NORTHERN STATES POWER COMPANY

PRAIRIE ISLAND NUCLEAR POWER PLANT

PROJECT: 21-7450-292

NINE MONTH RESPONSE TO GENERIC LETTER 81-07

CONTROL OF HEAVY LOADS

NOVEMBER, 1981

CHICAGO, ILLINOIS 60606

Item 2.2 SPECIFIC REQUIREMENTS FOR OVERHEAD HANDLING SYSTEMS OPERATING IN THE VICINITY OF FUEL STORAGE POOLS

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

RESPONSE

Auxiliary building crane, and new & spent fuel handling gantry crane are the only cranes which are physically capable of carrying loads into the spent fuel pool area.

	Capacity		
Crane/Type	Main	Auxiliary	Location
Auxiliary Building Bridge Crane	125 Ton	25 Ton	Auxiliary Building
New & Spent Fuel Handling Gantry Crane	3 Ton		Spent Fuel Pool

Item 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

None *

Item 2.2.3 Identify any cranes listed in 2.2.1, above, that 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.

* The construction crane for the fuel storage expansion is not a permanent system and was approved for use by the NRC in License Amendments for Dockets 50-282/306 dated 5/13/81.

RESPONSE

The cranes identified in Section 2.2.1 are not in strict compliance with Section 5.1.6 "Single-Failure-Proof Handling Systems."

The exclusion of these cranes was discussed in NSP's August 1981 response to Section 2.1, "General Requirements for Overhead Handling Systems." The salient aspects which justify exclusion of cranes per Section 5.1.2 subsection 2 of NUREG 0612 are presented.

Auxiliary Building Crane

Sketch 17 shows relative locations of spent fuel pool, auxiliary building, and the travel path for the auxiliary building crane.

The fuel pool enclosure is a Class I reinforced concrete building with 12 to 24 inch thick walls and roof, that are integrally connected to the fuel pool structure. The fuel pool enclosure, which covers both new and spent fuel storage facilities, is completely contained in the auxiliary building and is beneath the auxiliary building crane. Normal and special ventilation systems are provided for the fuel pool. The fuel pool enclosure is provided with 3'-6" wide crane access slot and equipment handling doors. This physically limits the area of spent fuel pool over which fuel shipping casks or heavy objects can be moved. Administrative procedures prohibit the movement of heavy objects, except as allowed in the Technical Specifications, when fuel is stored in this area.

There are no routine operations which require opening of the access slots. Furthermore, the auxiliary building crane does not have room above the enclosure to carry any significant loads; hence, load drop on the roof is not possible. Besides, the slab is designed to withstand tornado missiles.

The access slot is provided over pool number 1, which is designed to store the spent fuel transfer casks. The loads lifted by the auxiliary building crane are restricted from reaching the boundary of pool number 2 by the physical size of the access slot. Spent fuel generally is stored in pool number 2. The wall common to the two pools does not have an opening below the top of the stored fuel. Hence, an accidental loss of water from pool number one will not uncover fuel stored in pool number 2.

The auxiliary building crane is also used for the handling of new fuel shipping containers. The shipping containers are not handled in the vicinity of safety related equipment.

The new fuel assemblies do not qualify as heavy loads as defined in NUREG-0612.

The storage capacity of the spent fuel in the pool has been increased. This increased capacity provides storage space for all spent fuel until approximately 1989 (with a full core reserve). Accordingly, no spent fuel cask handling operations are planned or anticipated until that time. Currently, NSP does not have a shipping cask at the Prairie Island site. Further evaluation will continue.

Spent Fuel Crane

The spent fuel crane is used for the handling of new and spent fuel assemblies (by means of a long handling tool suspended from a hoist), divider gates, and pool covers. The travel of hoist and tool length are designed to limit maximum lift of a fuel assembly to a safe shielding depth.

The spent fuel storage facility is a contained structure, designed so that in case of a dropped fuel element accident, any release of radioactivity to the atmosphere is monitored and will not exceed the guidelines of 10CFR100. Normal and special ventilation systems are provided for the fuel pool enclosures.

Handling of Pool Divider Gates

The pool divider gates are used to seal the fuel transfer openings located between pools 1 and 2 and between each pool and the fuel transfer canal. Each gate is a stainless steel device 27'-6" x 2'-2" x 3/4" and weighs approximately 2620 pounds. To reduce the likelihood of a gate drop due to a single failure of a crane, both hoists of the spent fuel pool bridge crane will be attached to the gate when the gate is moved in a pool containing fuel. The capacity of each hoist is 6000 pounds. The two hoist system will provide total redundancy, and the probability of dropping a gate carried in this manner will be extremely low.

For handling the divider gates, a written procedure is in force at the plant site. With these special provisions and procedures, the gates are not considered "heavy loads" as discussed in the NSP letter dated March 10, 1981 which provided supplemental information with respect to the fuel storage expansion.

Handling of Pool Covers

In addition to the procedures for fuel handling and divider gates, detailed written procedures exist for lifting pool covers by the crane (not higher than 6").

Spent fuel pool #1 covers consist of three pieces, each weighing 1.85 tons. The covers are made of 3/16" chick stainless steel plate welded to a frame of built-up, wide flange beams and structural tees of corten B. These covers are used to protect spent fuel stored in pool #1 when maintenance is being performed on pool #2. The pool covers are placed into position over pool #1 using a spent fuel pool bridge crane. Two 3-ton trolleys are used with rigging extending down from each hook. The rigging engages at each end of the pool cover to handle each section. The bottom edge of the cover is never lifted more than six inches above the floor. When the cover is moved above pool #1, the north and south ends of the cover extend past the edge of the fuel pool and over the floor at all times. This ensures that even if a cover section is dropped, it will land on the floor and will not fall into the fuel pool. Movement of the covers occurs very infrequently. No movement is anticipated after the completion of the spent fuel storage rack modification in 1982. A detailed discussion concerning the pool covers is included in the license amendment request for the fuel rack modification (Jan. 31, 1980) and supplements thereto, which were approved by the NRC on May 13, 1981.

Item 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.

Item 2.2.4(a) Which alternatives (e.g., 2, 3, or 4) from those identified in NUREG 0612, Section 5.1.2, have been selected.

RESPONSE

The auxiliary building crane meets criteria 2 of Section 5.1.2 of NUREG 0612.

As discussed in Section 2.2.3, the auxiliary building crane is physically limited from travelling over the spent fuel enclosure with any heavy load due to a very limited space above the enclosure.
The movement of the fuel shipping cask is restricted, inside the enclosure, by the 3' - 6" crane access slot in the enclosure. Therefore, the fuel shipping cask cannot be moved over pool# 2. The distance from the slot to the edge of pool # 2 is less than the 15 foot guidance.

Item 2.2.4(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 access slots are covered with equipment handling doors, and movement of cranes in the area is regulated by the administrative procedures.

Item 2.2.4(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

Not applicable.

Item 2.2.4(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

Not applicable.

Item 2.2.4(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

Not applicable.

Item 2.3 SPECIFIC REQUIREMENTS OF OVERHEAD HANDLING SYSTEMS OPERATING IN THE CONTAINMENT

Item 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

Manipulator crane and containment polar cranes are the only cranes that are physically capable of carrying heavy loads over the reactor vessel.

CAPACITY

	Main	Auxiliary	
Manipulator Crane	3 Ton		Containment Building
Containment Polar Crane	230 Ton	20 Ton	Containment Building

Item 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

None

Item 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

Manipulator Crane

The manipulator crane, in our opinion, meets the intent of Section 5.1.6 of NUREG 0612, "Single-Failure-Proof Handling System." The multitude of safety features and interlocks to prevent an accidental load drop for the crane are described in Section 9.5 of FSAR. The pertinent section is reproduced below.

The manipulator crane is a rectilinear bridge and trolley crane with a vertical mast extending down into the refueling water. The bridge spans the refueling cavity and runs on rails set into the floor along the edge of the refueling cavity. The bridge and trolley motions are used to position the vertical mast over a fuel assembly in the core. A long tube with a pneumatic gripper on the end is lowered out of the mast to grip the fuel assembly. The gripper tube is long enough that the upper end is still contained in the mast when the gripper end contacts the fuel. A winch mounted on the trolley raises the gripper tube and fuel assembly up into the mast tube. The fuel is transported while inside the mast tube to its new position. The manipulator can lift only one fuel assembly at a time.

All controls for the manipulator crane are mounted on a console on the trolley. The bridge is positioned on a coordinate system laid out on one rail. The electrical readout system on the console indicates the position of the bridge. The trolley is positioned with the aid of scale on the bridge structure. The scale is read directly by the operator at the console. The drives for the bridge, trolley, and winch are variable speed and include a separate inching control on the winch. Electrical interlocks and limit switches on the bridge and trolley drives protect the equipment. In an emergency, the bridge, trolley, and winch can be operated manually using a handwheel on the motor shaft.

Safety features are incorporated in the system as follows:

a. Travel limit switches on the bridge and trolley drives.

b. Bridge, trolley, and winch drives which are mutually interlocked to prevent simultaneous operation of any two drives.

c. A position safety switch, the GRIPPER TUBE UP position switch, which prevents bridge and trolley main motor drive operation except when it is actuated.

d. An interlock which prevents the opening of a solenoid valve in the air line to the gripper except when zero suspended weight is indicated by a force gage. As back-up protection for this interlock, the mechanical weight actuated lock in the gripper prevents operation of the gripper under load even if air pressure is applied to the operating cylinder.

e. The EXCESSIVE SUSPENDED WEIGHT switch, which opens the hoist drive circuit in the up direction when the loading is in excess of a preset limit.

f. An interlock on the hoist drive circuit in the up direction, which permits the hoist to be operated only when either the OPEN or CLOSED indicating switch on the gripper is actuated.

g. An interlock of the bridge and trolley drives, which prevents the bridge drive from traveling beyond the edge of the core unless the trolley is aligned with the refueling canal centerline. The trolley drive is locked out when the bridge is beyond the edge of the core.

Suitable restraints are provided between the bridge and trolley structures and their respective rails to prevent derailing, and the manipulator crane is designed to prevent disengagement of a fuel assembly from the gripper in the event of a Design Basis Earthquake.

The operation of the crane is also covered by administrative controls and procedures.

Polar Crane

The containment polar crane identified in Section 2.3.1 is not in compliance with Section 5.1.6, "Single-Failure-Proof Handling Systems."

Item 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 evaluation of crane operation in the containment and your determination of compliance. This response should include the following information for each crane:

> Where reliance is placed on the installation and use of electrical interlocks or mechanical stops, indicate the circumstances under which these protective devices can be removed or bypassed and the administrative procedures invoked to ensure proper authorization of such action. Discuss any related or proposed technical specification concerning the bypassing of such interlocks.

RESPONSE

The containment polar crane is used for the handling of missile shields, reactor vessel head, upper and lower internals, in-service inspection tools reactor coolant pump components and pressurizer safety valves.

The heavy load handling operations and maintenance of the polar crane in the reactor building are controlled by the administrative procedures listed in Table 1. The safe load paths for various loads are defined in NSP procedures D58, "Control of Heavy Loads," as all paths except:

a. With the reactor head removed, the Reactor Building crane, main or auxiliary, load blocks with attached loads greater than 2100 pounds shall not be moved within 15 horizontal feet of the irradiated fuel without specific written procedures.

b. With the pressurizer missile shield removed, the Reactor Building crane load blocks with attached loads, greater than 4 tons shall not be moved over the open pressurizer vault.

The safe load paths for various loads are shown in sketches 18.

Safe shutdown equipment is that equipment required for continued decay heat removal and for maintaining the plant shutdown. The steam generators and/or residual heat removal systems are required per T.S.3.1. Since no single load can be carried over both steam generators, the auxiliary feedwater, main feedwater, and steam piping in containment is considered part of the safe load path.

A completely redundant residual heat removal piping system is provided in the reactor building. The physical separation between the redundant piping in our judgment is adequate to preclude damage to both systems due to a single heavy load drop accident.

Current reactor vessel head removal procedures D3 and reactor vessel head replacement procedures D7 will be modified prior to the next refueling outage such that the head removal and replacement will commence only after ascertaining that the two valves in both the supply and exhaust ducts are closed to isolate the containment vessel.

TABLE 1

HEAVY LOAD HANDLING OPERATIONS

COMPONENT	PROCEDURE
Reactor Vessel Head Removal	D3 Section 4.26, 4.27
Reactor Vessel Head Replacement	D7 Section 4.7
Upper Internals Removal	D4.1 Section 2.0
Upper Internals Replacement	D6.1 Section 2.0
Lower Internals Removal	D4.2 Section 2
Lower Internals Replacement	No Procedure Written*
Reactor Vessel Missile Shield Removal	D3 Section 4.28
Reactor Vessel Missile Shield Replacement	D7 Section 4.23
Pressurizer Missile Shield Removal/ Replacement	D58.3.1
Reactor Coolant Pump Motor	No Procedure Written*
Reactor Vessel ISI Tool	No Procedure Written*
Reactor Coolant Pump Internals	No Procedure Written*

MAINTENANCE, TESTING & INSPECTION PROCEDURES FOR CRANES

CRANE/INSPECTION	REFERENCE
11, 21 Reactor Bldg. Polar Crane Mechanical Inspection	PM 3160-1
11, 21 Reactor Bldg. Polar Crane Electrical Inspection	PM 3160-11
11, 21 Internals Lifting Rig Inspection	PM 3560-51
11, 21 Reactor Head Lifting Rig Spreader Assembly Inspection	PM 3560-52
Manipulator Crane	PM 3160-6

*Procedures will be written prior to handling of these loads and will take into consideration circumstances present at the time.

Item 2.3.4(b) Where reliance is placed on other, site-specific considerations (e.g., refueling sequencing), provide present or proposed technical specifications and discuss administrative or physical controls provided to ensure the continued validity of such considerations.

RESPONSE

See response to Section 2.2.4(a).

Item 2.3.4(c) Analyses performed to demonstrate compliance with Criteria I through III should conform with 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

Compliance with NUREG 0612 Guidelines 5.1-I

During refueling operations the containment air quality is maintained by ventilation. Each containment vessel is serviced by the containment purge system, which provides a supply of fresh tempered air at a rate that will result in 1-1/2 air changes per hour (33000 CFM). This system is common to both Units 1 and 2 and has been designed to ventilate only one unit at a time. The system supply and exhaust ducting is provided with a string of valves and dampers which line the system up with the containment vessel for either Unit 1 or Unit 2. Supply air is provided by an axial fan from the discharge of the auxiliary building make-up fan 22. Exhaust air is drawn through a particulate filter and discharged to the atmosphere through the Unit 1 shield building exhaust vent. All requirements common to both units for the containment purge system are located in the auxiliary building near the Unit 1 shield building.

