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September 22, 1981

Director of Nuclear Regulatory Regulation
United States Nuclear Regulatory Commission
Attn: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
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Washington, DC 20555

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U.S. NUCLEAR REGULATORY COMMISSION

Reference: Beaver Valley Power Station, Unit No. 1
Docket No. 50-334
Control of Heavy Loads - NUREG-0612

Gentlemen:

Attached for your review are the itemized responses as requested by your letter dated December 22, 1980. The three Sections submitted are:

2.2 Specific Requirements for Overhead Handling Systems Operating in the Vicinity of Fuel Storage Pools.

2.3 Specific Requirements of Overhead Handling Systems Operating in the Containment.

2.4 Specific Requirements for Overhead Handling Systems Operating in Plant Areas Containing Equipment Required for Reactor Shutdown, Core Decay Heat Removal, or Spent Fuel Pool Cooling.

Very truly yours,

J. J. Carey
Vice President, Nuclear

cc: Mr. D. A. Beckman, Resident Inspector
U. S. Nuclear Regulatory Commission
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U. S. Nuclear Regulatory Commission
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Washington, DC 20555

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2.2 Requirements for Overhead Handling Systems in the Vicinity of Fuel Storage Pools

2.2.1 Identify by name, type, capacity, and equipment designator, any cranes physically capable (i.e., ignoring interlocks, moveable mechanical stops, or operating procedures) of carrying loads which could, if dropped, land or fall into the spent fuel pool.

RESPONSE

Name: Moveable Platform Crane
Type: Electric Overhead Traveling
Capacity: 2-10 Tons (each)
Equip. Designation: CR-27

Note: Incorrectly listed as 5 tons each in Table 1 of June 23, 1981 submittal

2.2.2 Justify the exclusion of any cranes in this area from the above category by verifying that they are incapable of carrying heavy loads or are permanently prevented from movement of the hook centerline closer than 15 feet to the pool boundary, or by providing a suitable analysis demonstrating that for any failure mode, no heavy load can fall into the fuel-storage pool.

RESPONSE

Fuel Cask Crane is shown on Figure 3A of the June 23, 1981 submittal on this subject. This crane travels the length of the Decontamination Building and into the northwest section of the Fuel Building. The Fuel Building is oriented such that the fuel cask crane travel does not pass over the spent fuel pool. The spent fuel cask laydown area is separated by a concrete wall (2 feet thick) from the spent fuel pool. The only penetration is a 24 in. slot to allow for passage of spent fuel elements into the laydown area. This slot is entirely above the storage level of the spent fuel elements in the pool, thereby providing assurance that the loss of water via the slot could not uncover the fuel. The movement of the fuel cask within the fuel cask laydown area is handled in a two-lift operation with both levels of cask placement resulting in the cask remaining below the top of the 2 foot thick concrete wall. The only time that the cask is lifted above the level of the wall is to clear the platform hoist rail at the side of the fuel building. The time over this point is minimal and the distance to the fuel pool is the maximum possible. Thus, the physical arrangement of the Fuel Building is such that a cask drop accident would not cause damage to the stored spent fuel assemblies.

2.2.3 Identify any cranes listed in 2.2-1, above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaulation (i.e., complete compliance with NUREG 0612, Section 5.1.6 or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in Attachment 1.

RESPONSE None

2.2.4 For cranes identified in 2.2-1, above, not categorized according to 2.2-3, demonstrate that the criteria of NUREG 0612, Section 5.1, are satisfied. Compliance with Criterion IV will be demonstrated in response to Section 2.4 of this request. With respect to Criteria I through III, provide a discussion of your evaluation of crane operation in the spent fuel area and your determination of compliance. This response should include the following information for each crane:

a. Which alternatives (e.g., 2, 3, or 4) from those identified in NUREG 0612, Section 5.1.2, have been selected.

