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January 2, 1981

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Zion Station Units 1 and 2
Control of Heavy Loads Near Spent Fuel
NRC Docket Nos. 50-295 and 50-304

References (a): July 31, 1980 letter from D. G. Eisenhut to D. L. Peoples

(b): November 7, 1980 letter from T. R. Tramm to H. R. Denton

Dear Mr. Denton:

Reference (b) transmitted a report of our review of controls for handling heavy loads near spent fuel at Zion. During the review of that report the NRC Staff has found that additional information is necessary. Accordingly, Attachment A to this letter supercedes Attachment A to Reference (b). A complete response to each question is being submitted to avoid confusion. Some responses remain unchanged, others have been supplemented or clarified. The drawings referenced are not being resubmitted.

In general. we conclude that heavy loads are being handled safely at Zion and that such operations are or will be consistent with the guidelines contained in Section 5.1.1 of NUREG-0612 to the extent practicable. Attachment B to this letter addresses areas in which safe load handling is achieved by alternate means. More detailed review of other sections of Enclosure 1 to Reference (a) is to be docuemnted in the requested six-month report.

One (1) original and thirty-nine (39) copies of this letter are included for your use.

Please address further questions to this office.

Very truly yours,

Robert F. Janecek
for T. R. Tramm
Nuclear Licensing Administrator
Pressurized Water Reactors

cc: RIII Inspector - Zion

S. P. Carfagno, Franklin Research Center

ATTACHMENT A

Partial Response to Request for Additional Information on Control of Heavy Loads

2.1 General Requirements for Overhead Handling Systems

Request 1:

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).

Response 1:

The cranes and trolleys identified throughout the plant that handle loads in areas where equipment for shutdown or decay heat removal is located are listed below by building.

Containment

Polar crane
Underhung hand geared bridge crane (1 ton capacity)
Manipulator crane

Fuel Handling Building

Fuel building crane
Fuel handling bridge

Auxiliary Building

2-ton trolley attached to rail at 666' 0" elevation at roof of auxiliary building.

Diesel Generator Room

2-ton trolley attached to two 10-ton monorails running the full length of each side of each diesel generator.

Crib House

10-ton hoist attached to 16-ton monorail I-beam at 646' 11 3/4" elevation on roof of crib house.

Request 2:

Justify the exclusion o any overhead handling system from the above category 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 core decay heat removal.

Response 2:

The turbine building crane and MSR removal trolleys were excluded from item 1 above since no system or component required for plant shutdown or core decay heat removal is located in this building.

The radwaste crane and maintenance shop crane also are not listed since they are completely removed from the area of safe shutdown or decay heat removal equipment by concrete walls.

The two 4-ton monorails between the fuel building and the auxiliary building (one on Unit 1 side, one on Unit 2 side) do not have hoists physically attached to them, are separated from safety-related equipment by concrete walls, and physically far enough away from the spent fuel pool (approximately 40') to preclude consideration of dropping a load into the pool or damaging spent fuel.

The two 25-ton monorails at the 592'0" elevation of the auxiliary building in front of the elevator (running in the east-west direction) do not have hoists physically attached and are so low (approx. 7' off the floor) that a physical inspection of the area confirms that no safe shutdown or decay heat removal component could be damaged by a load drop.

Request 3:

With respect to the design and operation of heavy load handling systems in the containment and the spent fuel pool area and those load handling systems identified in 2.1-1, above, provide your evaluation concerning compliance with the guidelines of NUREG-0612, Section 5.1.1. The following specific information should be included in your reply:

Request 3a:

Drawings or sketches sufficient to clearly identify the location of safe load paths, spent fuel, and safety-related equipment.

Response 3a:

The prints below were provided with the previous submittal dated November 7, 1980.

MS-16 Hoist load path - Crib House
MS-681 Hoist load path - Plan Main Floor el. 642'0"
MS-682 Polar Crane load paths - Plan Mezz. Floor el. 617'0"
MS-683 Diesel Gen. Room Hoist load path - Plan ground floor el. 592'0".

These drawings have load paths clearly marked and the nearby equipment is also identified.