The containment vessel is isolated by the closing of two valves in both the supply and exhaust ducts. The valves in each duct are located adjacent to the containment vessel; one inside and one outside. Radiation releases resulting from fuel damaged by the drop of the reactor vessel head will be precluded by the administrative procedure requirement that the containment purge system isolation valves be closed before the reactor head and upper internals are lifted above the reactor vessel.

Compliance with NUREG 0612 Guideline 5.1 II

The neutronics analysis for the PWR Core is evaluated on the basis of the NUREG-0612 criteria (page A-5) and the value given in table 3.2.1 of the FSAR.

K_{eff} for the uncrushed core in 2000 ppm boron concentration is 0.90. Then using the estimated .05 maximum reactivity insertion due to crushing, the maximum achievable K_{eff} is still less than 0.95, which meets the requirement of the NUREG.

Compliance with NUREG 0612 Guidelines 5.1 III

An accidental drop of the reactor vessel head and the lifting gear onto the vessel during a heavy load handling operation was postulated with the following conservative assumptions.

- Maximum drop of vessel head is 23 feet.
- Refueling pool is empty at the time of head drop.
- Seals for the refueling pool will be broken as a result of a load drop.
- Reactor coolant loop may crack due to the load drop.
- Plastic impact between reactor vessel head and the pressure vessel.

The result of the load drop analysis concluded that under the postulated head drop, both 4" diameter SI lines will remain functional. They will, therefore, be able to provide borated water to the reactor vessel to make up for any water lost due to boil off.

Item 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

Item 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.

RESPONSE

Manipulator cranes in containment building satisfy single failure proof criteria of NUREG 0612, Section 5.1.6.

The detailed discussion for cranes are presented in Section 2.1. Item 2, subsection J of reference 1, and Section 2.3.3 of this report.

Item 2.4.2(a) For any crane 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:

> 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

Attachment I lists all overhead load handling systems in the plant. The remarks column of the attachment provides final disposition of the crane.

Attachment II shows physical location for the load handling systems in the plant.

Attachment III lists the primary function of the load handling systems, weight and size of items handled by them.

Item 2.4.2(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. Elimination on the basis of the aforementioned considerations should be supplemented by the following specific information:

(1) For load/target combinations eliminated because of separation and redundancy of safety-related equipment, discuss the basis for determining that load drops will not affect continued system operation (i.e., the ability of the system to perform its safety-related function).

RESPONSE

The "remarks column" of Attachment I summarizes criteria for the exclusion of heavy load handling systems. The safe shutdown equipment in the vicinity of the cranes and their redundant systems are discussed in NSP's response to Section 2.1, Item 2 (Reference 1).

The cranes and equipment not discussed in Section 2.1 are presented here.

Portable 5-Ton Trolley above RHR Hx Removal Hatch

See Attachment II, Sketch 4 for various locations of the trolley.

The trolley is used for maintenance of RHR heat exchangers. Each unit has two heat exchangers which are redundant to one another. The use of the crane will be under administrative controls. The operability of the redundant exchanger will be established prior to using the crane. The trolley is excluded from further considerations on the basis of redundancy and operational controls.

Temporary 1-Ton Trolley - Fuel Rack Job

See Attachment II, Sketch 5, for location of the trolley.

It is conceivable that during an accident, the trolley could rupture component cooling water pipe from the spent fuel heat exchanger. The pipe can be isolated easily without affecting

the operation of the reactor and without causing significant radiation problems. The crane is excluded from further considerations.

1-Ton Trolley - Above Relief Header

See Attachment II, Sketches 11 & 14 for location of the trolleys.

The trolleys are used only for maintenance of the main steam safety valve and will not be operated when the pipe is pressurized or when containment integrity cannot be violated as described in Technical Specification TS 3.6.A.

Damage to main steam relief header or to control valve CV 31089 is not critical when the pipe is not pressurized.

Auxiliary Building special vent filter and ducts are approximately five feet away from the monorail and are not susceptible to any conceivable load drop accident of the crane. A continued use of the reactor in case of one train of the Auxiliary Building special ventilation system being operable is governed by Technical Specifications TS 3.6.3 and 5. The trolleys are excluded on the basis of operational controls.

(2) Where mechanical stops or electrical interlocks are to be provided, present details showing the areas where crane travel will be prohibited. Additionally, provide a discussion concerning the procedures that are to be used for authorizing the bypassing of interlocks or removable stops, for verifying that interlocks are functional prior to crane use, and for verifying that interlocks are restored to operability after operations which require bypassing have been completed.

RESPONSE

The mechanical stops are planned for the following heavy load handling systems.

1. Six-ton trolleys above residual heat removal pit covers.

2. Turbine building cranes.

Six-Ton Trolleys

The mechanical stops for six-ton trolleys will consist of installing two angle irons on the monorails. The stops will be

located at quarter span from each end of the monorail. The removal of both mechanical stops will not be permitted except when repair or maintenance of the monorail is required. The removal of one of the two stops will be governed by the administrative procedures.

Turbine Building Cranes

NSP is presently studying the possibility to install weight sensors and an automatic power switch-off device for the turbine building cranes.

There is no safeguard equipment on the operating floor of the turbine building. However, redundant 4.16 kV switchgears are located in a Class I aisle between column rows 8 and 10 below the operating floor. It is conceivable that a load drop accident with a lifted load in excess of 12,500 lbs may cause excessive scabbing of the 18-inch thick concrete floor and damage the buses. In spite of the fact that the possibility of damaging both the redundant systems is extremely remote, NSP is investigating possible modifications to the crane. Possibilities include modifications such that lifting the loads in excess of 12,500 lb will require additional administrative control or making the crane single-failure proof. Detailed design analyses and feasibility studies will be done on several approaches before selecting one for implementation. Additional information will be submitted when a crane modification is selected.

(3) Where load/target combinations are eliminated on the basis of other, site-specific considerations (e.g., maintenance sequencing), provide present and/or proposed technical specifications and discuss administrative procedures or physical constraints invoked to ensure the continued validity of such considerations.

RESPONSE

None

Item 2.4.2(c) For interactions not eliminated by the analysis of 2.4.2(b), above, identify any handling systems for specific loads that 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).

RESPONSE

None

Item 2.4.2(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

None

REFERENCE

1: Letter of transmittal to US NRC from L. O. Mayer, Aug 31, 81 with a report entitled, "Control of Heavy Loads, NRC Generic Letter 81-07," by NSP Co., Prairie Island Nuclear Generating Plant, Aug 31, 1981.

ATTACHMENT 1

OVERHEAD HANDLING SYSTEMS

			Remarks *
A.	SCREENHOUSE		
1.	Elev. 675' - NF-39260-2		
	"A" - 2 Ton Trolley over #21 Cooling Water Pump		X
	"B" - 2 Ton Trolley over #11 Cooling Water Pump		X
2.	Elev. 695' and above - NF-39260-1		
	"A" - Fish Basket - Monorail and Chain Hoist		X
	"B" - Chlorine House - Monorail and Chain Hoist		X
	"C" - 2 Ton Trolley above Unit #2 Circ. Wtr. Pumps Bay		X
	"D" - 22 Cooling Water Pump Trolley - 3 Ton		O,R
	"E" - Moveable Strainer Trolley - 1/2 Ton (can be moved to any of 4 strainers)		X
	"F" - 11 Cooling Water Pump Trolley - 3 Ton		O,R
	"G" - Screenhouse Crane - (Trvlng Screen Crane) - 5 Ton		X
	"H" - Outside Gate Slot Trolley - Electric Chain		X
	"I" - Trash Rake		X
B.	GROUND FLOOR - ELEV. 695'		
1.	East - NF-39202		
	"A" - 2 Ton Swivel Trolley - Gas House	Outside	X
	"B" - 3 Ton Trolley - Gas Bottle Service	Outside	X
	"C" - D-2 Diesel Generator - Trolley 5 Ton	Ha-2	O,R
	"D" - D-1 Diesel Generator - Trolley 5 Ton	Ka-2	O,R
	"E" - 5 Ton Trolley - #11 & #12 Feedwater Pumps	F-5	X
	"F" - 6 Ton Trolley - Above RHR Pit Covers	H-5.5	M
	"G" - 2 Ton Trolley - Maintenance Area	J-9	X
	"H" - Trolley Rail Hot Machine Shop Decon. Area	J-10	X
	"I" - 2 Ton Trolley - Trash Compactor Area	Q-9a	X
2.	West - NF-39203		
	"A" - 5 Ton Trolley - #21 & #22 Feedwater Pumps	F-13	X
	"B" - 6 Ton Trolley - Above RHR Pit Covers	H-12.5	M
	"C" - 2 Ton "Swing" Trolley - Hot Machine Shop	K-11	X
	"D" - 1 Ton Trolley - Hot Machine Shop	K-11.5	X
C.	MEZZANINE FLOOR		
1.	East - NF-39204		
	"A" - 10 Ton Trolley - Condensate Polishing	A-4.5	X
	"B" - 6 Ton Trolley - Condensate Polishing	A-5	X
	"C" - 6 Ton Trolley - Condensate Polishing	A-5.5	X
	"D" - Portable 5-Ton Trolley - Above RHR Hx Removal Hatch	H-5	O,R
	"E" - Temporary 1-Ton Trolley - Fuel Rack Job	P-8	E

*See bottom of next page for explanation of remarks.

Attachment 1

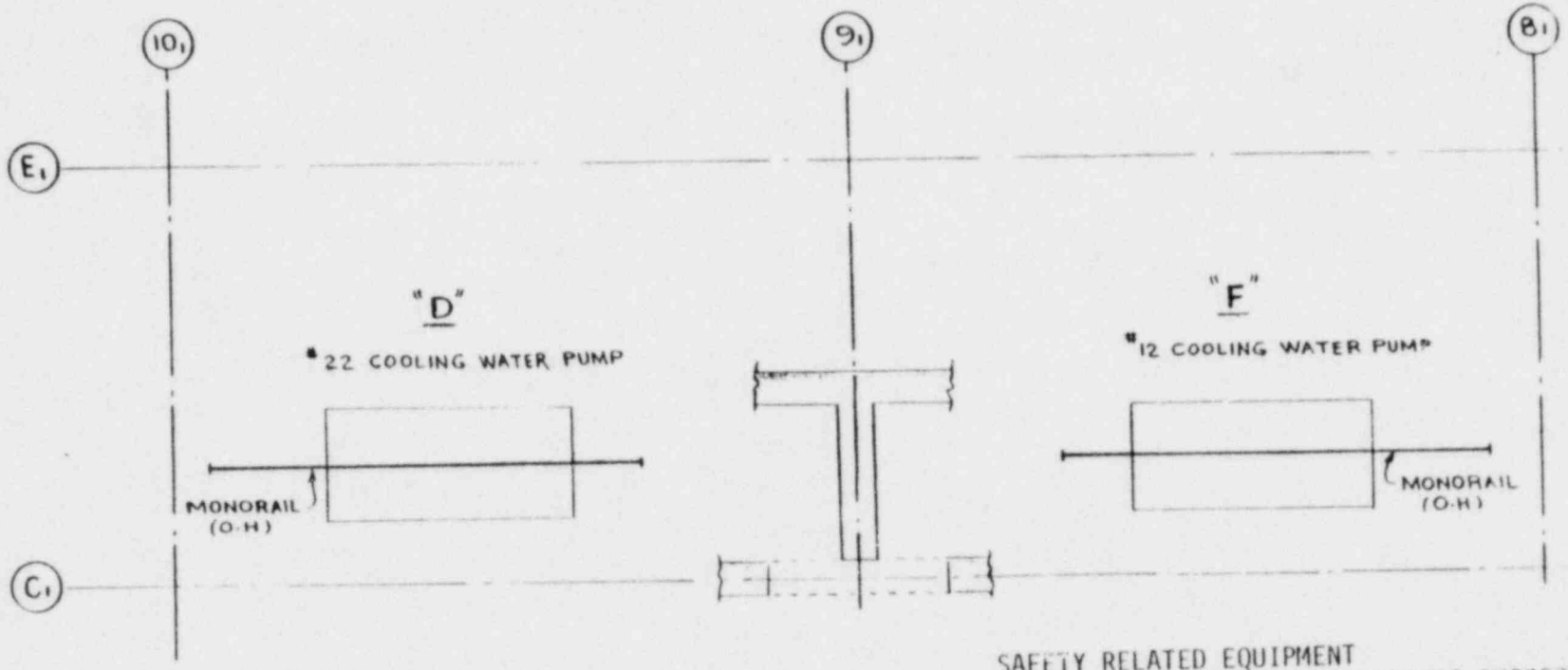
Overhead Handling Systems (continued)		Remarks*
2. West - NF-39205		
"A" - 6 Ton Trolley - Condensate Polishing	A-12.5	X
"B" - 6 Ton Trolley - Condensate Polishing	A-13	X
"C" - 6 Ton Trolley - Condensate Polishing	A-13.5	X
"D" - Portable 5 Ton Trolley Above RHR H_x Removal Hatch	H-12	O,R
D. OPERATING FLOOR		
1. East - NF-39206		
"A" - 2 Ton Swing Trolley - Maintenance Shop	F-2	X
"B" - Maintenance Shop Crane	(F-Ma)-(1-2)	X
"C" - 1 Ton Trolley Above MSIV	J-6	R
"D" - Trolley - between MS and FW Lines	J.7-6	O
"E" - 6 Ton Trolley - Demin Equip Hatches	K.5-(8-10)	X
"F" - 6 Ton Trolley - Demin Equip Hatches	L.2-8	X
"G" - 6 Ton Trolley - Demin Equip Hatches	L.2-10	X
"H" - 1 Ton Trolley - 30" MS Relief Hdr	N.5-6	O
"I" - Filter Room Crane	(L.5-M.5)-(7-11)	R
2. West - NF-39207		
"A" - 1 Ton Trolley Above MSIV	J-12	R
E. FUEL HANDLING & VENT FAN ROOM - EAST		
1. East - NF-39208		
"A" - 1 Ton Trolley Above - SFP Special & In-service Purge Filter	G.5-6.5	R
"B" - Trolley Above Relief Header	J.5-5.5	O
"C" - Manipulator Crane	Containment	O,S
"D" - SFP Crane	S.F.P.	E
"E" - 3 Ton - New Fuel Handling Crane	P-10	E
2. West - NF-39209		
"A" - Trolley above Safety Relief Header	J-12.5	O
"B" - Manipulator Crane	Containment	S
F. OTHERS		
"A", "B" - Turbine Bldg. Cranes (2)	Turbine Bldg.	F
"C" - Aux Bldg Crane	Aux. Bldg.	O, E
"D", "E" - Containment Polar Cranes (2)	Containment	E, O, R

*Explanation of Remarks

E: Exclusion on the basis of damage due to an accident will be within guidelines of the Generic Letter 81-07.
F: Further Investigation in Progress.
M: Crane travel will be limited by mechanical stops.
O: Plant operational procedural controls will be exercised.
R: Exclusion on the basis of redundant systems.
S: Single failure proof crane
X: Exclusion on the basis of no safeguard equipment in the vicinity of crane.

