Part I report (2.1(3)b) safe load paths are also identified in plant procedure MP-1-5 "Operation Testing and Inspection of Cranes and Material Handling Equipment" and attached to it for crane operator and signalman reference and use. Copies of the load path drawings will be available on the operating floor/area for reference and use by the signalman. In addition, a reference copy of the load path drawings will be located in the polar crane operator's cab. During crane operator training and qualification, operators are instructed regarding the above procedure including the proper and safe handling of heavy loads and identification of safe load paths. The signalman will "walk down" the load path prior to each lift or in cases where walking the load path is not possible, review the load path with the crane operator prior to giving the crane operator signals for lifting and moving the load. A telephone communication system betwen the Polar Crane operator and signalman will be available to provide a voice communication link which will assist with the review of load path, and provide more finite control of load movement. The telephone system will be installed during the next refueling outage.

During our most recent outage, difficulty was experienced in adhering to the load paths in the containment, resulting in numerous load path revisions to facilitate movement of the loads. CP&L has re-evaluated the containment load paths due to the severe space limitations and multitude of variations and combinations required in movement of components during maintenance and refueling outages. Revised safe load path/handling areas have been developed to accomodate the above factors. The revised drawings are attached to this response.

Due to the severe space limitations and multitude of load variations and combinations, it is absolutely necessary to handle heavy loads over spent fuel or safety related equipment. This is done only when there is no other alternative available.

The maintenance supervisor will be delegated the authority to approve alternate load paths and laydown areas in the containment from the load paths and load handling areas identified on the containment load path drawings. In his absence, the maintenance supervisor's designated alternate will have the authority to approve alternate load paths and laydown areas in the containment. If heavy loads not identified on the current containment load path drawings must be carried over the open reactor vessel when (1) the missile shield has been removed and (2) when the vessel contains fuel, prior PNSC review must be obtained. Approval of heavy load movement over the open reactor vessel is contingent upon meeting the following minimum conditions:

(a) utilize lifting equipment (lifting apparatus and crane) with a rated capacity at least twice the load to be handled.

(b) utilize a four (4) point or redundant lifting arrangement to preclude a load drop in the event of a single lift point failure.

FRC Recommendation 2.1.5.c

"The Licensee should provide information relative to Sections 3, 4 and 5 of ANSI N14.6-1978 so that a proper review can be performed to ensure that Robinson Unit 2 special lifting devices fully comply with the criteria of Section 5.1.4. of NUREG-0612."

CP&L Response

NUREG-0612, Section 5.1.1(4) states:

"Special lifting devices should satisfy the guidelines of ANSI N14.6-1978." Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4,500 kg) or more for Nuclear Materials. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the interevening components of the special handling device."

Table 3-1 of our Part I report identifies the following Special Lifting Devices:

1. Reactor Vessel Head Lifting Rig

2. Internals Lifting Rig
3. Reactor Coolant Pump Motor Lift Sling
4. Spend Fuel Cask Redundant Lifting Yoke
5. Fuel Storage Rack Lifting Frame and Slings
6. In-service Inspection - Removable Lifting Tool handling Tool
7. Turbine Lifting Beam.

The above special lifting devices were designed, constructed and delivered prior to the existence of ANSI N14.6-1978. Information relative to meeting the design and construction requirements of N14.6 is not available from the special lifting device supplier in some cases.

CP&L considers the existing special lifting devices to be of adequate design. The performance record during the past 11 years provides substantial verification of their design adequacy. However, resultant to our reevaluation of safe load paths and the unavoidable necessity to handle loads over the reactor and safe shutdown equipment in the containment, implementation of the inspection testing and maintenance requirements discussed herein will provide satisfactory assurance that design integrity does not deteriorate and that the probability for a load drop continues to remain at acceptable limits.

Where special lifting devices which carry heavy loads over safe shutdown equipment or spent fuel do not meet the rquirements of ANSI N14.6-1978 or where available information is inconclusive regarding design and construction, CP&L will implement augmented inspection, testing and maintenance requirements as discussed herein and/or emphasize increased safety factors and improved rigging configurations where practical. Plant operating and maintenance procedures which address the inspection testing and maintenance of special lifting equipment will be implemented within six (6) months from the date of this response. The procedures will address specific items discussed herein and other standard items which may be appropriate to assure lifting device integrity is maintained.

Special lifting equipment except the R.V. Head Lifting Rig will be NDE examined every five (5) years in accordance with ANSI N14.6-1978. A five year interval was chosen to balance requirements for examination, ALARA considerations and infrequent use (once every 12-14 months). In addition, prior to initial use for each outage (if required during outage) a visual examination will be made and documented. A nondocumented visual inspection will be made by the crane operator or signalman in accordance with ANSI B30.2 prior to each lift (use). Revelant indications of damage, flaws, defects or deterioration will be cause for immediate removal from service. Lifting apparatus will be returned to service only after repairs have been made, reinspected and accepted. Current plant procedures

require that only approved replacement parts and repair procedures shall be used for repair and or modification of special lifting devices.