RESPONSE Alternative 2

b. If Alternative 2 or 3 is selected, discuss the crane motion limitation imposed by electrical interlocks or mechanical stops and indicate the circumstances, if any, under which these protective devices may be bypassed or removed. Discuss any administrative procedures invoked to ensure proper authorization of bypass or removal, and provide any related or proposed technical specification (operational and surveillance) provided to ensure the operability of such electrical interlocks or mechanical stops.

RESPONSE The moveable platform crane spans the spent fuel pool and carries two electric hoists (one spent fuel and one new fuel). Fuel assemblies are moved within the spent fuel pool by means of a long-handled tool suspended from the hoist.

The hoist travel, tool, and sling length are designed to limit the maximum lift of a fuel assembly to a safe shielding depth. The motor-driven platform is also used to upend the new fuel assembly shipping container (its heaviest load). The upending operation consists of a hoisting motion concurrent with a traversing motion of the platform.

Although this is the heaviest load lifted by the crane, it is not truly a lifted load because the shipping container is never entirely lifted, only up-ended. Additionaly, this is not lifted near the spent fuel.

Further, the moveable platform load limit switch is set for 50 lb. over the weight of the fuel assembly and its handling tool. The crane design safety factor of 5 coupled with the load limiter results in a factor of safety of approximately 25.

In addition, loads in excess of 1.5 tons are prohibited from travel over the fuel assemblies in the Spent Fuel Storage Pool Building by Technical Specification 3.9.7. This restriction on movement of loads over fuel assemblies in the storage pool ensures that no more than the contents of one fuel assembly will be damaged in the event of a fuel handling accident. Thus, a fuel handling accident does not result in potential offsite exposures in excess of those listed in 10CFR100.

c. Where reliance is placed on crane operational limitations with respect to the time of the storage of certain quantities of spent fuel at specific post-irradiation decay times, provide present and/or proposed technical specifications and discuss administrative or physical controls provided to ensure that these assumptions remain valid.

RESPONSE Reliance is not placed on the time of storage of spent fuel.

d. Where reliance is placed on the physical location of specific fuel modules at certain post-irradiation decay times, provide present and/or proposed technical specifications and discuss administrative or physical controls provided to ensure that these assumptions remain valid.

RESPONSE Reliance is not placed on the physical location of specific fuel elements.

e. Analyses performed to demonstrate compliance with Criteria I through III should conform to the guidelines of NUREG 0612, Appendix A. Justify any exception taken to these guidelines, and provide the specific information requested in Attachment 2, 3, or 4, as appropriate, for each analysis performed.

RESPONSE Load drop analysis is not required in this case.

2.3 Requirement for Overhead Handling System in Containment

2.3.1 Identify by name, type, capacity, and equipment designator, any cranes physically capable (i.e., taking no credit for any interlocks or operating procedures) of carrying heavy loads over the reactor vessel.

RESPONSE

Name:	Containment Polar Crane		
Type:	Electric Overhead Circular Traveling		
Capacity:	Trolley No. 1	main hook	130 tons
		aux. hook	15 tons
	Trolley No. 2	main hook	130 tons
Equip. Designator:	CR-1		

2.3.2 Justify the exclusion of any cranes in this area from the above category by verifying that they are incapable of carrying heavy loads, or are permanently prevented from the movement of any load either directly over the reactor vessel or to such a location where in the event of any load-handling-system failure, the load may land in or on the reactor vessel.

RESPONSE (a) The Refueling Manipulator Crane (CR-5) lifts a maximum load of one fuel element and handling tool. By definition (NUREG-0612), this is not a heavy load. The results of a drop from this crane have been previously addressed in a detailed study entitled "Fuel Handling Accident Evaluation" dated October 31, 1977. In addition, the crane is scheduled to be modified to provide a dual cable hoist and various safety feature improvements.

(b) The Neutron Detector Carriage (CR-16) does not lift any heavy loads.

2.3.3 Identify any cranes listed in 2.3-1, above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG 0612, Section 5.1.6, or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in Attachment 1.