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL WITH 3 TON HOIST FOR COOLING WATER PUMPS A-2D
A-2F



SAFETY RELATED EQUIPMENT

1. DIESEL COOLING WATER PUMP
2. AIR COMPRESSOR MOTOR & CONTROLS
3. VARIOUS CONDUITS
4. PS16161, PS16184, PS16282, PS16283,
5. SV-33693, SV33828, SV33829, SV33696 FOR COMBUSTION AIR DAMPERS CD-34136 & CD-34139
6. FUEL OIL DAY TANK & PIPING
7. UNIT HEATER
8. PULL BOX 1281
9. AIR RECEIVERS
10. STATION AIR LINES

SCREENHOUSE

PLAN AT EL. 695'-0

(REF. DWG. NO. NF 39260-1)

N

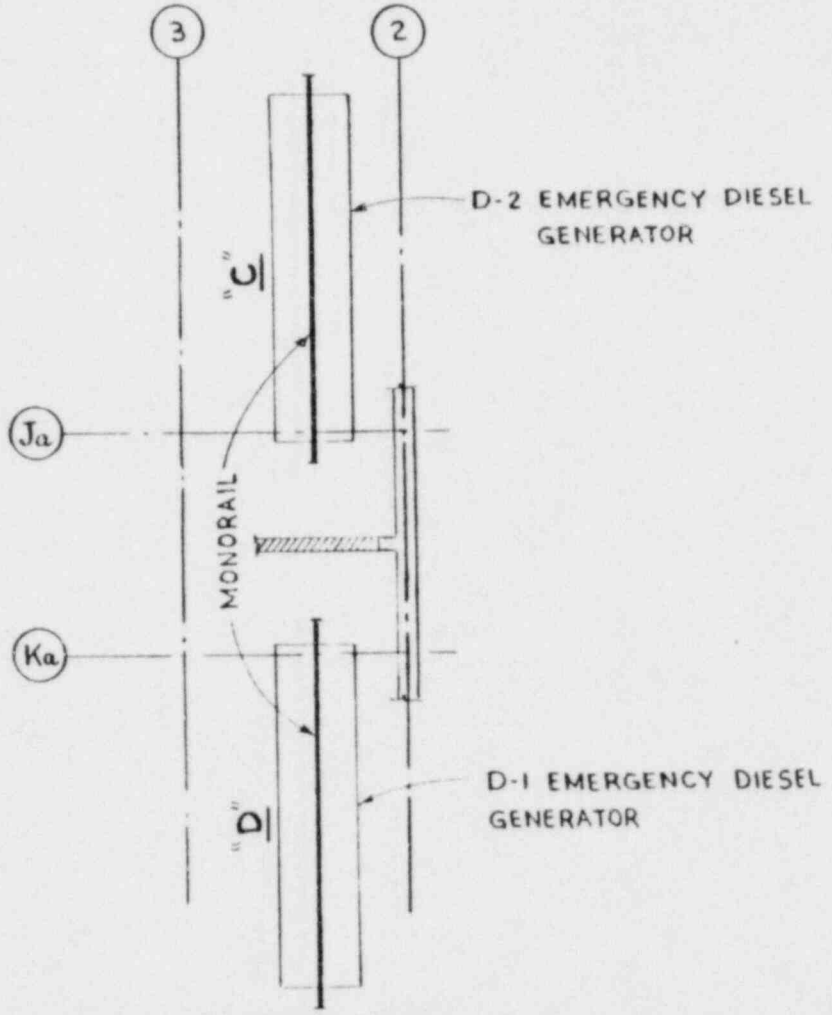
FLUOR POWER SERVICES, INC.

PREPARED BY: O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-1

(24)

CONTROL OF HEAVY LOADS - OVERHEAD HANDLING SYSTEM

MONORAIL WITH 5 TON HOIST FOR EMERGENCY DIESEL GENERATORS B-1C B-1D



GROUND FLOOR
PLAN AT EL. 695'-0
(REF. DWG. NO. NF 39202)

SAFETY RELATED EQUIPMENT
1. DIESEL GENERATOR & CONTROLS
2. AIR COMPRESSOR & CONTROLS
3. VARIOUS CONDUITS, LADDERS & TRAYS
4. SV-33498, SV-33987 FOR DIESEL GEN. DAMPERS CD-34049 & CD-34049
5. FUEL OIL PIPING

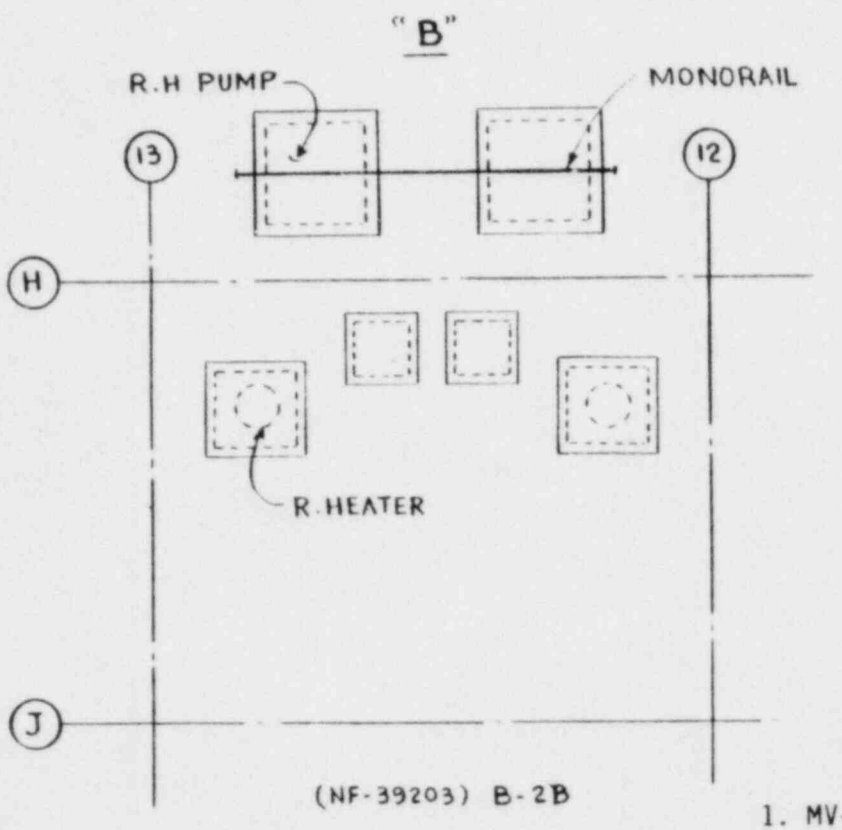
N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-2

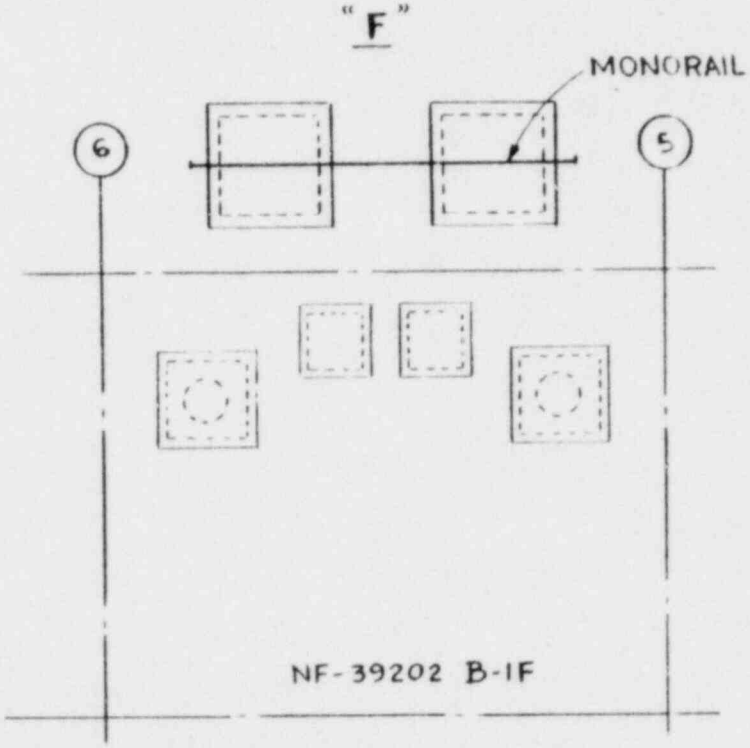
(25)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL WITH 6 TON HOIST FOR REMOVAL OF RESIDUAL HEAT COMPONENTS. B-1F
B-2B



(NF-39203) B-2B



NF-39202 B-1F

SAFETY RELATED EQUIPMENT

1. MV-32129 (22 RSDL HEAT EXGR COMP. CLNT. INLT. MV)
2. MV-32128 (21-RSDL. HT. EXGR COMP. CLNT. INLT. MV)
3. #22 RHR PIT SUMP CONTROL STATION
4. #21 RHR PIT SUMP CONTROL STATION
5. 11 & 12 RESIDUAL HEAT PIT SUMP CONTROL BOXES.
6. MV-32094 (12 RSDL. HEAT EXGR. COMP. CLNT. INLT. MV)
7. AUX. BLDG. SPEC. VENT. DUCT

GROUND FLOOR,
PLAN AT EL. 695-0
(REF. DWG. NO. NF-39202 & NF 39203)

N

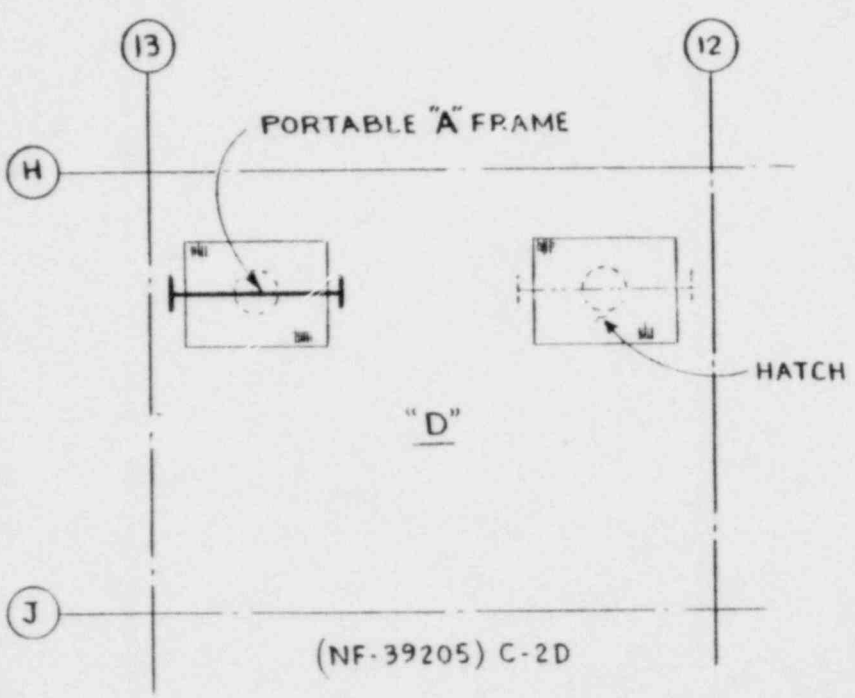
FLUOR POWER SERVICES, INC.

PREPARED BY D.R.	PROJ NO 21-7450-292
CHECKED BY L.G.	SK 5

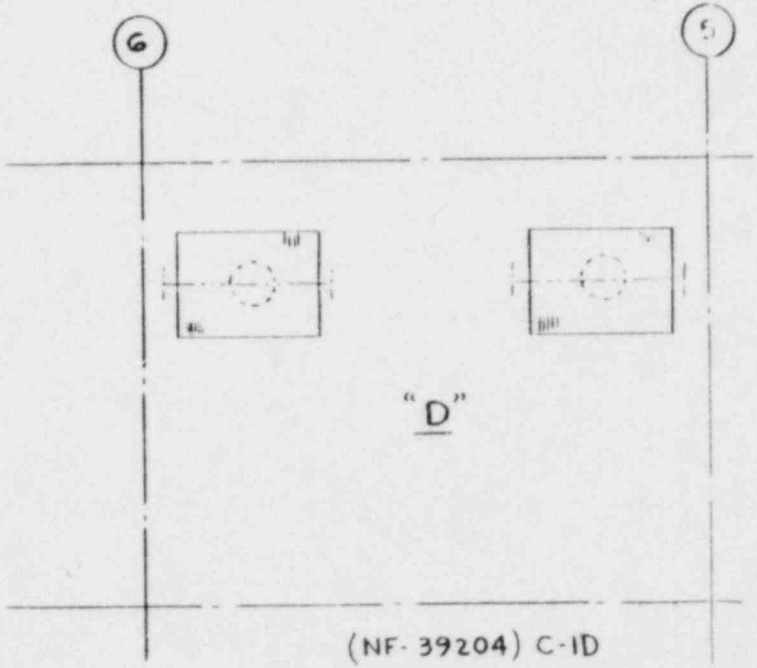
(92)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

PORTABLE 5 TON "A" FRAME FOR RESIDUAL HEAT EXCH. REMOVAL.
(ONE PORTABLE FRAME SERVES 4 LOCATIONS) C-1D
C-2D



(NF-39205) C-2D



(NF-39204) C-1D

SAFETY RELATED EQUIPMENT

1. CONTAINMENT FAN COIL DAMPER CONTROL PANEL UNITS 11 & 13
2. VALVE OPERATOR RHR 4-1 ON EL. 695'-0
3. P.T-21161 (RESIDUAL HEAT REMOVAL PUMP DSCH PRESSURE TRANSMITTER
4. TRAY 1AR-TB3 AND LADDER 1AG-LB10

MEZZANINE FLOOR
PLAN AT EL. 715'-0
(REF. DWG. NO. NF 39204 & NF 39205)

N

FLUOR POWER SERVICES, INC.