Heavy loads drop analysis and safe load path information concerning the fuel handling building have been previously submitted to the NRC in the 4-8-76 letter from R.L. Bolger to A. Schwencer, 9-14-76 letter from R.L. Bolger to A. Schwencer, and the 8-9-77 letter from D.E. O'Brien to A. Schwencer.

Request 3b:

A discussion of measures taken to ensure that load handling operations remain within safe load paths, including procedures, if any, for deviation from these paths.

Response 3b:

Loads moved in the areas defined in Section 5.1.1 (1) are listed in attached Table 3-1. The procedures governing the assembly/disassembly and movements of these loads are also listed.

Loads number 1 through 9 are covered by maintenance department procedures. These procedures allow the movement of the loads from only one point to another. While the paths for these movements are not explicitly stated in the procedures, the movements follow the safest and shortest routes. These routes are shown in the sketches listed in the response to Request 3a above.

This practice is consistent with the company's general safety rules and practices. These safety rules are an integral part of Zion Station's Maintenance Department Administrative Instructions (MDAI's) under which all maintenance work is performed. Also, this work is performed by maintenance nuclear mechanics and "A" men who are supervised by maintenance foremen. These personnel have achieved these positions by demonstrating their craft knowledge and ability in performing the required work. Loads are thus handled along safe paths under the control of experienced personnel according to established rules. As indicated in Attachment B, specific prohibitions against handling loads over the reactor vessel are being added to the plant procedures. If the analyses requested by the NRC indicates that other controls are appropriate, they will be addressed in the six-month report.

Request 3c:

A tabulation of heavy loads to be handled by each crane which includes the load identification, load weight, its designated lifting device, and verification that the handling of such load is governed by a written procedure containing, as a minimum, the information identified in NUREG-0612, Section 5.1.1 (2).

The attached Table 3-1 lists the cranes and the loads normally handled by each.

Table 3-1 indicates the written rocedures that govern the handling of each load. These procedures generally include sections such as Equipment Description, Purpose, References, Initial Plant and/or component Conditions, Precautions/Limitations in addition to the step by step instructions. The procedures being used meet the intent of Secton 5.1.1 (2) of NUREG-0612.

Restrictions on loads in the vicinity of the spent fuel pit are also stated in the Composite Licenses for the Zion Units.

For applicable loads that will be moved in the future for which no procedure is now in effect (i.e., reactor vessel lower internals), a procedure will be developed prior to the movement of such a load.

Specific load handling devices are identified below:

Rx vessel head lifting rig
RCP tripod
Upper internals lifting rig
Lower internals lifting rig

Request 3d:

Verification that lifting devices identified in 2.1.3-c, above, comply with the requirements of ANSI 14.6-1978, or ANSI B30.9-1971 as appropriate. For lifting devices where these standards, as supplemented by NUREG-0612, Section 5.1.1 (4) or 5.1.1 (5), are not met, describe any proposed alternatives and demonstrate their equivalency in terms of load-handling reliability.

Response 3d:

This equipment was designed according to industrial standards using good engineering practices.

A review of calculations for design of the Reactor Vessel Head Lift Rig indicates that the calculations were based on using 1/5 of the ultimate material allowable stresses for lifting the dead weight of the assembled head. Using todays AISC standards, applicable to the weakest design point of the structure, (i.e. the sling block) produces a factor of safety of 1.93.

Using the actual material test report yield strength of 45.2KSI results in a factor of safety of greater than 2.0 at the sling block. All other areas of the design provide a factor of safety of at least 2.0.

The design calculation for the Internals Lift rigs also showed that they were based on 1/5 of the ultimate material allowable stresses over the dead weight of the internals.

A dynamic load factor applied to the weight of the lift is 2 for the reactor coolant pump motor tripod. Design stresses are as specified in ASME Section III, Appendix XVII.

Fittings for the above lift rigs were selected such that the load does not exceed 5 times the breaking strength of the fitting.The RCP motor lifting cable and the 17-ton shield blocks slings used at the station comply with ANSI B30.9-1971. This includes, use, maintenance, and storage.

The RCP motor lifting cable is an 8 part braided rope of 6 x 19 construction using 1" diameter improved plow steel grade component ropes, and is rated at approximately 50 tons.

A 50 ton shackle is used to attach this cable to the tripod. This shackle is manufactured in accordance with Federal Specification RR-C-271 and has a safety factor of 5.