RESPONSE The Beaver Valley Unit 1 polar crane was designed with a minimum safety factor of 5 in accordance with EOCI Specification 61 and meets the later requirement of CMAA 70. The crane bridge was designed for 200 tons, with an occasional overload of 25 percent; and was capable of withstanding the one-time overload lift of 375 tons for the reactor vessel and a 345 ton lift with bridge rotation for each steam generator. The centerline of the 375 ton load was located between the centerline of bridge and a point 37 ft. from centerline of bridge toward the extended girder end.

See Enclosure 1 for the load-handling-system information specified in Attachment 1.

2.3.4 For cranes identified in 2.3-1, above, not categorized according to 2.3-3, demonstrate that the evaluation criteria of NUREG 0612, Section 5.1, are satisfied. Compliance with Criterion IV will be demonstrated in your response to Section 2.4 of this request. With respect to Criteria I through III, provide a discussion of your evaulation of crane operation in the containment and your determination of compliance.

<u>RESPONSE</u> There are no cranes in this category

2.4 Requirements for Overload Handling Systems in Proximity to Safe Shutdown Equipment

2.4.1 Identify any cranes listed in 2.1-1, above, which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small for all loads to be carried and the basis for this evaluation (i.e., complete compliance with NUREG 0612, Section 5.1.6, or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in Attachment 1.

<u>RESPONSE</u> As discussed in Section 2.1.3f and Section 2.33, the polar crane (CR-1) was conservatively designed such that the possibility of a load drop is small. In addition to the design features, the rigorous administration controls imposed by refueling procedures and comprehensive operator training provide an in depth defense against load drop. Further, the inclusion of NUREG 0612 requirements in maintenance procedures and of ANSI B30.2 requirements for inspection, testing, and maintenance will increase the margin of safety.

The load-handling-system information is provided in Enclosure 1

2.4.2 For any cranes identified in 2.1-1 not designated as single-failure-proof in 2.4-1, a comprehensive hazard evaluation should be provided which includes the following information:

a. The presentation in a matrix format of all heavy loads and potential impact areas where damage might occur to safety-related equipment. Heavy loads identification should include designation and weight or cross-reference to information provided in 2.1-3-c. Impact areas should be identified by construction zones and elevations or by some other method such that the impact area can be located on the plant general arrangement drawings. Figure 1 provides a typical matrix.

RESPONSE Table 1 shows the matrix of heavy loads and potential impact areas.

b. For each interaction identified, indicate which of the load and impact area combinations can be eliminated because of separation and redundancy of safety-related equipment, mechanical stops and/or electrical interlocks, or other site-specific considerations.

RESPONSE Table 1 provides this information.

c. For interactions not eliminated by the analysis of 2.4-2-b, above, identify any handling systems for specific loads which you have evaluated as having sufficient design features to make the likelihood of a load drop extremely small and the basis for this evaluation (i.e., complete compliance with NUREG 0612, Section 5.1.6, or partial compliance supplemented by suitable alternative or additional design features). For each crane so evaluated, provide the load-handling-system (i.e., crane-load-combination) information specified in Attachment 1.

RESPONSE This information is included in the response to 2.4.1

d. For interactions not eliminated in 2.4-2-b or 2.4-2-c, above, demonstrate using appropriate analysis that damage would not preclude operation of sufficient equipment to allow the system to perform its safety function following a load drop (NUREG 0612, Section 5.1, Criterion IV).

RESPONSE All interactions were eliminated.

Enclosure 1 to Attachment A

Load - Handling - System Data

Name:	Polar Crane (CR-1)
Crane Mfr:	P&H (a product of Harnischfeger)
Design Rated Load:	375 Tons (main trolleys)
	15 Tons (aux.hoist)
Max. Critical Load:	130 Tons (main trolleys)

The Beaver Valley Power Station - Unit No. 1 containment polar crane (CR-1) was purchased in 1969 prior to the publishing of NUREG-0554 (1979). The design was compared to the NUREG, and the results are outlined below.