For the R.V. Head lifting rig, the tripod and attachment points which do not remain on the vessel head during operation will be evaluated every five years, considering ALARA, visual examination results, and five year use to determine if nondestructive examination as described above is required. The portions of the rig remaining attached to the RV head and the RV head to rig attachment points will be evaluated every ten years on the same basis to determine if NDE is required and/or justified. The first evaluation will be performed during the next refueling outage, with subsequent evaluations falling in the ten year ISI outage. Visual examinations as described above will be performed on the same basis as for other special lifting devices. If evaluation determines that NDE is required for the head portion of the rig, this examination will be performed after the head has been removed from the RV and placed on the head storage stand.

Effect of dynamic loading imposed by crane (polar) is considered negligible due to the slow hook speed of 2.75 FPM. Using CMAA Spec allowance for dynamic loading of .5% for each one (1) foot per minute of hook speed the dynamic loading would be 1.375%.

Table 3 provides a comparison of special lifting rig design to the requirements of ANSI N14.6-1978 and as requested by FRC in the TER.

In-Service Inspection Tool/Removable Lifting Tool

This special handling device has been designed in accordance with and meets the requirements of ANSI N14.6-1978. Westinghouse has confirmed this in writing to CP&L. "The weakest link of the rig has a safety factor of 10.24 based on ultimate tensile strength and 6.65 based on yield strength of the materials used. The safety factors of all other components are greater than those stated for the weakest link. The computations were performed assuming max load (static) 10,500 pounds." This special lifting tool is supplied by Westinghouse during in-service inspection. Procedures for use, inspection and testing provided by "W" during in-service inspection will be incorporated into plant procedures prior to performing the inspection.

Turbine Lifting Beam

Carolina Power & Light Company is excluding this special lifting device from meeting the requirements of ANSI N14.6 since the turbine crane heavy loads will be excluded in our Part II Report. Load exclusion will be based on redundancy of the 480V and 4160V power supplies located on elevations below the turbine operating deck.

FRC Recommendation 2.1.6.c

1. "Verify that all nonspecially designed lifting devices subject to NUREG-0612 are installed and used in accordance with ANSI B30.9-1971.

2. Verify that the load used in properly selecting and marking a sling is based upon the sum of the maximum static and maximum dynamic loads.

3. Verify that slings restricted in use to certain crane(s) are clearly marked to so indicate."

CP&L Response

All nonspecially designed lifting devices subject to NUREG-0612 are installed and used in accordance with ANSI B30.9-1971. Nonspecial lifting devices when being selected will be based on the sum of the static load plus at least 15% for unanticipated dynamic loading and other unknowns. Slings will be tagged to indicate their maximum capacity. With the exception of several slings (i.e. turbine components, etc.), Carolina Power & Light Company does not limit the use of slings to specific cranes or loads. Slings which are restricted for specific uses such as above will be clearly marked and personnel will be instructed accordingly. Where loads must be handled over spent fuel or equipment required to maintain safe shutdown, personnel will be instructed by plant procedure and the attached load path drawings to utilize increased safety factors and four (4) point or redundant lifting arrangements. Safety factors will be increased by doubling the static load and adding a 15% dynamic load allowance. The resultant will be used to select proper sling size from standard sling charts. Where it is impossible to obtain a safety factor of 10, the lifts will be considered on a case by case basis and will be described in a written procedure properly approved by plant management.

FRC Recommendation 2.1.8.c

"The Licensee must evaluate the containment polar crane, solid waste handling crane, and the turbine building crane for compliance with CMAA-70 and ANSI B30.2-1976 or an appropriate alternative."

CP&L Response

A technical evaluation of the above cranes was performed to determine whether the design and safety features are comparable with the current requirements of ANSI B30.2-1976 and CMAA-70 and to identify areas of variance, if any. Features which enhance reliability beyond those currently required are also identified.

Summary and Conclusions

Procurement records such as design specifications, vendor drawings and data were reviewed and evaluated to ascertain the extent of conformance with current governing codes and standards. Plant walk throughs, review of procedures and interviews with plant personnel and scrutiny of records were used to determine compliance with safety standards.

The design of the cranes identified above substantially meet the current requirements of CMAA-70 and Chapter 2-1 of ANSI B30.2.

Inspection Testing and Maintenance of these cranes also complies substantially with the requirements of ANSI B30.2 Chapter 2-2. Recommendations during the Interim Actions review were made and implemented to enhance CP&L compliance to ANSI B30.2 as discussed in our Interim Action response.