4-1" 6 x 19 classification improved plow steel grade ropes with independent wire rope cores make up the bridle sling for lifting the shield blocks. This allows a load lift of 24 tons.

A 26 ton shackle is used to attach the shield block sling to the hook. This shackle also meets Federal Specification RR-C-271 and has a Safety factor of 5.

Request 3e:

Verification that ANSI B30.2-1976, Chapter 2-2, has been invoked with respect to crane inspection, testing, and maintenance. Where any exception is taken to this standard, sufficient information should be provided to demonstrate the equivalency of proposed alternatives.

Response 3e:

The crane inspection, maintenance, and operating procedures are all based upon ANSI B30.2-1976, and Section 179 of 29CFR1910.

Request 3f:

Verification that crane design complies with the guidelines of CMAA Specification 70 and Chapter 2-1 of ANSI B30.2-1976, including the demonstration of equivalency of actual design requirements for instances where specific compliance with these standards is not provided

Response 3f:

The cranes used at Zion Station were purchased to the Sargent & Lundy Specification for Electric Overhead Traveling Bridge Cranes, Form 280B, which is based on the American Institute of Steel Construction Specifications and the Electric Overhead Crane Institute, Inc. Specifications and USAS Safety Code B30.2.0-1967. A comparison of the requirements of Form 280B to the CMAA70-1975 Specification is shown in Table 3-3. This Table 3-3 and the following discussion shows that the Zion crane procurement specification, Form 280B, meets the intent of CMAA-70:

1) Impact Force: The Electric Overhead Crane Institute's (EOCI) specification which was referenced in Form 280B, requires a design force equal to 15% of the rated capacity of the crane. The CMAA #70-1975 specifies that the impact load be 1/2% load X Hoist Speed in feet per minute and that the impact should not be less than 15% or greater than 50% of the rated capacity. Therefore, the Zion cranes have been procured to a criteria which conforms to the requirements of CMAA specification for hoist speed less than 30 ft/min. Both the polar crane and the Fuel Handling Building cranes have hoist speed of 5 ft/min or less. Therefore, those cranes satisfy CMAA-70-1975.

2) Compressive Stress: As shown in Table 3-3, the allowable compressive stress specified in Form 280B is identical to those specified by CMAA-70-1975 for members with non-slender compressive flange. A comparison of the allowable compressive stress criteria given in Form 280B and CMAA-1975 is shown in Figure 3-1. The box girders for the polar crane and the fuel handling building crane in Zion have a b/c ratio of 11 and 24, respectively. For these b/c ratios, these structural elements meet the requirements of CMAA-70-1975.

Request 3g:

Exceptions, if any, taken to ANSI B30.2-1976 with respect to operator training, qualification, and conduct. Response 3g:

The crane operators for the Maintenance are all 'B' category union personnel.

The polar crane can only be operated by 'A' union personnel who have demonstrated their capability through on-the-job performance.

The fuel handling crane operators receive a refresher course in crane operations prior to every refueling outage. This is seminar type training administrated by the senior fuel handling foremen.

It has been determined that our current training program does comply with ANSB30.2-1976, but, as stated previously, our committment is to include a reference to Chapters 2-3 of ANSI B30.2-1976 in our current program and to provide a review of that document at the end of the training session. We do not feel this will change our program but will provide a review of the course and ANSI B30.2-1976 at its end.