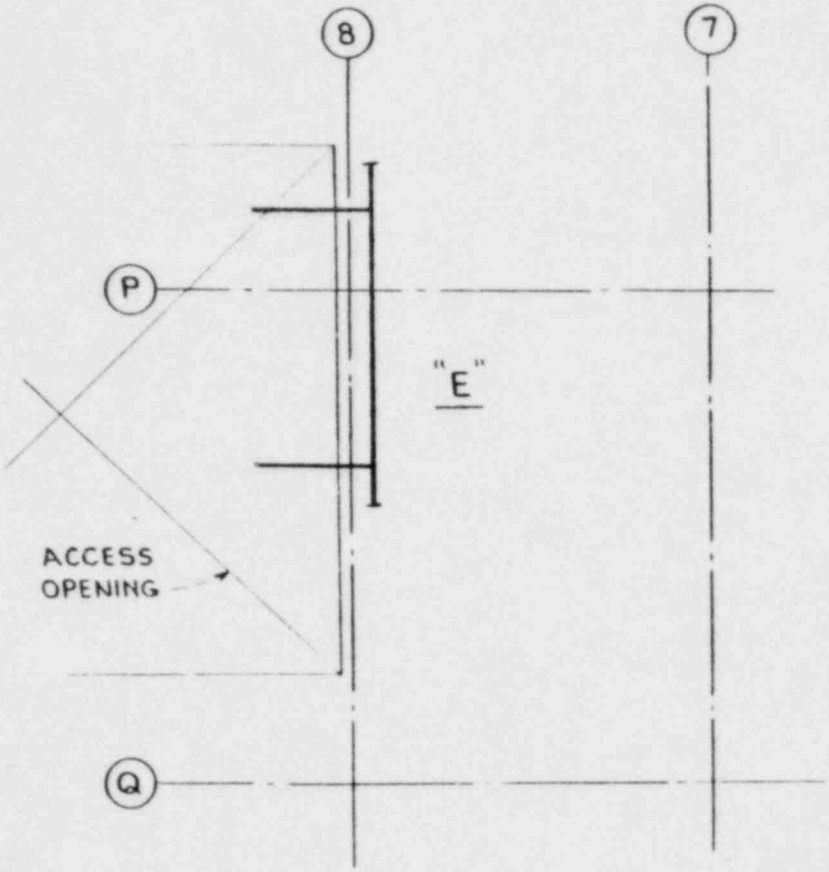
PREPARED BY D.F PROJ. NO 21-7450-292

CHECKED BY L.G SV-1

(27)

CONTROL OF HEAVY LOADS - OVERHEAD HANDLING SYSTEM

TEMPORARY 1-TON TROLLEY FOR FUEL RACKS. C-1E



(82)

SAFETY RELATED EQUIPMENT
1. COOLING WATER PIPE COMPONENTS
2. SPENT FUEL HEAT EXCHANGER

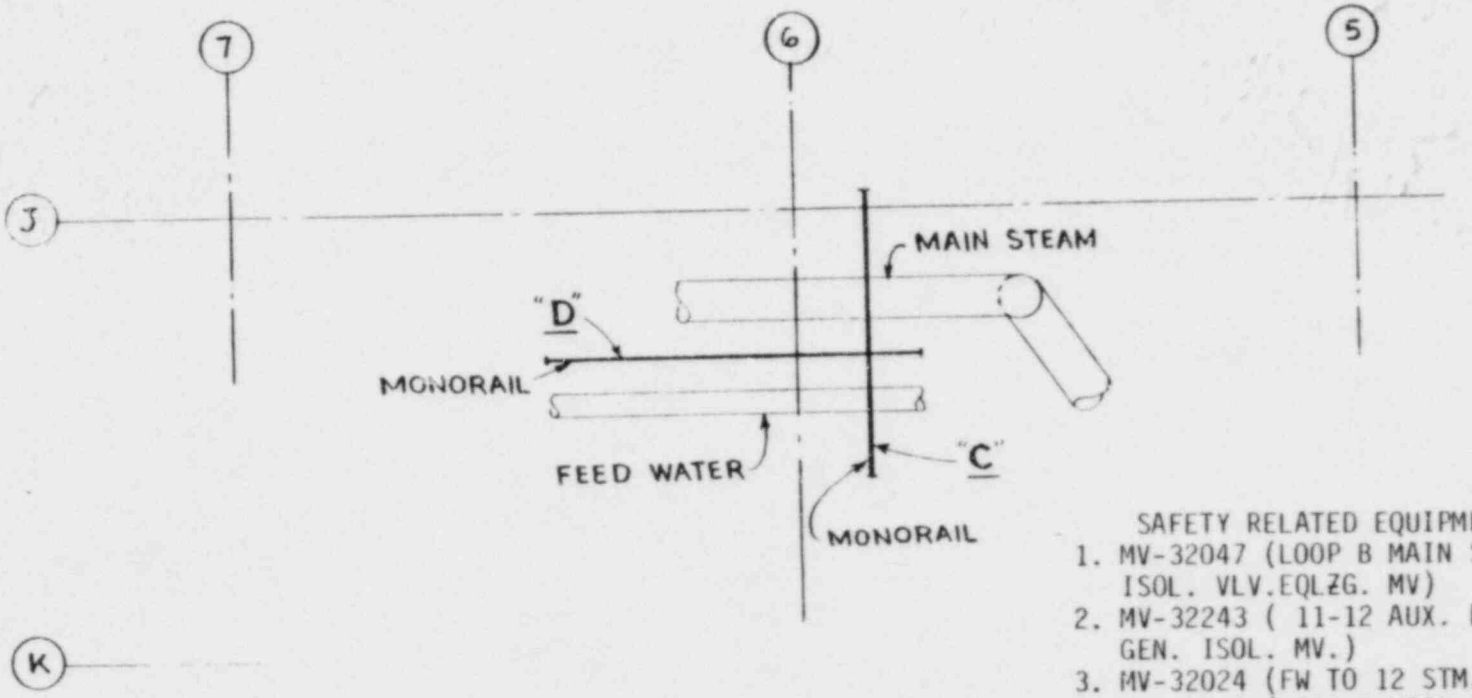
MEZZANINE FLOOR
PLAN AT EL. 715-0
(REF. DWG. NO. NF-39204)

N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-5

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL WITH 1-TON HOIST FOR MAIN STEAM ISO. VALVE. D-1C
AND SERVICE OF MAIN STEAM AND FEED WATER LINES D-1D



SAFETY RELATED EQUIPMENT

1. MV-32047 (LOOP B MAIN STEAM HEADER ISOL. VLV.EQLZG. MV)
2. MV-32243 (11-12 AUX. FW TO 12 STM. GEN. ISOL. MV.)
3. MV-32024 (FW TO 12 STM. GEN. ISOL. MV)
4. MV-32017 (LOOP B MAIN STEAM TO 11 TO AUX. FW PUMP MV.)
5. CONTROL BOX FOR CU-31099 (12 LOOP B MAIN STEAM HDR. ISOL. CV.
6. CV31370 & ASSOC. SV's & LIMIT SWITCHES (FW TO 12 STM. GEN. BYPASS CV.)

OPERATING FLOOR
PLAN AT EL. 735-0
(REF. DWG. NO NF.39206)

N

FLUOR POWER SERVICES, INC.

PREPARED BY O.R PROJ NO. 21-7450-292

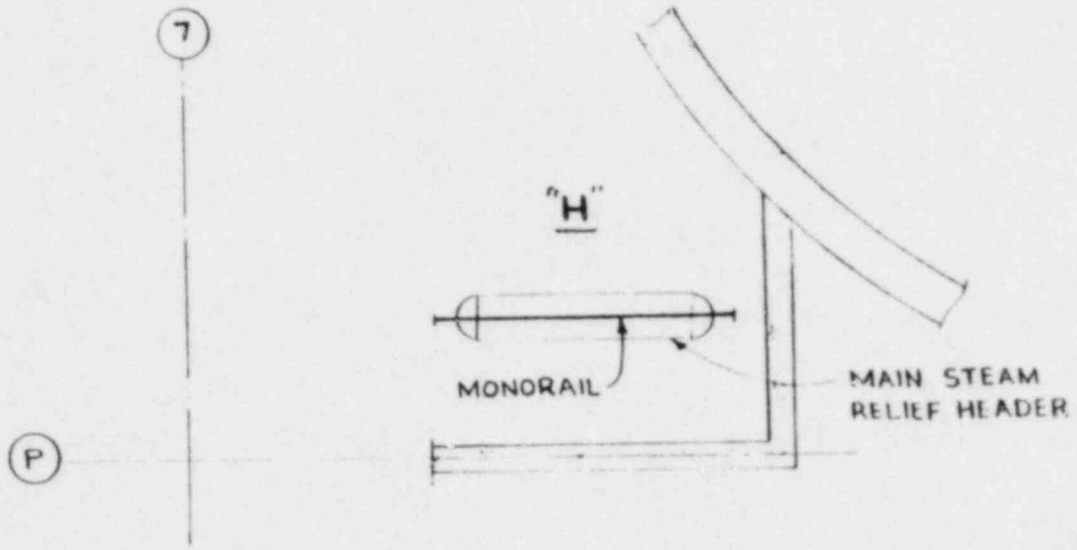
CHECKED BY L.G SK-6

(29)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL WITH 1 TON HOIST FOR MAIN STEAM RELIEF HEADER

D-1H



SAFETY RELATED EQUIPMENT

1. MV32016 (LOOP A MN. STM TO 11 TD AUX FW PMP MV.)
2. 1 CA-123 OVER CRANE & WITHIN
   1 LA1-26 4'-0

OPERATING FLOOR

PLAN AT EL. 735'-0

(REF. DWG. NO. NF-39206)

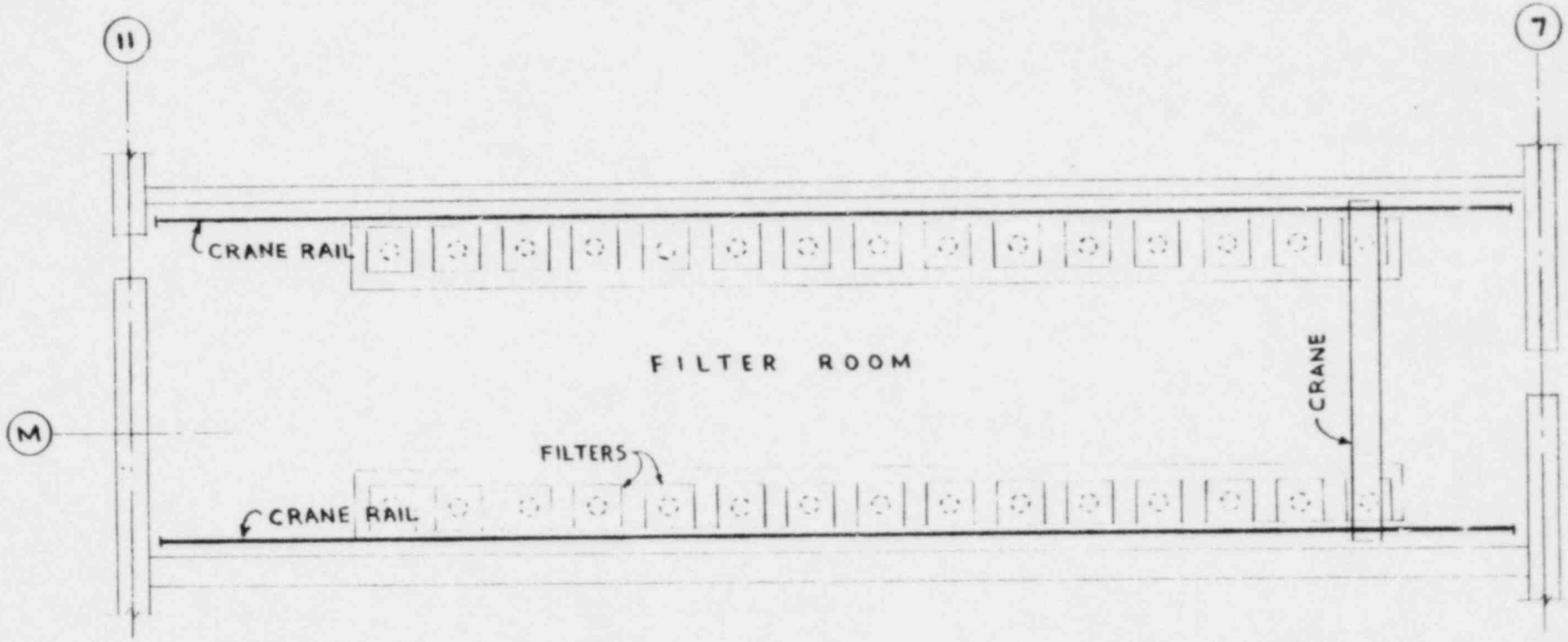
N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-7

(30)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

FILTER ROOM CRANE D-1I



SAFETY RELATED EQUIPMENT

1. FILTER HOUSINGS
2. FILTER PIPING

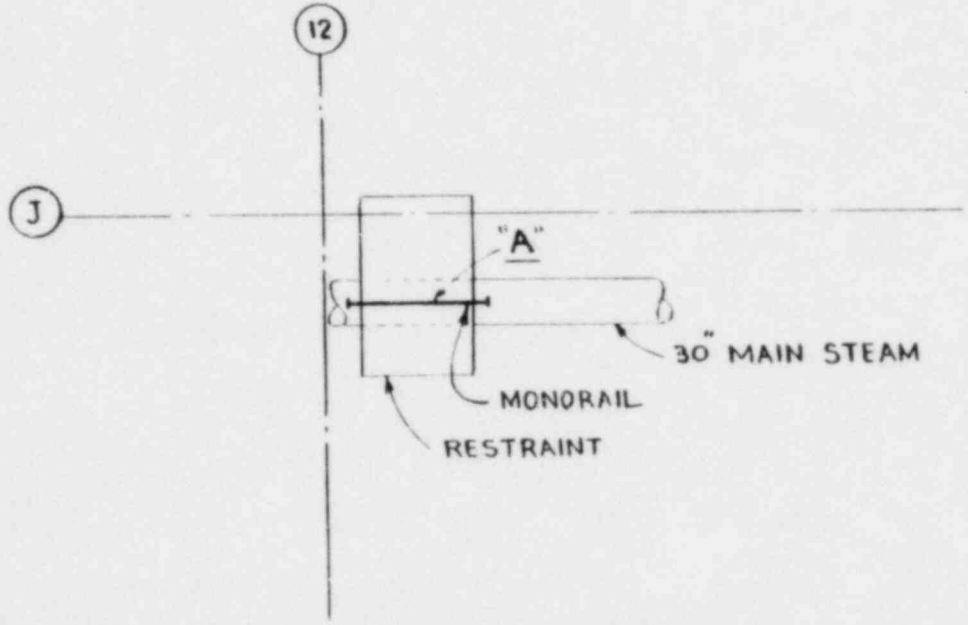
PLAN AT EL. 735'-0
(REF. DWG. NO NF 39206)

N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-8

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL WITH 1-TON HOIST FOR MAIN STEAM ISO. VALVE D-2A



SAFETY RELATED EQUIPMENT

1. MV-32050 (LOOP B MN. STM. HDR. ISOL VLV EQLZG MV.)
2. MV-32020 (LOOP B MN. STM. TO TD AUX. FW. PMP. MV.)
3. MV-32249 (21/22 AUX FW TO 22 STM GEN ISOL MV.)
4. MV-32151 (22 FC CLG WTR RTRN ISOL MV B)
5. 2CB-168 (3'-0 NORTH)
   2CB-412 (4'-0 NORTH)
   TB 2501 (WITHIN 3'-0 SOUTH)

OPERATING FLOOR,
PLAN AT EL. 735-0
(REF. DWG. NO NF 39207)

N

FLUOR POWER SERVICES, INC.