Qualification and training of operators is in compliance with the requirements of ANSI B30.2 Chapter 2-3. Improvements were made to plant training procedures which made them more comprehensive and coordinated. Details of the evaluation and changes are available in the "Interim Action" report on file in our offices.

Identification of Design Codes and Standards

Table 1 identifies codes, standards and design documents utilized in design and fabrication of the load handling devices identified above.

Code identification was achieved by researching library files and discussions with various crane manufacturers. The design specifications of these cranes referred only to "applicable codes and standards", without being specific. Available crane supplier data did not yield any further specific code and standard information.

In the 1966-1967 period when the polar and turbine building cranes were ordered, Electric Overhead Crane Institute (EOCI) Specification No. 61 was the industry standard in effect. American National Standard Institute (ANSI) B30.2-1967 provided safety standards for Cable Ways, Cranes, Derricks, Hoists, Hooks, Jacks and Slings. Subsequently, EOCI became the Crane Manufacturer's Association of America (CMAA) and in 1971 Specification 61 was replaced by CMAA 70. The current (1975) CMAA 70 specification references and incorporates the safety requirements of ANSI B30.2 Chapter 2-2.

The five (5) ton bridge crane and monorail used for the solid waste handling crane complied with EOCI-61 for the bridge and HMI specification 100 for electric wire rope hoist. The design information of this crane and vendor information as available did not

provide any specific information on other codes and standards. Carolina Power & Light intends to exclude this crane and monorail in the Part II response based on structural analyses which will demonstrate the ability of the three foot reinforced slab floor to withstand a 10,000 pound load drop without resulting in failure of the slab or generation of unacceptable secondary missiles.

Evaluation for Comparable Adequacy

A technical evaluation of the cranes identified herein was performed to verify that the design was comparable to the current requirements of governing codes and standards and to identify areas of variance. Features which enhance reliability beyond those currently required are also highlighted.

Crane designs were reviewed with respect to current CMAA-70 (revised 1975) and ANSI B30.2 (revised 1976) requirements. CMAA governs the design quality and performance and ANSI B30.2 establishes safety standards that apply to the construction installation, operation, maintenance and inspection of these cranes.

Results of the evaluation are summarized in Table 2B. Whereas Table 1 identifies current codes and standards applicable, Table 2B provides a comparison of crane design and fabrication features to the requirements of CMAA-70 and ANSI B30.2. Design, construction and fabrication features of the existing cranes are based on information from design specification and vendor documents.

It is evident from Table 2B that the existing crane design, construction and fabrication features are in substantial compliance with the requirements of current codes and standards. Features such as bearing life, torque capacity of trolley and main auxiliary brakes not only meet but exceed the current requirements. Specified welding in accordance with AWS-D.2 (standard specifications for welded highway and railway bridges) does not conform to the current requirements of AWS D14.1 (specification for welding industrial and mill cranes). Whiting Corporation, the crane manufacturer verbally confirmed that the specified AWS D.2 was apparently an error, and that in fact AWS D14.1 was used by Whiting for the polar and turbine building crane as has been the case historically for all these cranes.

Crane Modifications

The polar crane has been modified to enhance the safe operability as follows:

Modification #39 Cutting 136 ventilation holes in boxed sections of polar crane.

Modification #214	Install a screw type (geared) limit switch on the main hoist drum to prevent the main hoist from traveling beyond its upper limit.
Modification #231	Install emergency stop button and forward/reverse limit switches on polar crane trucks and connect bridge control circuit to prevent collision between polar crane and manipulator crane.
Modification #313	Install automatic stoppage of polar crane bridge before colliding with manipulator crane.

FRC Recommendation 2.2.3.b

"The Licensee has not provided sufficient information to enable a determination of compliance with Interim Protection Measure 6 of NUREG-0612."

CP&L Response

"Interim Actions" as identified in enclosure 2 of the NRC letter dated December 22, 1980 were implemented by CP&L at H. B. Robinson Unit 2 in July of 1981. (Items (1) through (5) below, correspond to IPM's 2 through 6.)

An "Interim Action" report was prepared which identifies the actions taken to determine the extent of compliance to NUREG-0612 and to provide recommended changes to procedures and drawings necessary to implement the requirements of enclosure 2 stated below.