SPECIFICATION AND DESIGN CRITERIA

This crane was designed and fabricated to comply with the requirements of EOCI Specification No. 61, however, it does meet the later requirements of CMAA 70. The design rated load exceeds the maximum critical load by almost a factor of 3. Its design took into account the containment environment to which it would be subjected.

A coldproof test as recommended as an alternative for operating plants (NUREG-0554) using a single dummy load equal to 1.25 times the MCL is not considered necessary for this polar crane. All construction loads were far in excess of this load and were performed over a period during which the containment was not closed and during the months of June thru December. A nondestructive examination of all critical areas was conducted after each construction lift.

The crane structure is fairly flexible and a review of crane drawings has not revealed any welds which would be susceptible to lamellar tearing. Most welds are small fillet welds. In most cases, welded parts on this crane are made of carbon steel. These steels have good weld ability. This crane was a shop fabricated structure and all welding was performed to manufacturers standard procedures.

The crane will perform only a limited number of lifts (several hundred) throughout the life of the plant. Of these lifts, the heaviest expected load is that of the reactor vessel head each refueling. Because the number of cycles is small and the maximum stresses are well below yield stress, fatigue failure is highly unlikely.

SEISMIC ANALYSIS

The method of analysis employed by the crane manufacturer (Harnischfeger Corp.) was computational in nature and was based upon the matrix displacement method (direct stiffness method). The first step in this method was to approximate the actual configuration as a structural framework which was defined as a stable system of uniform (constant cross section), weightless beam segments, and joints at which loads are applied and weights are lumped. This model information along with the structural loading (static loads and dynamic loading in the form of a shock spectra input) is used by the computer to perform the computations to provide the following information:

1. Displacements, shear and axial forces, and moments of members for static loadings.

2. Reactions and equilibrium checks at each joint for static loadings.

3. Frequencies and node shapes.

4. Displacements, shear and axial forces, and moments of members for each of first six forced nodes of vibration.

The polar crane meets the requirements of Regulatory Guide 1.29, "Seismic Design Classification" and is designed for all normal operating loads acting simultaneously with both horizontal and vertical seismic loading. The horizontal and vertical operating basis seismic loading is combined directly considering a single horizontal direction earthquake. The stress level due to these combined loading condition does not exceed 90 percent of the minimum yield strength. The following design cases were analyzed:

Case I — In this case the crane analysis considered the sum of the following:

Dead Load: This is the weight of all effective parts of the bridge structure, machinery parts, and the fixed equipment supported by the structure.

Live Load: This is wieght of the trolleys and the lifted load (rated capacity - 200 tons).

Impact Allowance: This is an additional load equal to 15 percent of the rated capacity.

Case II — In this case an analysis was performed considering all dead loads and a 380 ton construction live load.

Case III — In this case an analysis was performed considering all dead loads and a 418 ton test load.

Case IV

a — This analysis was for the operating base earthquake (OBE) considering the sum of all dead loads and live loads (no lifted load).

b. This analysis was for the design base earthquake (DBE) considering the sum of all dead loads and live loads (no lifted load).

SAFETY FEATURES

Crane motor controls are of the "dead man" type with spring return to "OFF" position. The bridge movement is controlled by four (4) self adjusting, hydraulically operated, brakes which are mounted on the bridge motor extension shaft and actuated by a foot lever located in the cab. Each main hoist and auxiliary hoist has three brakes, an eddy current load brake and two spring-set, electrically released, double shoe type load holding brakes. All are rated at 150 percent of motor full load torque. The holding brakes are automatically applied to the motor shaft when the motor is deenergized. The trolley traverse motor has a half-torque brake which is automatically applied to the motor shaft when the motor is deenergized. Limit switches have been provided to limit travel of the hoists in both the upward and downward directions.

HOISTING MACHINERY

The basic hoisting system used on the polar crane hoists consists of a hoist drum driven by an electric motor through a gearcase. The hoist drum is used to takeup and payout the wire rope used to raise and lower the load.