PREPARED BY DR | PROJ NO 21-7450-292

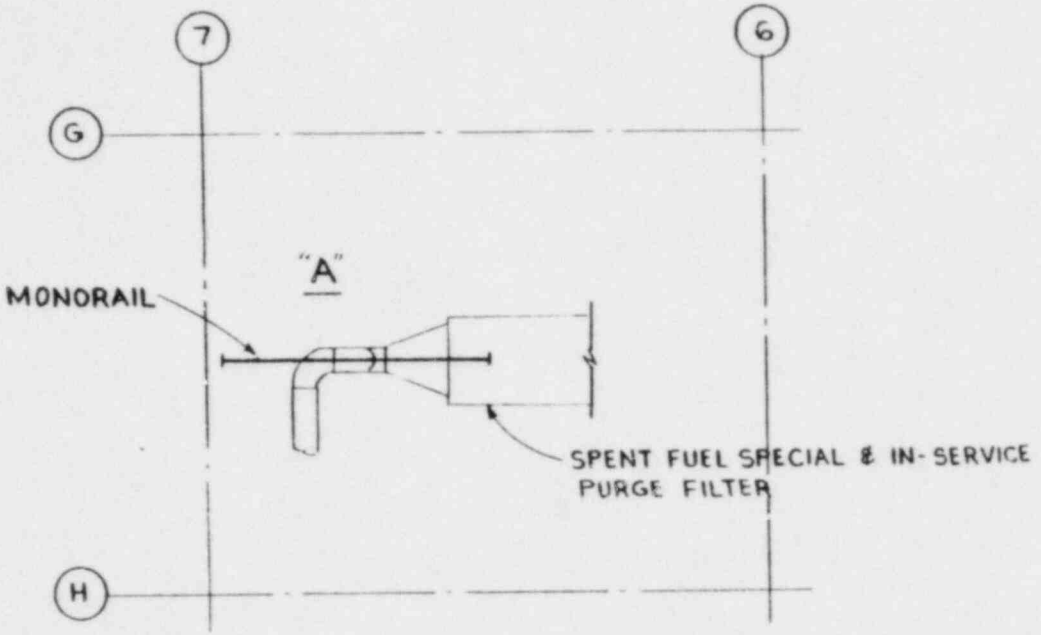
CHECKED BY LG | SK-9

(32)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL WITH 1 TON HOIST FOR SPENT FUEL SPECIAL AND IN SERVICE PURGE FILTER

E-1A



(33)

SAFETY RELATED EQUIPMENT

1. CV-31085 (11 STM GEN MN STM DMP TO ATM CV A1)
2. CV-31090 (12 STM GEN MN STM DMP TO ATM CV B1)
3. CV-31091 (12 STM GEN MN STM DMP TO ATM CV B2)
4. CV-31086 (11 STM GEN MN STM DMP TO ATM CV A2)
5. VARIOUS CONDUITS
6. 1 Au-TA6

PLAN AT EL. 755'-0

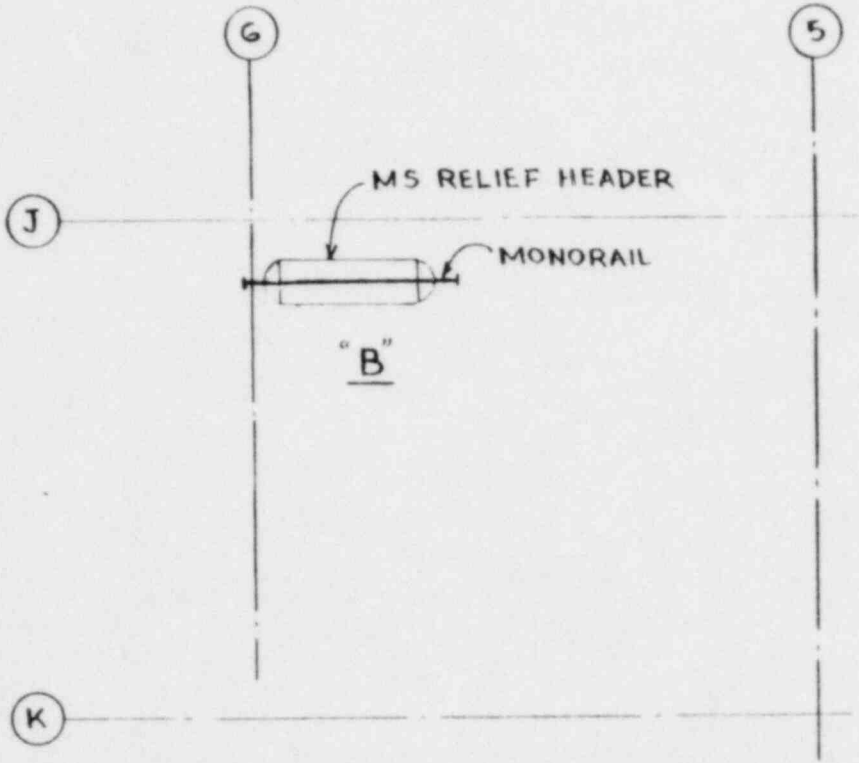
(REF. DWG. NO. NF-39208)

N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY LG	SK-10

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL FOR HOIST ABOVE MAIN STEAM RELIEF HEADER. E-1B



SAFETY RELATED EQUIPMENT

1. STEAM RELIEF VALVES SPRING LOADED
2. VARIOUS CONDUITS
3. MS RELIEF HEADER INCLUDING CV31089

PLAN AT EL. 755'-0

(REF. DWG. NO NF 39208)

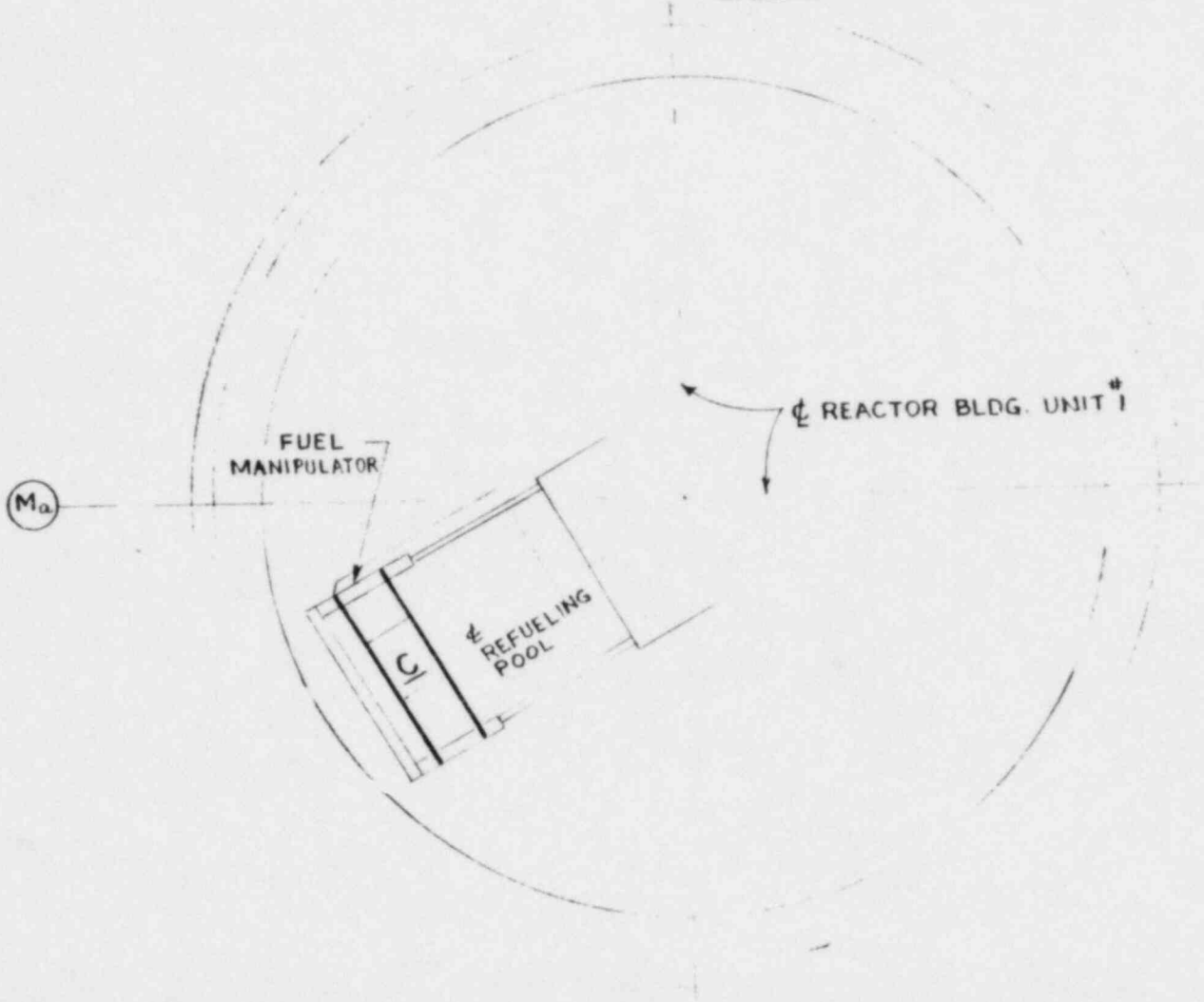
N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G.	SK-11

(34)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MANIPULATOR CRANE E-1C



SAFETY RELATED EQUIPMENT

1. NEW & SPENT FUEL

PLAN AT EL. 755'-0

(REF. DWG. NO. NF-39208)

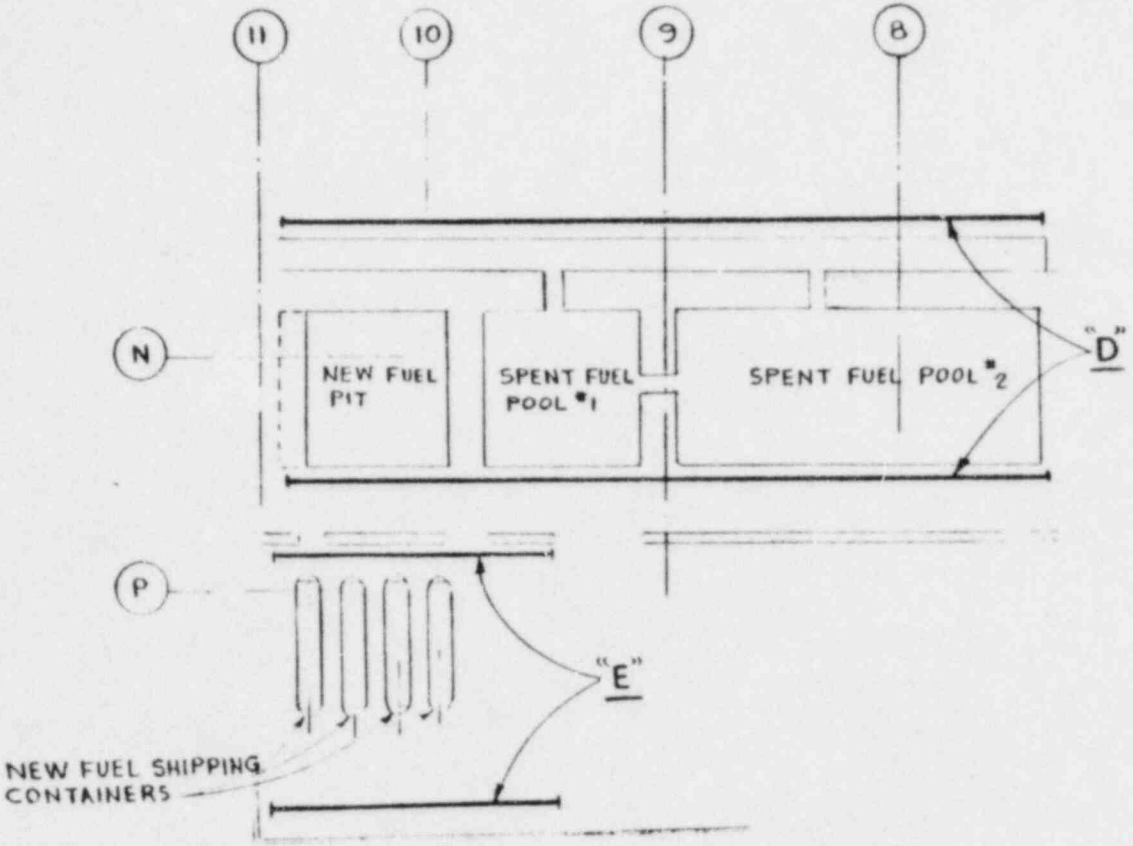
N

FLUOR POWER SERVICES, INC.	
PREPARED BY: O.R	PROJ NO 21-7450-292
CHECKED BY L.G.	SK-12

(35)

CONTROL OF HEAVY LOADS - OVERHEAD HANDLING SYSTEM

3 TON FUEL HANDLING GANTRY CRANE FOR SPENT FUEL POOL E-1D
3 TON NEW FUEL HANDLING CRANE E-1E



SAFETY RELATED EQUIPMENT

1. NEW & SPENT FUEL
2. 2 TR. "A" CONDUITS ALONG NORTH WALL (CONTINUE INTO FUEL POOL)

PLAN AT EL. 755'-0
(REF. DWG. NO. NF 39211)

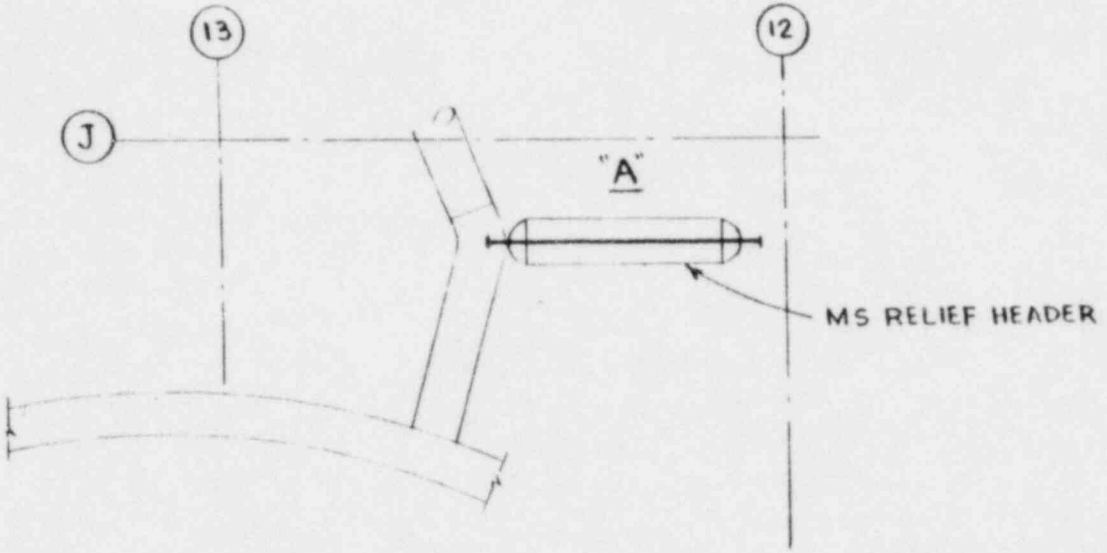
N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-13