Interim Actions

(1) Safe Load Paths should be defined per the guidelines of Section 5.1.1(1) (See Enclosure 1 of December 22, 1980 letter);

(2) Procedures should be developed and implemented per the guidelines of Section 5.1.1(2) (See Enclosure 1 of December 22, 1980 letter);

(3) Crane operators should be trained, qualified and conduct themselves per the guidelines of Section 5.1.1(3) (See Enclosure 1 of December 22, 1980 letter);

(4) Cranes should be inspected, tested, and maintained in accordance with the guidelines of Section 5.1.1(6) (See Enclosure 1 of December 22, 1980 letter); and

(5) In addition to the above, special attention should be given to procedures, equipment, and personnel for the handling of heavy loads over the core such as vessel internals or vessel

inspection tools. This special review should include the following for these loads: (1) review of procedures for installation of rigging or lifting devices and movement of the load to assure that sufficient detail is provided and that instructions are clear and concise; (2) visual inspections of load bearing components of cranes slings and special lifting devices to identify flaws or deficiencies that could lead to failure of the component; (3) appropriate repair and replacement of defective component; and (4) verify that 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.

In general, it is CP&L's conclusion that heavy loads are being handled in a safe manner at H. B. Robinson Unit 2.

The following summarizes the actions taken to reach our conclusion regarding "Interim Actions" and provides recommendations that were implemented to make load handling operations consistent with the "Interim Actions" requirements. Details of our analysis supporting our conclusions are on file and available for review in our engineering department.

To answer the above questions an inventory of plant overhead handling equipment was taken to develop a list of heavy loads handled by each crane/monorail.

The overhead handling systems used to handle loads in the area of the reactor vessel or spent fuel pool and other areas where an accidental drop may damage safe shutdown systems and/or spent fuel have been evaluated for conformance to the guidelines of Enclosure 2 and Section 5 of NUREG-0612 as discussed below.

1. Safe Load Paths

Request

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 structures are more likely to withstand the impact. These load paths should be defined in procedures, shown on equipment layout drawings, and marked on the floor in the area where the load is to be handled (if practical). Deviations from defined load paths should require written alternative procedures approved by the plant safety review committee.

Response

The following drawings define safe load paths for movement of heavy loads in the area of the reactor vessel, spent fuel pool, and other areas where loads are handled adjacent to equipment required for safe shutdown.

81-022-M-001, Sheets 1 through 4
81-022-M-002
81-022-M-003
81-022-M-004
81-022-M-005

These drawings have safe load paths marked and identify nearby equipment required for safe shutdown or new/spent fuel. It must be noted that due to the variety of work performed during plant outages and the extreme space limitations in the containment, laydown areas will vary according to space available. Therefore, significant latitude has been given to maintenance/operations personnel for laydown of components in the containment. Components that do not have specific load paths identified on the above drawings may be moved anywhere on the operating floor except over the reactor vessel when the missile shield has been removed for maintenance and/or refueling except as noted on drawing 81022-M-002. Crane operations should also avoid carrying loads over the manipulator crane.

Exception has been taken to the NRC requirement of marking load paths on the floors. Due to the number of paths, their configurations, and other floor markings, marked load paths would cause confusion and, therefore, would not contribute to ensuring the safe handling of loads.

Note: Revisions and clarification to the load handling/operations procedures and load paths were discussed previously in this reply. Please refer to our reply to FRC Question 2.1.2.c.1 and 2.1.2.c.2 of T.E.R.

2. Procedures

Request

Procedures - should be developed and implemented 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 the load; the steps and proper sequence to be followed in handling the load; defining the safe load path; and other special precautions.

Response

Procedures governing the assembly, disassembly, and movement of loads defined in Section 5.1.1 of NUREG-0612 are covered by Refueling Instructions (FTs), Periodic Tests (PTs) and Maintenance Instructions (MIs). These procedures refer to applicable drawings for identification of load paths, provide detailed instructions for assembly and disassembly sequences, indicate required tools and equipment, establish prerequisites and precautions, and require inspection of load-handling equipment. Several H. B. Robinson Steam Electric Plant procedures required revision to comply with the intent of NUREG-0612 and specifically the required "Interim Actions" and were subsequently revised to include missing data. Procedure checklists used to determine compliance to the "Interim Actions" requirements are on file.

Crane Operation, Testing, Inspection, and Maintenance

CP&L recognizes the importance of proper crane operator training and qualification, as well as good crane maintenance testing and inspection. Subsequent to our review of current plant procedures and operating practices and to assure maximum efforts toward the safe handling of loads, a new general procedure has been issued entitled "Operation Testing and Inspection of Cranes and Material-Handling Equipment".

This procedure provides the necessary instructions for compliance with ANSI B30.2, OSHA, and other applicable standards such as ANSI B30.9 and B30.10 concerning the safe handling of loads. The crane operator training and qualification program has been upgraded to include the contents of the new procedure. In addition, the crane testing and inspection procedures have been or are in the process of being upgraded to provide more detailed information.

3. Crane Operators

Request

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

Finding

Review of the H. B. Robinson crane operator training and qualification program indicated a need to be upgraded.