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Table 3-1

LOADS	PROCEDURE
1) Reactor Vessel Head and Lifting Rig	1) RC001-1 "Reactor Vessel Head Installation" RC001-4 "Reactor Vessel Head Removal"
2) Reactor Upper Internals and Lifting Rig	2) RC001-5 "Removal of Reactor Vessel Upper Internals" RC001-6 "Installation of Reactor Vessel Upper Internals"
3) Reactor Lower Internals and Lifting Rig	3) No procedure now. Will be developed when needed.
4) Reactor Coolant Pump Motor	4) P/RC110/410-6N "Inspect/Adjust Reactor Coolant Pump Motor"
5) Reactor Coolant Pump	5) P/RC110/410-1N "Reactor Coolant Pump Seal Inspection/Replacement"
6) Shield Blocks	6) RC001-1 and RC001-4
7) Reactor Vessel Head Studs and Stud Hydraulic Tensors	7) RC001-1 and RC001-4
8) Service Water Pump and Motor	8) SW001-1 "Disassembly/Assembly of Layne Bowler Service Water Pump"
9) Equipment Hatch and Missile Shields	9) P/PP000-2N "Removal and Installation of Equipment Hatch"
10) Spent Fuel	10) FHI-23
11) New Fuel	11) FHI-02 FHI-14 FHI-33
12) Fuel Handling Equipment	12)
A) Spent Fuel Assembly Handling Tool	A) FHI-19
B) Thimble Plug Assembly Handling Tool	B) FHI-20
C) Rod Control Cluster Change Fixture	C) FHI-21
D) Full Length Control Rod Drive Shaft Unlatching Tool	D) FHI-26

LOADS	PROCEDURE
E) Irradiation Sample Handling Tool	E) FHI-30
F) Burnable Poison Rod Assembly Handling Tool	F) FHI-31
G) Guide Tube Cover Handling Tool	G) FHI-32
H) New Fuel Assembly Handling Tool	H) FHI-33
I) Rod Control Cluster Changing Tool	I) FHI-37
J) Manipulator Crane	J) FHI-13
K) Fuel Transfer System Operation	K) FHI-12
13) Spent Fuel Handling and Shipment	13) FHI-23
14) Site Removal of New Assemblies from Shipping Containers and Handling of Shipping Containers	14) FHI-02

TABLE 3-2
ZION STATION - UNITS 1&2
CRANES AND HOISTS

Crane/Hoist Identification	Location	Loads Carried	Load Weight	Load Path
Polar Crane 225T Main Hook 35T Aux. Hook	Each Containment. Rail Elevation 617'-0"	RPV Head RPV Upper Internals RPV Lower Internals RC Pump Motor RC Pump Concrete Slabs	73.5T 60T 170T 36T 51T 17T	See MS-682
Underhung Hand Geared Bridge Crane - 1 ton	Each Containment on permanent rails over the reactor cavity. (In place only during refueling).	RX vessel head studs. 2 work baskets. Thimble plugs.	.5T .125T .05T	Same as RPV head. Along cavity walls when head is on. In RX cavity.
Maintenance Bridge 1 ton	Each Containment over reactor cavity.	Spent fuel assy's. New fuel assy's. Fuel handling tools.	.8T .8T .2T	Reactor cavity Reactor cavity Reactor cavity
Fuel Handling Building Crane 125T Main Hook 15T Aux. Hook	Fuel Handling Building. Rail Elevation 643'-0". Col. Rows R-W/17-23	Spent Fuel Cask New Fuel Containers.	100T 3T	See Fig. 1 in 7/14/76 letter.
Spent Fuel Bridge 1 ton	Spent fuel building over spent fuel pool.	Spent fuel assy's. New fuel assy's. Fuel tools	.8T .8T .2T	In spent fuel pool. In RX cavity.

Table 3-2

Crane/Hoist Identification	Location	Loads Carried	Load Weight	Load Path
2T Trooley	Auxiliary Building in each Diesel Generator Room. Approx. Rail Elevation 615'-0".	Diesel Generator. Parts	2T	See MS-683
2T Trolley	Auxiliary Building. Approx. Rail Elevation 666'-0". Col. Row N/18-20	Equipment Removal	2T	See MS-681
10T Trolley	Crib House. Rail Elevation 646'-11 3/4". Row CC-BB/101-113	Removal Slab SW Pump SW Pump Motor	6T 5T 7.5T	See MS-16