A magnetorque load brake rated for 150 percent of full motor torque is located between the motor and gearcase. The magnetorque is an electromagnet exerting torque on the motor to preload the motor and to provide the speed control of a normally loaded motor without the use of a mechanical load brake. Magnetorque control provides superior speed regulation over any other AC crane control and actually exceeds the control available with DC dynamic lowering control. An additional feature of Magnetorque control is that it is impossible for the load to lower with the controller on any hoist position. OFF position braking is a safety feature with Magnetorque control. With the controller in the OFF position, the Magnetorque unit is excited at a reduced voltage. In the case of an electric motor brake failure, the load will overhaul the hoisting unit, but the Magnetorque brake will exert a braking torque to slowly lower the overhauling load to the floor, thus preventing a free falling load.

In addition to the above braking system, each hoist is equipped with two (2) shoe-type electric brakes. These brakes are spring-set and electrically released.

The hoisting ropes used on the main hoists are 12-part, 1-1/8 inch, 6 x 37, extra-high-strength ropes with independent wire rope centers. The hoisting rope used on the auxiliary hoist is 4-part, 5/8 inch, 6 x 37 improved steel plow cable. The attachment of the cable ends to the the drums is such that if all but two wraps of the rope were unwound, the attachment would be strong enough to carry the load with a factor of safety of at least five.

Drums, sheaves, bottom blocks, and hoisting ropes were designed such that when raising or lowering, no twisting of the cables occurs. Bottom sheave blocks are of the enclosed type with guards to prevent cables from leaving the sheaves. Limit switches have been provided which limit the travel of hoists in the upward direction, thereby preventing two-blocking.

Maximum hoisting speed for the critical load for the polar crane is in compliance with the requirements of CMAA Specification #70.

A static load test was performed on each hook in addition to the 418-ton load test described under "Testing and Preventive Maintenance". Physical measurements of the hooks were taken prior to and after the load test and again after each special construction lift and were acceptable. Hooks were magnetic particle tested for cracks and flaws before and after the load test, and after each special construction lift. The hook bottom blocks and main pinion shaft fillets (on the drum side of each shaft) were ultrasonically tested for cracks and flaws at the same time.

BRIDGE AND TROLLEY

Bridge structure braking is accomplished by four type DH brake assemblies. All are shoe-type hydraulic applied and spring-released brakes. The DH type brake is self-adjusting and does not require any adjustments during normal operation. Depressing the pedal on the master cylinder, pumps hydraulic fluid to the wheel cylinder on the brake.

Trolley movement is controlled by a disc-type electric brake which is spring-set and magnetically released. Operating the motion control device associated with a crane motion closes the circuit which applies power to both the motor and brake coil. Energizing the brake coil pulls the armature which compresses the spring and releases the brake. Returning the motion control device to the OFF position, opens the circuit to both the motor and brake coil, and the spring sets the brake.

The crane speed limits are in compliance with those specified in Specification CMAA #70.

DRIVERS AND CONTROLS

The polar crane main hoists are driven by 50 HP wound rotor motors, while the auxiliary hoist is driven by a 15 HP motor. Each of the motors are protected by thermal overload relays and speed controlled by PVA timed Magnetorques. Hoisting movement is limited in the up direction by P&H type HB weight operated limit switches and in the down direction by geared type limit switches. All control circuits, hoisting, braking, and holding systems have been satisfactorily tested and are further described in other sections of this response. The complete operating control system and provisions for emergency controls for this crane are located in the operators cab on the bridge.

OPERATING MANUAL AND INSTALLATION INSTRUCTIONS

The requirements of NUREG-0554 concerning the manufacture's issuing of a manual of information and procedures for use in construction, checkout, testing, control and operation of the polar crane have been fully satisfied.