As discussed above, a new general procedure has been issued which defines safe operating practices and operator qualification. The requirements and information set forth in this procedure have been incorporated into the crane operator training program assuring a more comprehensive training program and compliance to ANSI B30.2. The compliance checklists used to evaluate the program are a part of the interim action analysis.

Note: The existing crane operator training and qualification program is coordinated by the maintenance foreman. They are responsible for maintaining the qualification records, assuring that qualification and requalification is accomplished in a timely manner in accordance with TI 106, and that operators conduct themselves within the requirements of B30.2.

TI 106 has been rewritten to provide a more comprehensive training program. The maintenance supervisor is responsible for implementing this program. It was suggested that a maintenance training coordinator coordinate the maintenance training program for crane operator qualification and other training areas as deemed necessary by the maintenance supervisor. (This was accomplished in 1981).

4. Cranes

Request

Cranes - should be inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2.0-1976, "Overhead and Gantry Cranes". Where it is not practical to meet the test and frequency, the tests and inspections should be performed prior to their use.

Finding

A thorough review of the procedures, tests and instructions listed on the compliance checklist indicated that H. B. Robinson Steam Electric Plant was basically in compliance with ANSI B30.2, Chapter 2-2.1 through 2-2.4. However, in order to consolidate information and provide more detailed instructions, a new procedure entitled "Overhead and Gantry Crane Maintenance" was recommended. The new

procedure was given to site maintenance for addition of crane inspection checklists and other detailed information from manufacturers as required. The revised procedure has been implemented.

5. Items Requiring Special Attention

Request

Special attention should be given to procedures, equipment, and personnel for handling of heavy loads over the core, such as reactor vessel head, steam dryers and separators, and inspection tools. This special review should include the following for these loads.

(1) Review the procedures for installation of rigging or lifting devices and movement of the load to assure that sufficient detail is provided and that instructions are clear and concise.

(2) Visual inspections of load-bearing components of cranes, slings, and special lifting devices to identify flaws or deficiencies that could lead to failure of the component.

(3) Appropriate repair and replacement of defective components.

(4) Verify that the crane operators have been properly trained and are familiar with specific procedures used in handling these loads, e.g., hand signals, conduct of operations, and content of procedures.

Finding

A review of the H. B. Robinson procedures was performed and a checklist used to record the results. Recommended changes were implemented by the plant, and are included in the Interim Action report. The recommended changes include inclusion of and/or guideline instructions for load-path identification, inspection of lifting devices, use of qualified operators, replacement or repair of defective lifting components and use of only approved repair parts and approved repair procedures.

TABLE 1
Identification of Crane
Codes and Standards

	Cranes	Design Spec. No.	Codes & Standards Applicable at Construction Time	Current Codes & Standards	Comments
1.	Polar Crane (Whiting)	WELC 5379-54	EOCI-61	CMAA-70	
2.	Turbine Building (Whiting)	WELC 5379-56	EOCI-61	CMAA-70	
	Overall Design		EOCI-61(61)	CMAA-70(75)	
	Construction and Installation		EOCI-61, ANSI B30.2(67)	CMAA-70(75) ANSI B30.2(76)	
3.	Solid Waste Bridge Crane and Monorail (Underhung Type) (P&H)	WELC 5379-S12	EOCI-61	CMAA-74, ANSI B30.11	
	Overall Design of Bridge		EOCI 61, MMA	CMAA 74(74), ANSI B30.11(80)	
	Hoist and Trolley	Mfr. Standard	HMI 100	ANSI B30.16(81)	Hoist and trolley are manufacturer's standard

TABLE 2-A
General Crane Information

Description of Design Features	Polar Crane	T.B. Crane	Drumming Room Bridge & Monorail Crane
Manufacturer and Serial No.	Whiting 9701	Whiting 9700	P&H 689-1018
Type	Circular Gantry Bridge	Gantry Bridge, Outdoor	Top Underhung
Main Hoist Rating/Speed (Ton/FPM)	155/2.75	145/4.5	5/6-18
Aux. Hoist Rating/Speed (Ton/FPM)	15/25	25/23	None
Gantry Speed (FPM)	60	65	30
Trolley Speed (FPM)	25	25	35
Span (Ft)	92 dia	100	26
Hook Lift (Ft)	60	26	25

TABLE 2-B
Comparable Design Adequacy

Design, Contruction and Fabrication Features as Specified

Description of Design Features	Polar Crane	T.B. Crane	Drumming Room Bridge & Monorail Crane	CMAA 70/ (EOCI 61) Requirements	Conformance With CMAA 70	Conformance With B30.2
Material (ASTM)						
Structural Steel	A-36	A-36	A-36	A-36/(A-7)	Yes	Yes
Sheaves, Drum, Couplings, etc.	A-48	A-48	ND	A-48 or C140/ (Specified Steel or CI)	Yes	Yes
Factors of Safety						
Ropes for Main and Aux. Hoist (5)	5	5	5	5/(5)	Yes	Yes
Gears, Shafts, Drums, Blocks, etc. (5)	5	5	ND	5/(5)	Yes	Yes
Maximum Allowable Combined Stresses KIPS						
Tension	17.6	17.6	ND	17.6/(16)	Yes	Yes
Compression	17.6	17.6	ND	17.6/(16)	Yes	Yes
Shear	13.2	13.2	ND	13.2/(12)	Yes	Yes
Bending	8	8	ND	--		
Torsion	4	4	ND	--		