(36)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MONORAIL FOR HOIST ABOVE MAIN STEAM RELIEF HEADER. E-2A



(37)

SAFETY RELATED EQUIPMENT

1. STEAM RELIEF VALVES SPRING LOADED
2. CONDUITS FROM A1079 PARALLEL TO STL. BEAM

PLAN AT EL. 755'-0

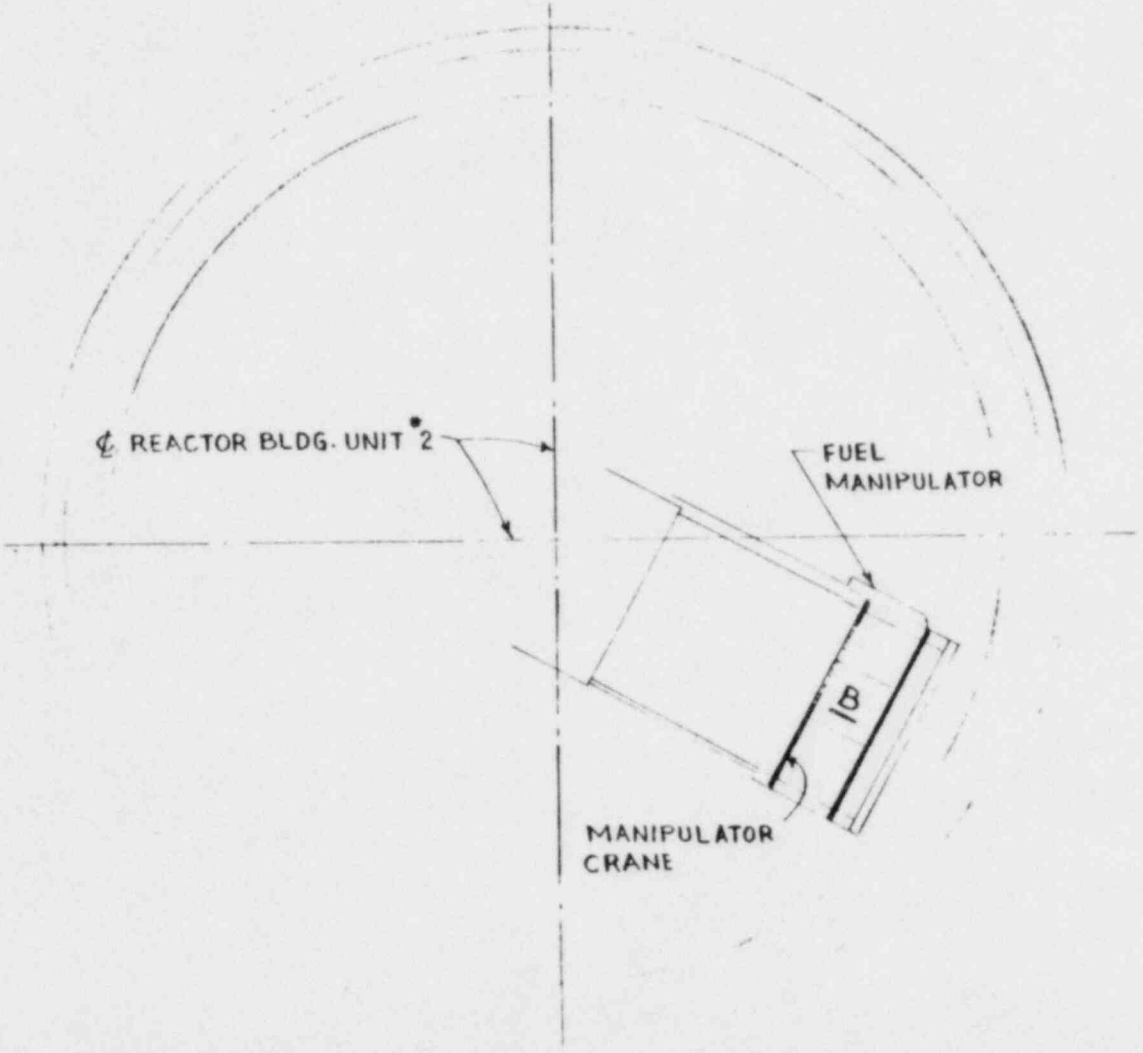
(REF. DWG. NO NF 39209)

N

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY LG	SK-14

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

MANIPULATOR CRANE E-2B



PLAN AT EL. 755-0
(REF. DWG. NO NF 39209)

SAFETY RELATED EQUIPMENT

1. NEW & SPENT FUEL

N

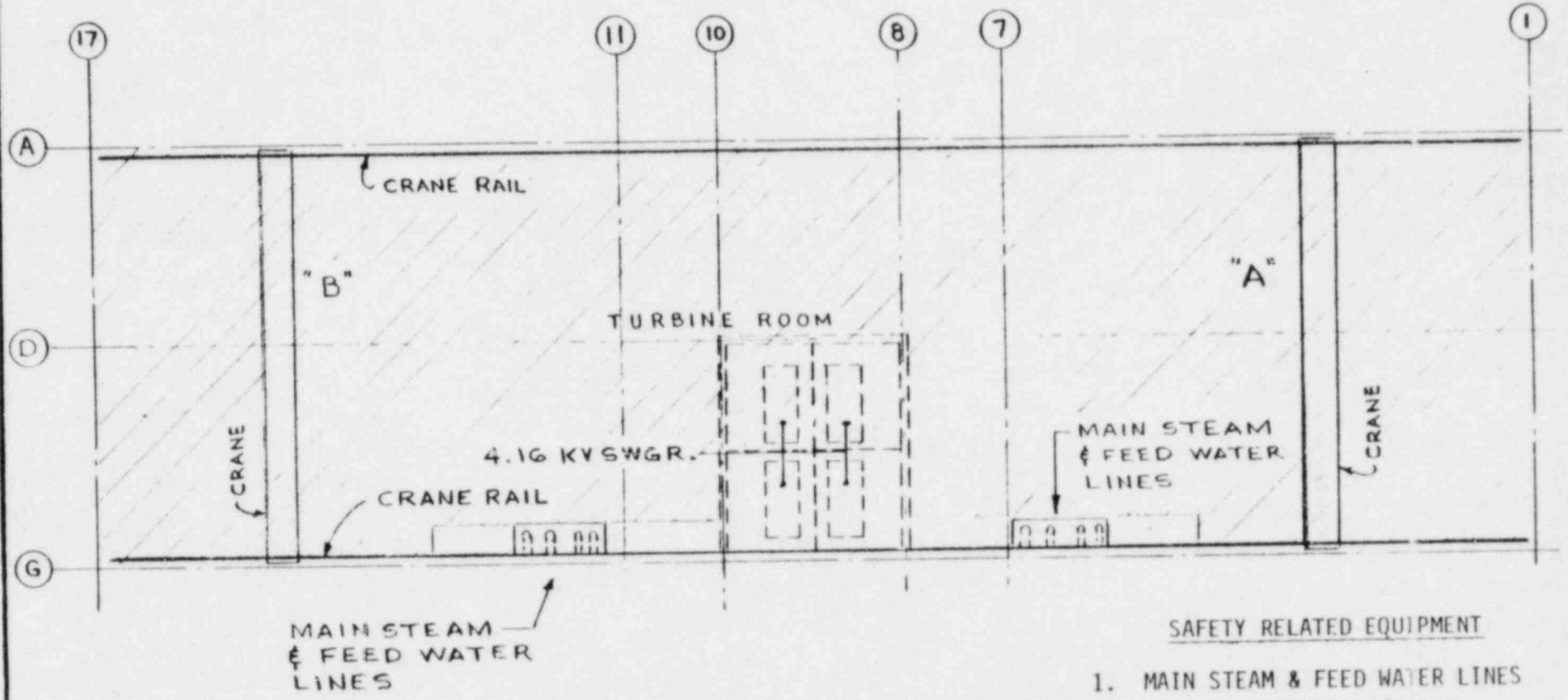
FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY LG	SK-15

(38)

CONTROL OF HEAVY LOADS - OVERHEAD HANDLING SYSTEM

TURBINE BUILDING CRANES

F-A
F-B



(39)

SAFETY RELATED EQUIPMENT

1. MAIN STEAM & FEED WATER LINES
2. 416 KV SWITCHGEAR (BELOW)
   (BELOW ON MEZZ. FLOOR)

PLAN AT EL. 735-0

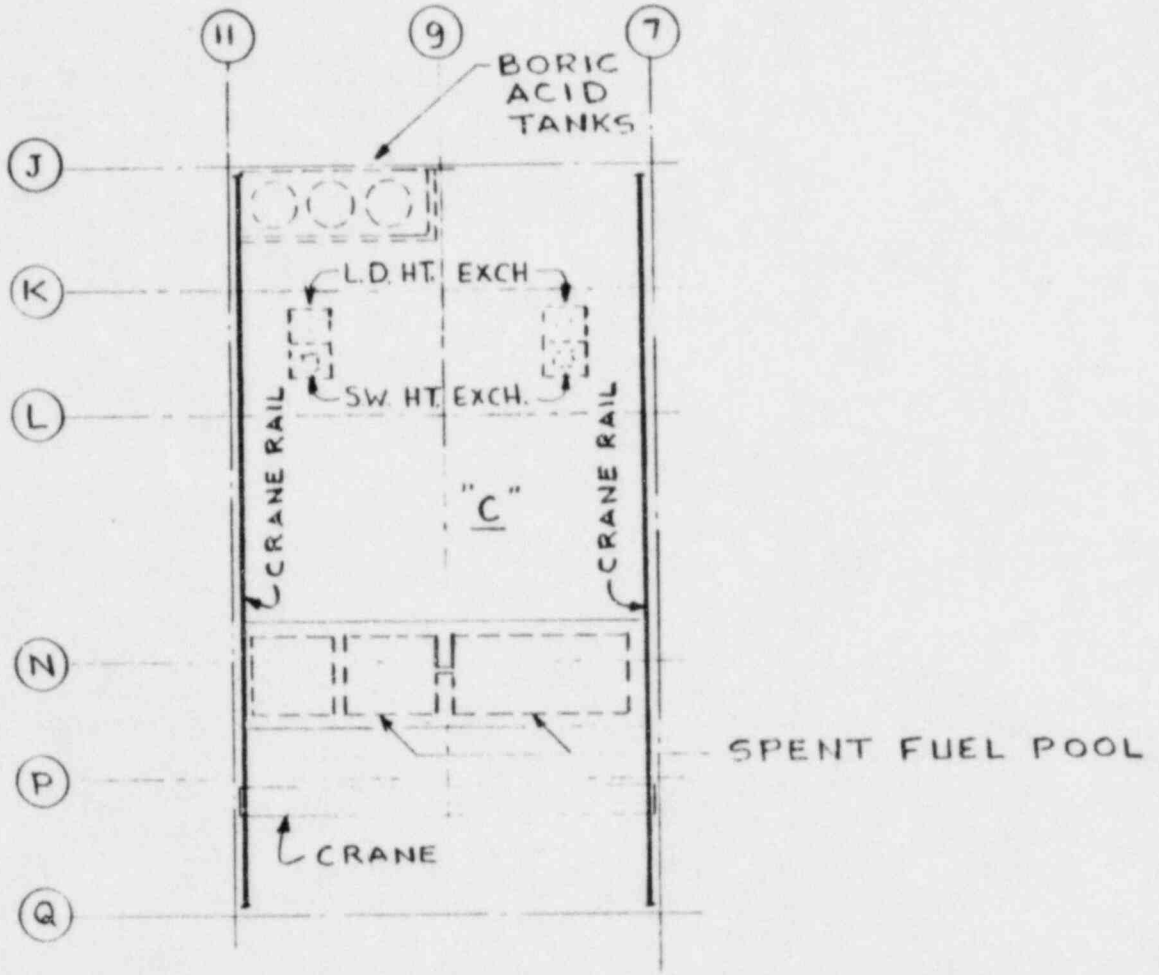
(REF. DWG. NO. NF 39206 & NF 39207)

N

FLUOR POWER SERVICES, INC.	
PREPARED BY - O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-16

CONTROL OF HEAVY LOADS - OVERHEAD HANDLING SYSTEM

AUX. BUILDING CRANE F-C



PLAN AT EL. 755'-0
(REF. DWG. NO NF 39208)