TESTING AND PREVENTIVE MAINTENANCE

After erection of the polar crane and prior to acceptance, the crane underwent a complete testing program and a 418-ton load test. This load test was 321% of the maximum critical load to be lifted by the crane. The test consisted of raising the 418-ton load 0.5 inches and stopping it to check the holding of the hoist brakes (duration of hold was one hour). After successful completion of this test, the load was raised at the lowest speed position possible (#3); and as the load came approximately one inch off the floor, the main power was shut off in the operator's cab. The brakes held satisfactorily under this loss of power. The load was then raised using the 3rd, 4th, and 5th speeds to a suitable height (about 15 feet). The load was then lowered through all five speeds, and when within one foot of the floor, the power was again shut off in the cab, and the brakes again held satisfactorily. The load was then raised to a height of 5 feet and the bridge and trolley travel were tested with the load traversing to the mid-span of the bridge.

At the completion of the above test, an NDT and a visual inspection was performed on the hooks and on the critical points.

A thorough visual examination of the entire crane was performed for evidance of permanent deflection or wear resulting from the load test. The crane was then used for the successful installation of the reactor vessel, pressurizer vessel, and three steam generators.

TABLE 1

LOAD/IMPACT AREA MATRIX

CRANE	LOAD	WEIGHT(TONS)	2.1.3.a Fig.	SAFETY RELATED EQUIPMENT	COORDINATES[1]	ELEVATION	HAZARD ELIMINATION CATEGORY
CR-9 (766'-7")*	NONE SPECIFIED	7.5	5C	RIVER WATER PIPING	K, 11 1/2	713	a[2],b
CR-15 (798'-4")*	SPENT FUEL SHPG.CASK	21.5	3A	FUEL POOL COOLING PIPING	P-R, 8 1/2	766	a[3],b,d
CR-17 (745'-0")*	RIVER WATER PUMP MOTOR	6.5 2.7	4	RIVER WATER PIPING SERVICE WATER PUMPS & PIPING (BVPS-2)	C-D, 2-6	705	a[5],b
	RAW WATER PUMP MOTOR	9.3 3.8	4	RIVER WATER PUMP & PIPING SERVICE WATER PUMPS & PIPING	C-D, 2-3 & 5-6	705	a,b
	ELECTRIC FIRE PUMP MOTOR	3.0 2.0	4	RIVER WATER PIPING	D-E, 2-3	666	a,b
	DIESEL FIRE PUMP ENGINE	3.0 1.9	4	RIVER & SERVICE WATER PIPING	D-E, 2-6	666	a,b
	HYDRO-PNEUMATIC TANK	1.2	4	RIVER WATER PIPING	D-3, 2-3	666	a,b
	REMOVABLE COVERS	4.3 (largest)	4B	RIVER & SERVICE WATER PUMPS & PIPING	C-E, 2-6	705	a,b
	SERVICE WATER PUMP & MOTOR	13.8	4	RIVER & SERVICE WATER PUMPS & PIPING	C-E, 3-6	705	a,b

TABLE 1

LOAD/IMPACT AREA MATRIX

CRANE	LOAD	WEIGHT (TONS)	2.1.3.a Fig.	SAFETY RELATED EQUIPMENT	COORDINATES[1]	ELEVATION	HAZARD ELIMINATION CATEGORY
CR-17 (745'-0")* cont.	TRAVELING[6] SCREENS	10.4 (heaviest)	4A				
	STOP LOGS[6]	10	4A				
CR-19[4] (751'-6")*	NONE SPECIFIED	13.9 (MAX)	NONE	CABLES ON THE LEVEL BELOW	F-H, 5-9	725	b
CR-20 (742'-0")*	CHARGING PUMP MOTOR	3.8 2.0	5C	REMAINING CHARGING PUMPS & PIPING	G [illegible]/8-J, 8 [illegible]/8-10 1/4	722	b[7]
	REMOVABLE COVERS	5.0 (MAX)	5C	REMAINING CHARGING PUMPS & PIPING	G 7/8-J, 8 7/8-10 1/4	722	b[7]
CR-21 (746'-0")**	COMPONENT COOLING WATER PUMP MOTOR	1.5 1.7	5C	AUX. BUILDING VENT. EXHAUST (CHARGING PUMP EXHAUSTS INTO THIS DUCT)	K-L, 9 3/8-11	732	b,c
CR-23 (760'-0")**	SEAL WATER HEAT EXCHANGER	1.1	5C	RIVER WATER PIPING	J-K, 11 1/2-13	730	d
	NON REGENERATIVE HEAT EXCHANGER	4.3	5B	" "	" "	"	d
	DEBORATING DEMINERALIZER	1.0	5B	" "	" "	"	d
	CESIUM REMOVAL ION EXCHANGER	1.0	5B	" "	" "	"	d