TABLE 2-B (Continued)
Comparable Design Adequacy
Design, Construction and Fabrication Features as Specified

Description of Design Features	Polar Crane	T.B. Crane	Drumming Room Bridge & Monorail Crane	CMAA 70/ (EOCI 61) Requirements	Conformance With CMAA 70	Conformance With B30.2
Seismic						
Horizontal (% of Dead Load max)	50	--	ND	--		
Vertical (% of Dead Load max)	15	--	ND	--		
Wind (Psf)	N/A	30	ND	--		
Impact Load - (% of Lift Load)	15	15	ND	15-50/(15)	Yes	Yes
Welding (AWS)	D14.1	D14.1	ND	D14.1/ (Unspecified AWS)	Yes	Yes(1)

TABLE 2-B (Continued)
Comparable Design Adequacy

Design, Construction, and Fabrication Features as Specified

Description of Design Features	Polar Crane	T.B. Crane	Drumming Room Bridge & Monorail Crane	CMAA 70/ (EOCI 61) Requirements	Conformance With CMAA 70	Conformance With B30.2
Deflection Under Max Load (Inch/Inch of Span)	0.001	0.001	ND	0.00125	Exceed	Exceed
Bearings, Antifriction (in hrs min Life Expectancy)	5,000	5,000	ND	3,000(B10)/ (1,000)	Exceed	Exceed
Brakes - Torque Capacity (% of Motor Torque/Type)						
Bridge and/or Gantry	100/ Hydraulic	100/ Hydraulic	ND ND	100/ Unspecified	Yes	Yes
Parking	100/ Electric	100/ Electric	ND	100 elec/ (75 elec)	Yes	Yes
Trolley	100/ Electric Spring Set	100/ Electric Spring Set	ND	50 elec/ (50 elec)	Exceed	Exceed
Hoist for Main and Auxiliary						
Holding Brake	Two, Each 150/Electric Spring Set	Two, Each 150/Electric Spring Set	ND	Two 100 elec/ (100 elec) One 125 elec/ (125 elec)	Exceed	Exceed
Control Brake - (1 each)	150/Dynamic D.C.	150/Dynamic D.C.	N/A	125/(125)	Exceed	Exceed

TABLE 2-B (Continued)
Comparable Design Adequacy

Description of Design Features	Polar Crane	T.B. Crane	Drumming Room Bridge & Monorail Crane	CMAA 70/ (EOCI 61) Requirements	Conformance With CMAA 70	Conformance With B30.2
Motors						
One Motor for Each Motion Wound Rotor Totally Enclosed	Yes	Yes	N/A	Yes	Yes	Yes

TABLE 2-B (Continued)
Comparable Design Adequacy

Design, Construction, and Fabrication Features as Specified

Description of Design Features	Polar Crane	T.B. Crane	Drumming Room Bridge & Monorail Crane	CMAA 70/ (OECI 61) Requirements	Conformance With CMAA 70	Conformance With B30.2
Controllers	Yes	Yes	N/A	Yes	Yes	Yes
Resistors	Yes	Yes	N/A	Yes	Yes	Yes
Protection	Yes	Yes	N/A	Yes	Yes	Yes
Limit Switch	Yes	Yes	N/A	Yes	Yes	Yes
Testing (% of Rated Capacity)	125	125	125	125/(125)	Yes	Yes

NOTES: (1) - See text evaluation for comparable adequacy.
N/A - Not Applicable.
ND - Not Determinable.
MMA - Monorail Manufacturers Association
HMI - Hoist Manufacturers Institute
EOCI - Electric Overhead Crane Institute
CMAA - Crane Manufacturers Association of America
ANSI - American National Standards Institute

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Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: Spent Fuel Cask Redundant Lift Yoke

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 3.1		
3.1.1 Limitation on use.	Yes	
3.1.2 Identification of critical components.	Yes	
3.1.3 Signed stress analyses	Yes	
3.1.4 Permissible repair procedures.	Yes	
Section 3.2		
3.2.1 Minimum stress factors - 3 yield, 5 ultimate.	Yes	
3.2.4 Similar stress factor for pins, links, adaptors, etc.	Yes	
3.2.5 Slings comply with ANSI B30.9 - 1971.	N/A	
3.2.6 Material testing.	Yes	
Section 3.3		
3.3.1 Consideration of lamellar tearing.	Yes	
3.3.4 Design for even distribution of load.	Yes	
3.3.5 Prevention of inadvertant disengaging.	Yes	
3.3.6 Verification of remote actuator engagement.	Yes	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: Spent Fuel Cask Redundant Lift Yoke