Table 3-3

OVERHEAD AND GANTRY CRANES

COMPARISON OF STRUCTURAL DESIGN CRITERIA

ZION 1 & 2

Structural Requirements / Specifications	Design Forces: Impact = I	Design Forces: Lateral	Structural Steel Material	Allowable Stresses (ksi): Tension	Allowable Stresses (ksi): Compression (2)	Allowable Stresses (ksi): Shear	Allowable Stresses (ksi): Bearing	Hoisting Rope Rated Cap	(3) Non-Struct Load Beari Capacity
CMAA Spec #70 Copyright 1975 Class A1 (Standby Service)	1. ½% Load X (Hoist Speed in Feet/Min) 2. 15% ≤ I ≤ 50% of rated capacity.	2½% of (Live Load + Bridge)	ASTM-A36	17.6	17.6 for b/c ≤ 38	13.2	26.4	20% Breaking Strength	20% Fultimat
Zion Crane (1) Procurement Specification, Form 280B	I=15% of the Rated Capacity	5% of (Live Load + Bridge)	ASTM-A36	17.6	17.6 for b/c ≤ 41	13.2	21.6, AISC Fitted Stiffeners	20% Breaking Strength	20% Fultimat

Notes

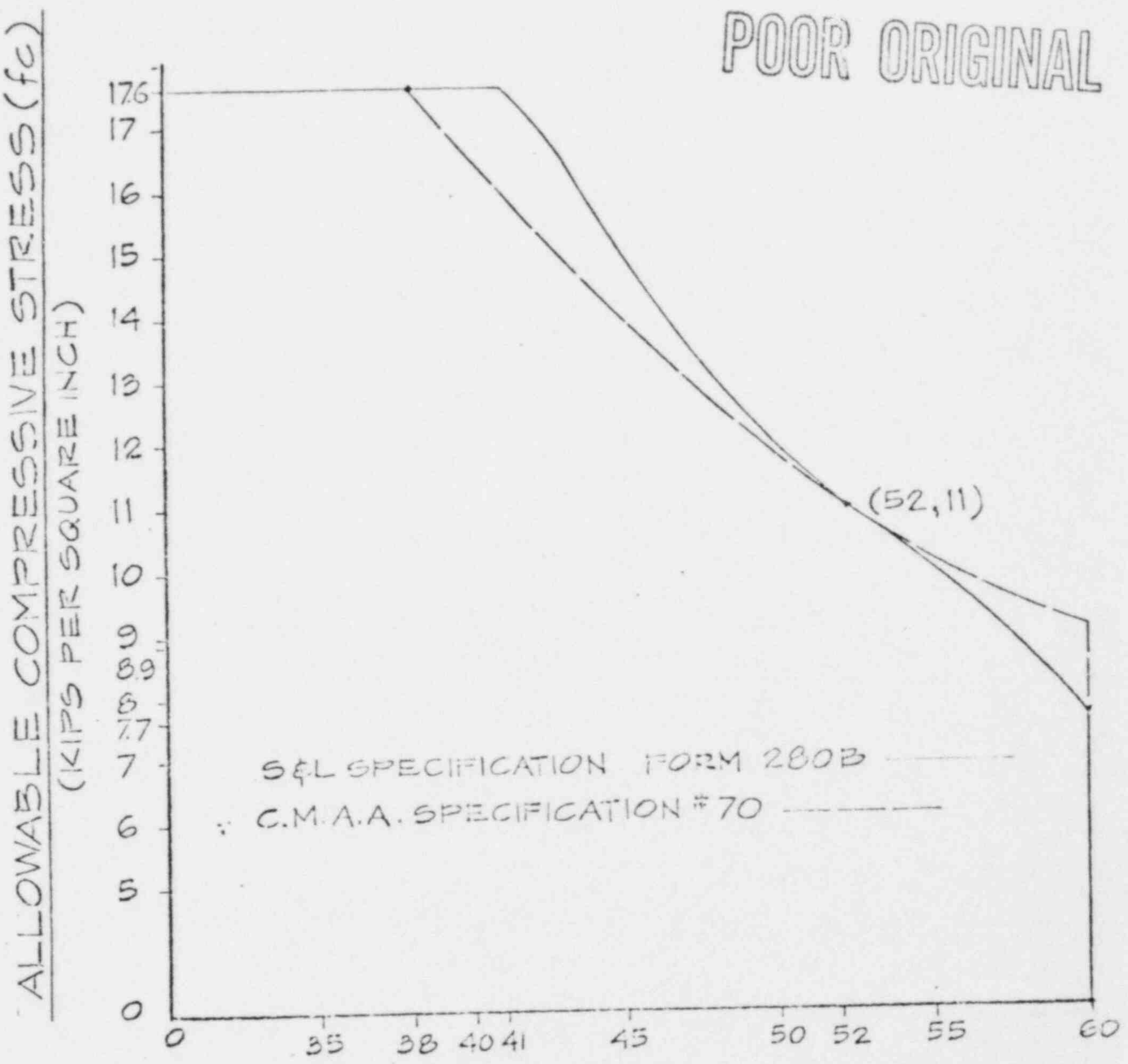
(1) Based on 1.1 times the allowables of EOCI #61, Class A Service or 0.8 Times the allowables of AISC (6th Edition) and use of A36 Steel.