N

SAFETY RELATED EQUIPMENT

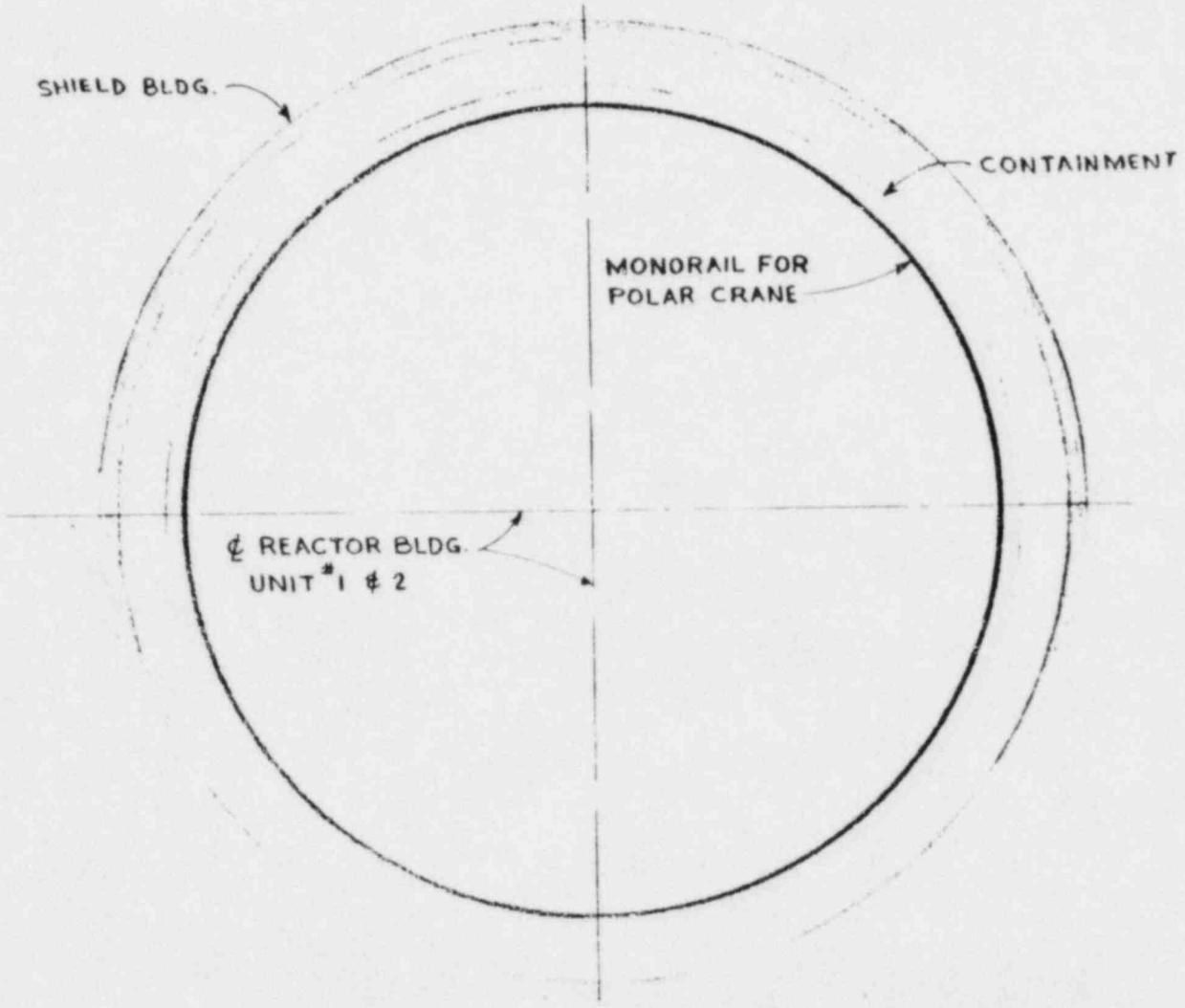
1. BORIC ACID TANKS
2. LETDOWN HEAT EXCHANGERS
3. SEALWATER HEAT EXCHANGERS
4. SPENT FUEL POOL

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY LG	SK-17

(40)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANES F-D
F-E



PLAN AT EL. 821'-6
(REF. DWG. NO. NF-39210)

N

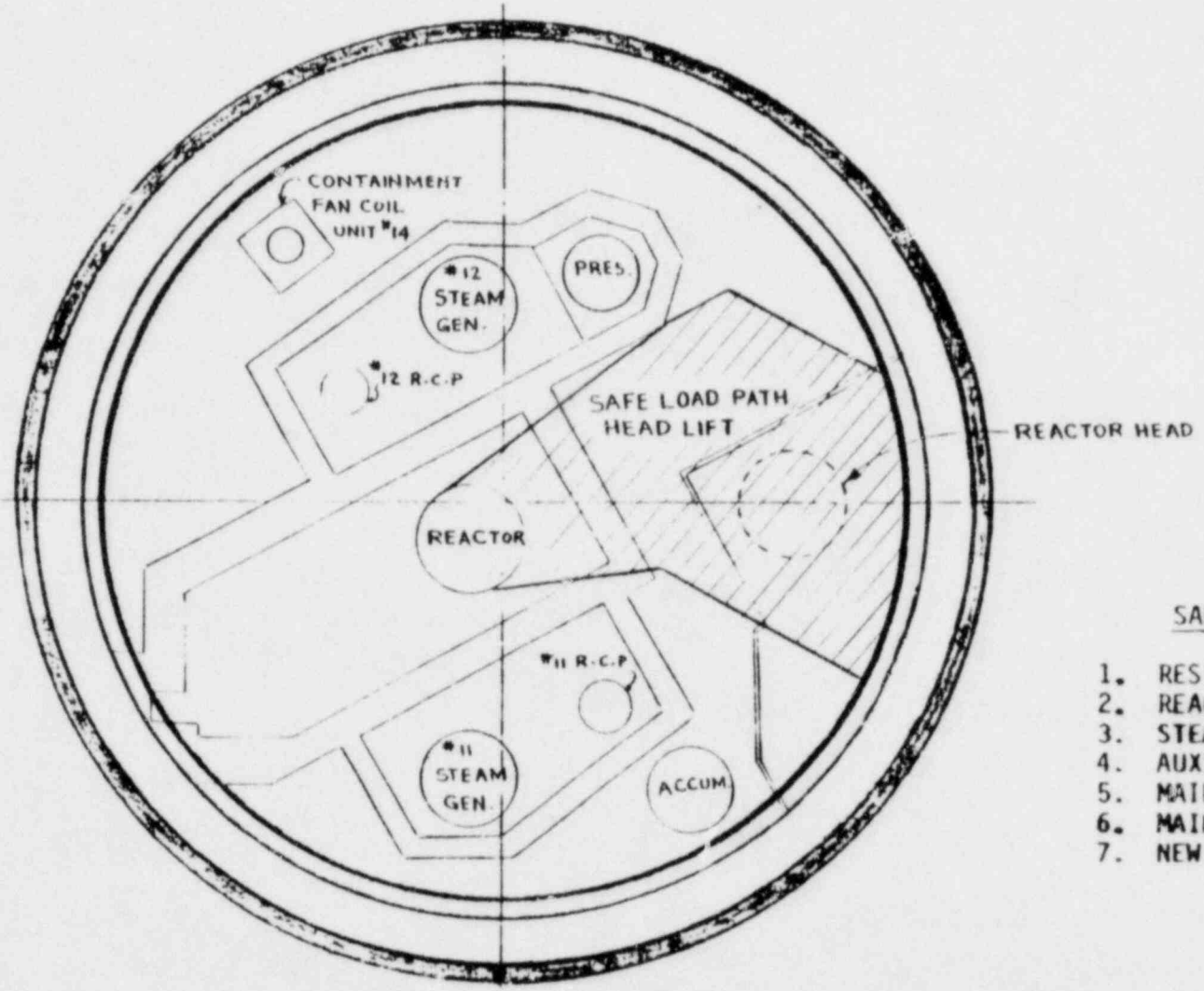
SAFETY RELATED EQUIPMENT

1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
3. STEAM GENERATOR
4. AUXILIARY FEED WATER PIPING
5. MAIN FEED WATER PIPING
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

FLUOR POWER SERVICES, INC.	
PREPARED BY O.R	PROJ NO 21-7450-292
CHECKED BY L.G	SK-18

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANE F-D



PLAN AT EL.
(REF. DWG. NO NF.392)

SAFETY RELATED EQUIPMENT

1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
3. STEAM GENERATOR
4. AUXILIARY FEED WATER PIPING
5. MAIN FEED WATER PIPING
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

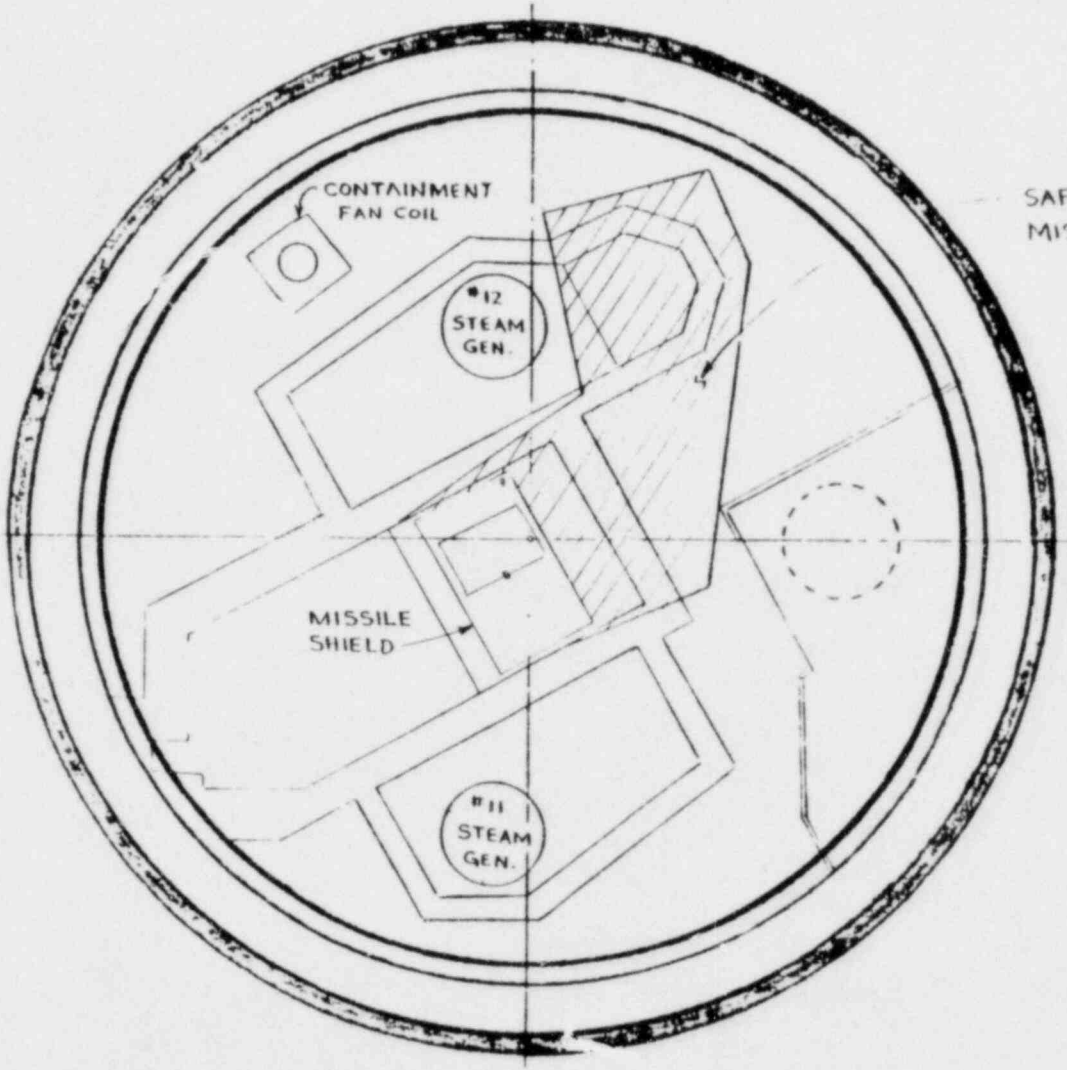
N

FLUOR POWER SERVICES, INC.	
PREPARED BY :- O.R	PROJ NO 21-7490-292
CHECKED BY L.G.	SK-18 A1

(42)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANE F-D



SAFE LOAD PATH REACTOR VESSEL MISSILE SHIELD REMOVAL/REPLACEMENT

PLAN AT EL.
(REF. DWG. NO. NF.392)

N

SAFETY RELATED EQUIPMENT

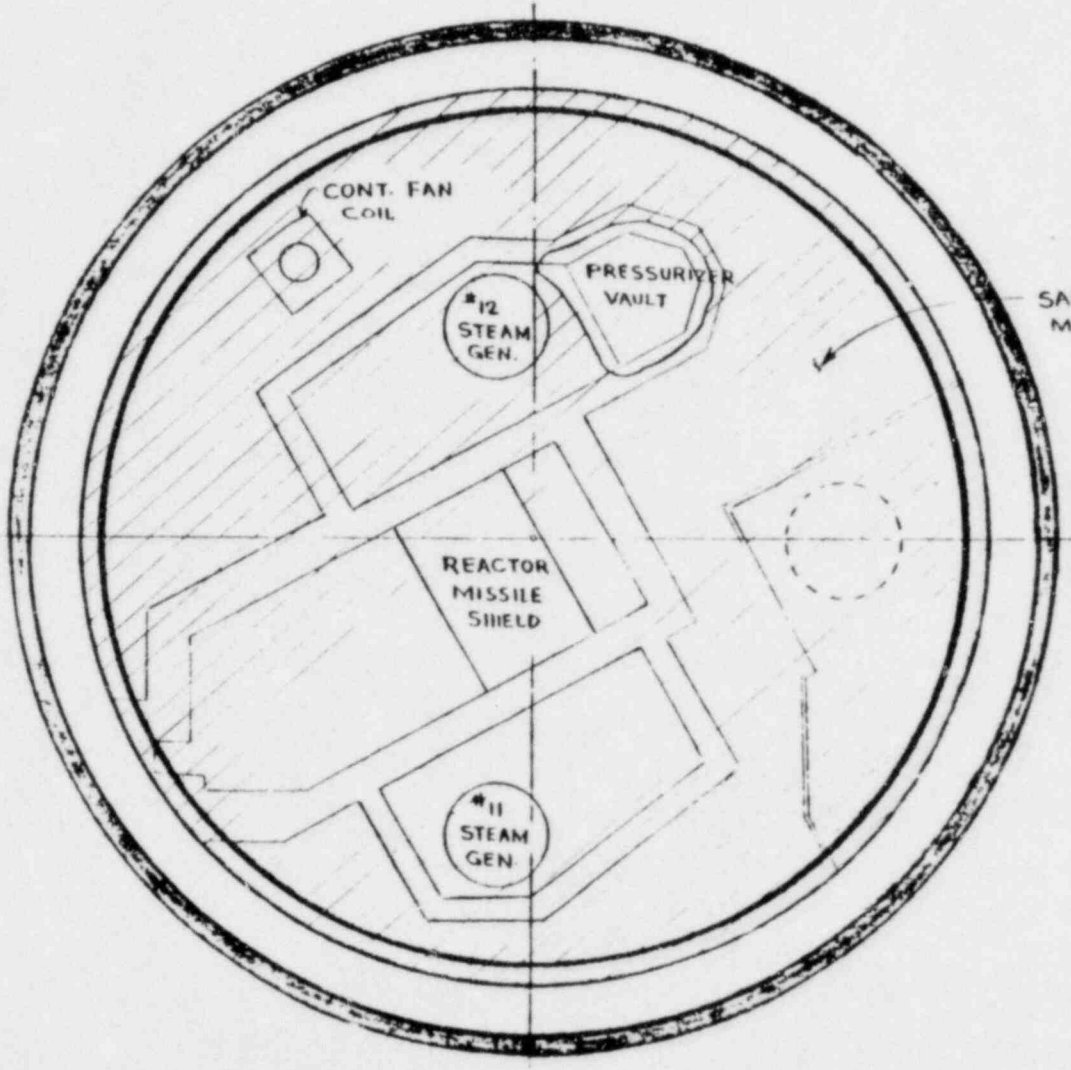
1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
3. STEAM GENERATOR
4. AUXILIARY FEED WATER PIPING
5. MAIN FEED WATER PIPING
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