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 4.1		
4.1.3 Selection and use of material.	Yes	
4.1.4 Compliance with fabrication practices.	Unknown	
4.1.5 Qualification of Welders, procedures, etc.	Unknown	
4.1.6 Quality Assurance Program.	Unknown	
4.1.7 Identification and certification of equipment.	Unknown	
4.1.9 Verify that material/ services are produced under controls and qualifications.	Unknown	
Section 5.1		
5.1.3 Implement testing schedule and system to indicate expiration.	Yes	
5.1.4 Establish operating procedures.	Yes	
5.1.5.1 Identify sub-assemblies which may be exchanged.	Yes	
5.1.5.2 Suitable markings.	Yes	
5.1.6 Maintenance history.	Yes	
5.1.7 Conditions for removal from service.	Yes	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: Spent Fuel Cask Redundant Lift Yoke

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 5.2		
5.2.1 150% initial load test.	Yes	
5.2.2 Qualification of replacement parts.	Yes	
Section 5.3		
5.3.1 Annual load test or inspection requirements.	Yes	
5.3.2 Retesting following major maintenance.	Yes	
5.3.3 Testing after application of substantial stresses.	Yes	
5.3.6 & .7 Inspections by operating and nonoperating personnel.	Yes	

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Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: RCP Motor Lift Sling

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 3.1		
3.1.1 Limitation on use.	Yes	See R.V. Head Lift Rig Comment.
3.1.2 Identification of critical components.	Unknown	See R.V. Head Lift Rig Comment.
3.1.3 Signed stress analyses	Yes	
3.1.4 Permissible repair procedures.	No	See R.V. Head Lift Rig Comment.
Section 3.2		
3.2.1 Minimum stress factors - 3 yield, 5 ultimate.	Yes	
3.2.4 Similar stress factor for pins, links, adaptors, etc.	Yes	
3.2.5 Slings comply with ANSI B30.9 - 1971.	Yes	
3.2.6 Material testing.	Unknown	
Section 3.3		
3.3.1 Consideration of lamellar tearing.	N/A	
3.3.4 Design for even distribution of load.	Yes	
3.3.5 Prevention of inadvertant disengaging.	Yes	
3.3.6 Verification of remote actuator engagement.	N/A	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: RCP Motor Lift Sling

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 4.1		
4.1.3 Selection and use of material.	Yes	Standard Manufactured Components
4.1.4 Compliance with fabrication practices.	Unknown	
4.1.5 Qualification of Welders, procedures, etc.	Unknown	
4.1.6 Quality Assurance Program.	Unknown	
4.1.7 Identification and certification of equipment.	Unknown	
4.1.9 Verify that material/ services are produced under controls and qualifications.	Unknown	
Section 5.1		
5.1.3 Implement testing schedule and system to indicate expiration.	Yes	Per statements made in Item 4.
5.1.4 Establish operating procedures.	Yes	
5.1.5.1 Identify sub-assemblies which may be exchanged.	Yes	
5.1.5.2 Suitable markings.	Yes	
5.1.6 Maintenance history.	Yes	
5.1.7 Conditions for removal from service.	Yes	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: RCP Motor Lift Sling

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 5.2		
5.2.1 150% initial load test.	No	125%
5.2.2 Qualification of replacement parts.	Yes	
Section 5.3		
5.3.1 Annual load test or inspection requirements.	Yes	Per Item 4 reply meets intent of N14.6.
5.3.2 Retesting following major maintenance.	Yes	
5.3.3 Testing after application of substantial stresses.	Yes	
5.3.6 & .7 Inspections by operating and nonoperating personnel.	Yes	

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Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: Internals Lifting Rig

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 3.1		
3.1.1 Limitation on use.	Yes	See R.V. Head Lifting Rig Comments.
3.1.2 Identification of critical components.	Unknown	See R.V. Head Lifting Rig Comments.
3.1.3 Signed stress analyses	Yes	
3.1.4 Permissible repair procedures.	No	See R.V. Head Lifting Rig Comments.
Section 3.2		
3.2.1 Minimum stress factors - 3 yield, 5 ultimate.	Yes	Stress factors based on lower internals static load minimum stress factors for upper internals are approximately 2.5 times greater.
3.2.4 Similar stress factor for pins, links, adaptors, etc.	Yes	
3.2.5 Slings comply with ANSI B30.9 - 1971.	N/A	
3.2.6 Material testing.	Unknown	
Section 3.3		
3.3.1 Consideration of lamellar tearing.	Yes	
3.3.4 Design for even distribution of load.	Yes	
3.3.5 Prevention of inadvertant disengaging.	Yes	
3.3.6 Verification of remote actuator engagement.	No	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: Internals Lifting Rig