TABLE 1

LOAD/IMPACT AREA MATRIX

CRANE	LOAD	WEIGHT (TONS)	2.1.3.a Fig.	SAFETY RELATED EQUIPMENT	COORDINATES[1]	ELEVATION	HAZARD ELIMINATION CATEGORY
(cont.)	FUEL POOL ION EXCHANGER	1.0	5B	RIVER WATER PIPING	J-K, 11 1/2-13	730	d
	REMOVABLE COVERS	8.5 (largest)	5B	" "	" "	"	d
	SEAL FILTER REMOVAL SHIELD	7.5	5B	" "	" "	"	d
CR-24 ** A&B (782'-0")	REMOVABLE COVERS	6.0	5A	CHARGING AND VOLUME CONTROL PIPING	J-L, 8 7/8-9 3/8	753	a[8]
CR-27 ** (788'-6")	NEW FUEL SHIPPING CONTAINER	2.5 (fully loaded)	3B	FUEL POOL HEAT EXCHANGERS	P-R, 10 3/4-11 3/4	741	a,b,d[9]
	FAILED FUEL ASSY. STORAGE CAN	1.5 (full)	3A	FUEL POOL COOLING PIPING	M-R, 8 1/8-10 3/4	741	a

NOTES:

1. Coordinates are column designations from plant equipment location.
2. Redundant line: 24" - WR - 19 - 151 - Q3.
3. Redundant line: 6" - FC - 39 - 152 - Q3.
4. CR - 19 13.9 ton load limit discussed in 2.1.3.f remains in effect.
5. The entirely separate auxiliary intake structure provides redundancy as well as the redundant river water pumps and piping.
6. These loads, listed in response to 2.1.3c, are physically prevented (because of their size) from being lifted over any safety related equipment.
7. These lifts will be controlled to maintain the minimum lift height possible (generally less than 6") and to insure that the load passes over no floor opening other than that required to gain access to the affected equipment.

NOTES: cont.

8. In the unlikely case that a floor plug would be dropped in such a manner that it passed through the smaller sized floor opening and then damaged either boric acid transfer pump suction pipe (2"-CH-41-153WQ3 or 2"-CH-42-153W-Q3), the other transfer pump would remain unaffected and would continue to perform its intended function. Also emergency boration means exist by lining up operating charging pump with the borated refueling water supply tank.

9. This load is never fully lifted, only upended. In addition the lift is restricted by the crane safe load path. Finally, the fuel pool cooling system contains 100 percent redundant pumps and heat exchangers which would continue to perform their intended function in the event of a load drop sufficient to cause damage to either of the "a"or "b" train equipment. The river water system is also provided as an emergency means of cooling the spent fuel pool, if required.

* Elevation of the top of the crane rail.

** Elevation of the hook at maximum height.

HAZARD ELIMINATION CATEGORIES:

a. System redundancy and separation precludes loss of capability of system to perform its safety-related function following this load drop.

b. Sufficient administrative controls exist to prevent lifting this load to a height sufficient to penetrate the concrete floor separating the lifting device and load from the safety related equipment.

c. Sufficient time exists to allow repair of any damage caused by this drop before loss of capability of this system to perform its safety-related function would occur.

d. Administrative controls exist to maintain the load within the bounds of the safe load path and to prevent the movement of the load over the safety related equipment.