(2) b = Distance between web plates (inches)
c = Thickness of top cover plate (inches)

(3) Fult = Published average ultimate stress of material

11/25/80

POOR ORIGINAL



b/c RATIO

b = DISTANCE BETWEEN WEB PLATES IN INCHES

c = THICKNESS OF TOP COVER PLATES IN INCHES

FIGURE 3-1

ATTACHMENT B

Summary of Review of
Load Handling Operations at Zion
with Respect to Section 5.1.1 of NUREG-0612

A review of Section 5.11 of NUREG 0612 has shown that the Zion Station is substantially in compliance. Only five(5) points of deviation are discernable and these are itemized below. These points are expanded upon in the specific question area of this response.

1) In Item 1) of paragraph 5.1.1 of NUREG 0612, Safe Load Paths, a requirement is made for clearly marking load paths on the floor in the area where the load is to be handled.

2) Also, deviations from defined load paths should require alternative procedures approved by the plant safety review committee.

Discussion:

Loads are moved by the safest and shortest paths as shown on the Zion drawings MS-16, 681, 682, and 683 previously submitted. Because no deviations are allowed from the load paths identified on the drawings, no alternate procedures are required.

Due to the configuration of the load paths (e.g. the load path for the RCP is from the pump deck up to the 617' level then over grating to its lay down area; the service water pump motors are removed through the roof of the crib house and moved across the roof) it is not apparent that marking load paths on the floor is generally feasible or would contribute to reactor safety.

3) In Item 2) of paragraph 5.1.1 of NUREG 0612, Procedures, a requirement is made for defining the safe load path in the procedures.

Discussion:

Zion maintenance procedures are controlled by administration procedures (MDAI's). To comply with the above item, Commonwealth Edison will add the following paragraph to the administrative procedures:

"All loads inside containment shall be moved by straight line or shortest path to its lay down area.

No load shall be moved over the Rx vessel except the following items during their removal or installation:

ductwork
fan plenum assembly
missil: shield blocks
missi:e shield block support beams
CRDM equipment"

The applicable maintenance procedure provides the proper sequence for these movements.

Should the analysis of Zion for compliance to paragraphs 5.1.2, 5.1.3, 5.1.4 (due 1/21/81) show additional area specific noncompliances, we are prepared to revise the procedures further to ensure that they are in complete compliance.

4) In Item 3) of paragraph 5.1.1 of NUREG 0612, Crane Operators, a requirement is made for training and qualifying crane operators in accordance with Chapters 2-3 of ANSI B30.2-1976.

Discussion:

A review of the Zion crane operator training program has shown that is does comply with Chapters 2-3 of ANSI B30.2-1976 and provides plant specific crane operator training, both in the classroom and with actual crane operation. This training is followed with a written quiz and an operational evaluation of the individual crane operator's knowledge.

However, to insure that the intent of the specific questior is met, we will include a reference to Chapters 2-3 of ANS B30.2-1976 in our current program, and will provide a review of that document at the end of the training session

5) In Item 5) of paragraph 5.1.1 of NUREG 0612, Special Lifting Devices, a requirement is made for satisfying the guidelines of ANSI N14.6-1978. Paragraph 3.2.1 states tha the load bearing members of a special lifting device shall be capable of lifting three times the combined weight of the shipping container plus the weight of intervening components. They shall also be capable of lifting five times that weight without exceeding the ultimate strength of the materials.

Discussion:

Lifting devices at Zion were designed to be capable of lifting five times the load without exceeding the ultimate strength of the materials. The design safety factor is two not three as required by ANSI N14.6. Since ANSI N14.6 did not exist at the time of Zion design, good engineering practice was used, and a safety factor of 2 was considered to be adequate.