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 4.1		
4.1.3 Selection and use of material.	Unknown	
4.1.4 Compliance with fabrication practices.	Unknown	
4.1.5 Qualification of Welders, procedures, etc.	Unknown	See R.V. Head Lift Rig Comment.
4.1.6 Quality Assurance Program.	Unknown	
4.1.7 Identification and certification of equipment.	Unknown	
4.1.9 Verify that material/ services are produced under controls and qualifications.	Unknown	
Section 5.1		
5.1.3 Implement testing schedule and system to indicate expiration.	Yes	Per statement made in Item 4.
5.1.4 Establish operating procedures.	Yes	
5.1.5.1 Identify sub-assemblies which may be exchanged.	Yes	
5.1.5.2 Suitable markings.	Yes	
5.1.6 Maintenance history.	Yes	
5.1.7 Conditions for removal from service.	Yes	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: Internals Lifting Rig

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 5.2		
5.2.1 150% initial load test.	No	125%
5.2.2 Qualification of replacement parts.	Yes	
Section 5.3		
5.3.1 Annual load test or inspection requirements.	Yes	Per Item 4 reply meets intent of N14.6.
5.3.2 Retesting following major maintenance.	Yes	
5.3.3 Testing after application of substantial stresses.	Yes	
5.3.6 & .7 Inspections by operating and nonoperating personnel.	Yes	

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Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: R.V. Head Lifting Rig

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 3.1		This rig meets the intent of N14.6, and is used only in the containment which is a controlled atmosphere. Rig is not subjected to temperatures below NDTT, corrosive environment or physical abuse during normal plant operating conditions.
3.1.1 Limitation on use.	Yes	
3.1.2 Identification of critical components.	Unknown	
3.1.3 Signed stress analyses	Yes	3.1.2.-Design specification not available from supplier. All lifting rig components considered critical. Modification and/or replacement is accomplished through concurrence of supplier.
3.1.4 Permissible repair procedures.	No	
Section 3.2		3.1.4.-Procedures not identified by supplier. Appropriate repair procedure, if required, will be developed prior to performing any repairs.
3.2.1 Minimum stress factors - 3 yield, 5 ultimate.	Yes	
3.2.4 Similar stress factor for pins, links, adaptors, etc.	Yes	3.2.1.- 4.4 based on yield.
3.2.5 Slings comply with ANSI B30.9 - 1971.	N/A	
3.2.6 Material testing.	Unknown	
Section 3.3		
3.3.1 Consideration of lamellar tearing.	Yes	
3.3.4 Design for even distribution of load.	Yes	
3.3.5 Prevention of inadvertant disengaging.	Yes	Locking pins and nuts.
3.3.6 Verification of remote actuator engagement.	N/A	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: R.V. Head Lifting Rig

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 4.1		
4.1.3 Selection and use of material.	Unknown	
4.1.4 Compliance with fabrication practices.	Unknown	
4.1.5 Qualification of Welders, procedures, etc.	Unknown	Could not be verified, however, supplier generally uses qualified welder and procedures.
4.1.6 Quality Assurance Program.	Unknown	
4.1.7 Identification and certification of equipment.	Unknown	
4.1.9 Verify that material/ services are produced under controls and qualifications.	Unknown	
Section 5.1		
5.1.3 Implement testing schedule and system to indicate expiration.	Yes	Testing schedule and system for indicating expiration will be implemented in accordance with the statements made in Item 4.
5.1.4 Establish operating procedures.	Yes	
5.1.5.1 Identify sub-assemblies which may be exchanged.	Yes	
5.1.5.2 Suitable markings.	Yes	
5.1.6 Maintenance history.	Yes	
5.1.7 Conditions for removal from service.	Yes	

Comparison of Special Lifting Devices to ANSI N14.6

TABLE 3

Special Lifting Device: R.V. Head Lifting Rig

ANSI N14.6 - 1978 Requirement	Conforms to N14.6 - 1978 Yes/No	Comments
Section 5.2		
5.2.1 150% initial load test.	No	Lifting rig was load tested to 125%.
5.2.2 Qualification of replacement parts.	Yes	
Section 5.3		
5.3.1 Annual load test or inspection requirements.	Yes	Per reply in Item 4, meets intent of Section 5.3.1.
5.3.2 Retesting following major maintenance.	Yes	
5.3.3 Testing after application of substantial stresses.	Yes	
5.3.6 & .7 Inspections by operating and nonoperating personnel.	Yes	