FLUOR POWER SERVICES, INC.	
PREPARED BY:- O.R	PROJ. NO. 21-7450-292
CHECKED BY	SK-18B1

(43)

CONTROL OF HEAVY LOADS - OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANE F-D



PLAN AT EL.
(REF. DWG. NO. NF.392)

N

SAFETY RELATED EQUIPMENT

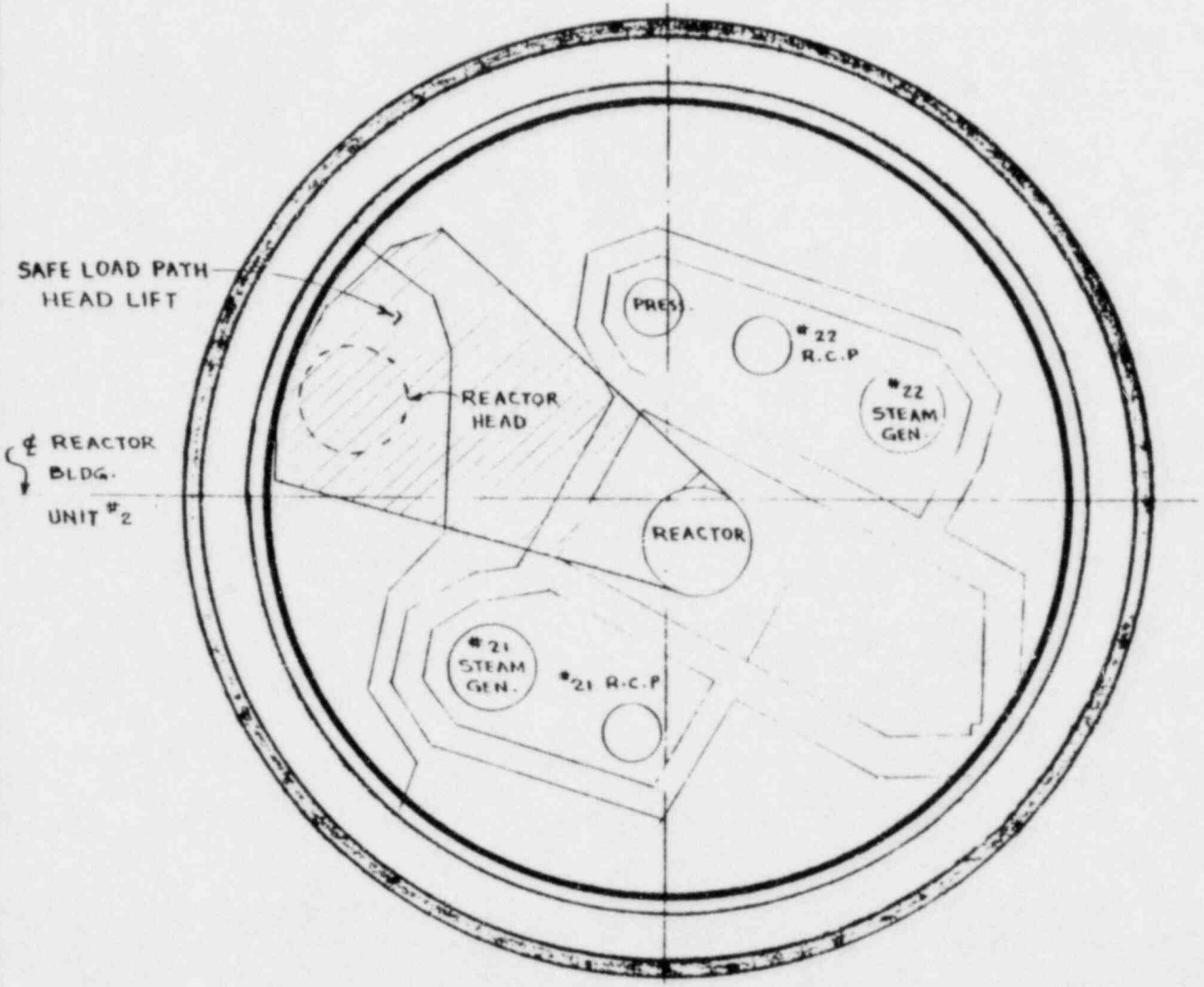
1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
3. STEAM GENERATOR
4. AUXILIARY FEED WATER PIPING
5. MAIN FEED WATER PIPING
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

FLUOR POWER SERVICES, INC.	
PREPARED BY:- O.R	PROJ NO. 21-7450-292
CHECKED BY	SK-1801

(44)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANE F-E



PLAN AT EL.
(REF. DWG. NO NF.392)

N

SAFETY RELATED EQUIPMENT

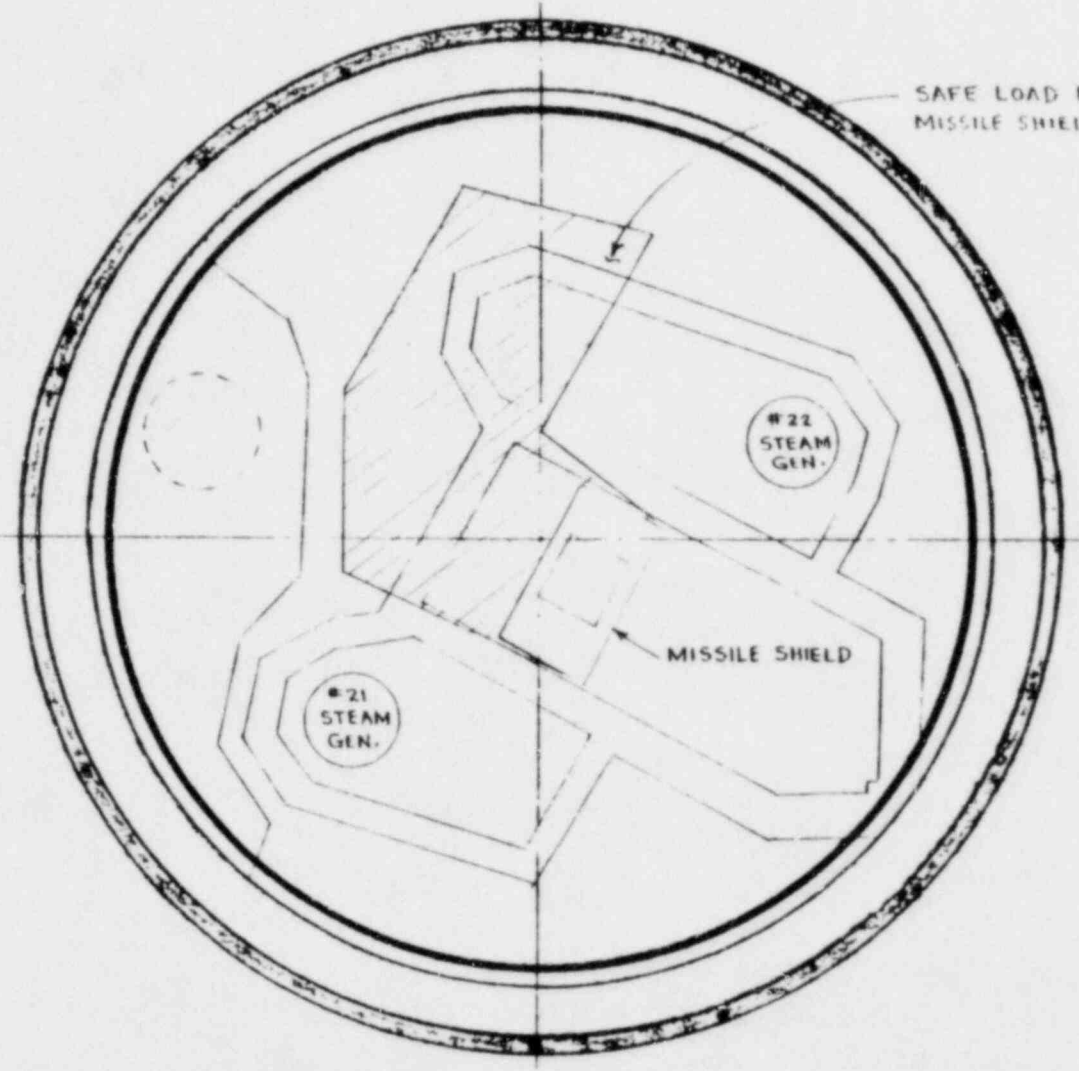
1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
3. STEAM GENERATOR
4. AUXILIARY FEED WATER PIPING
5. MAIN FEED WATER PIPING
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

FLUOR POWER SERVICES, INC.	
PREPARED BY:- O.R	PROJ. NO 21-7450-292
CHECKED BY LG	SK-18A2

(45)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANE F-E



PLAN AT EL.
(REF. DWG. NO NF.392)

N

SAFETY RELATED EQUIPMENT

1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
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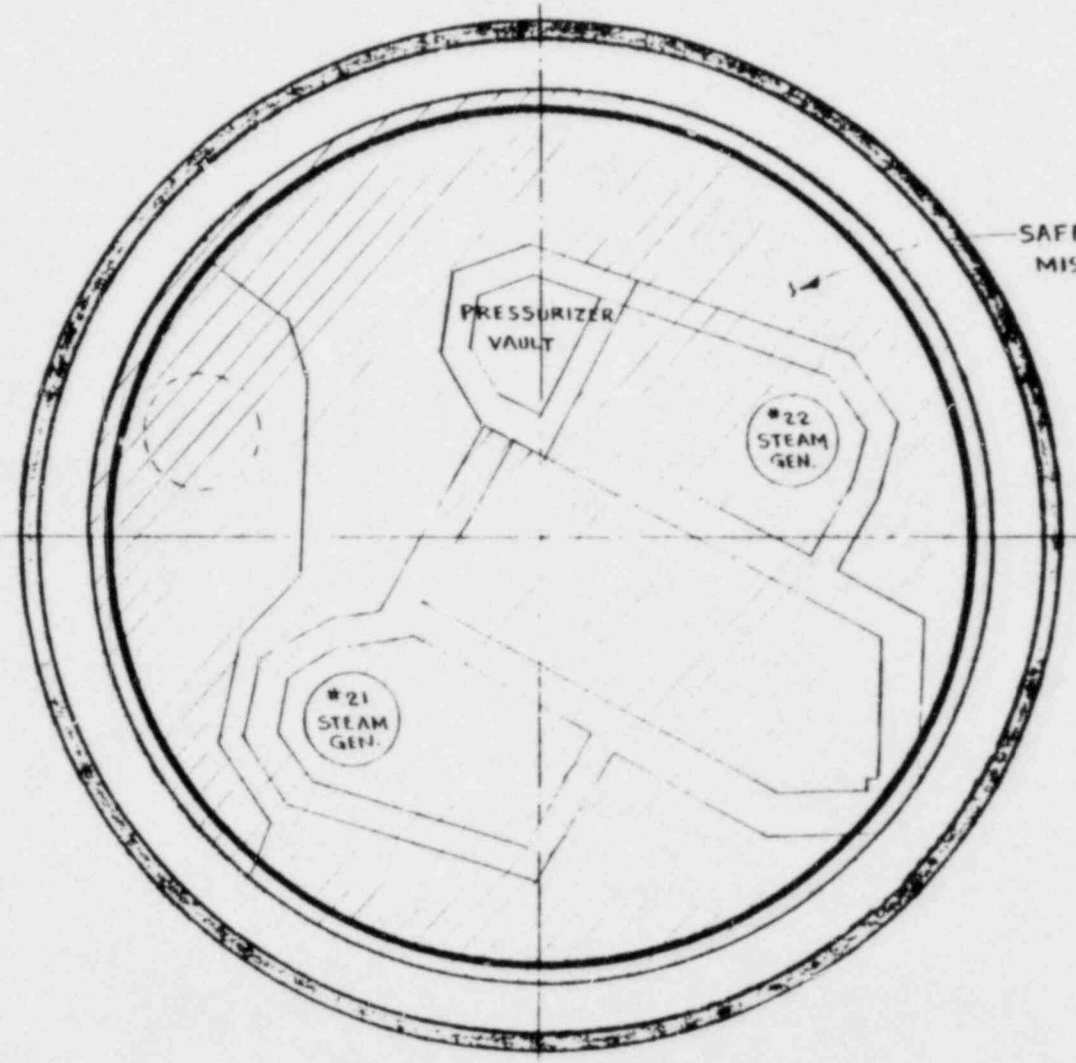
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

FLUOR POWER SERVICES, INC.	
PREPARED BY: O.R	PROJ NO 21-7450-292
CHECKED BY: [illegible]	SK-1E B2

(46)

CONTROL OF HEAVY LOADS- OVERHEAD HANDLING SYSTEM

CONTAINMENT POLAR CRANE F-E



PLAN AT EL.

(REF. DWG. NO. NF.392)

SAFETY RELATED EQUIPMENT

1. RESIDUAL HEAT PUMPS & PIPING
2. REACTOR COOLANT PUMPS
3. STEAM GENERATOR
4. AUXILIARY FEED WATER PIPING
5. MAIN FEED WATER PIPING
6. MAIN STEAM PIPING
7. NEW & SPENT FUEL

FLUOR POWER SERVICES, INC.	
PREPARED BY:- O.R	PROJ NO 21-7450-252
CHECKED BY	SK-18C2

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ATTACHMENT III

FUNCTION OF CRANES

OVERHEAD HANDLING SYSTEM	PRIMARY FUNCTION	ITEM(S) HANDLED	DIMENSION OF ITEM HANDLED	WEIGHT OF ITEM HANDLED
#11, #22 Diesel Cooling Water Pumps Trolley A.2.D & F	Assist in dismantling diesel	Various small components of Diesel Engine	Various	Typically less than 500 lbs
D-1, D-2 Diesel Generator B.1.C, D	Assist in dismantling Diesel Generator	Engine Components	Various	Typically less than 1000 lbs.
6 Ton Trolley above RHR B.1.F, B.2.B	Maintenance of RHR Pump	1. Motor 2. Pump 3. Shield Block	1. 33" dia x 52" 2. 36"x36"x40" 3. 4'-11" sq x 2'	1. 2400 lbs 2. 2000 lbs (includes casing) 3. 7250 lbs
Portable 5-Ton Trolley above RHR Hx C.1.D	Maintenance of RHR Heat Exchanger	1. RHR Rx Shell 2. RHR Hx Tube Bundle 3. Shield Block	1 & 2.33" dia. x 22'-6" 3. 5'-5"x5'-5"x 2'-6"	*Combined Weight 10,500 lbs 10,000 lbs
Trolleys for MSIV's D.1.C,D	MSIV Maintenance	1. MSIV and check valve bonnets	1. 38" dia x 5" thick	1600 lbs
Temporary 1-Ton Trolley-Fuel Rack Job C.1.E	Lift a guage to check dimensional tolerances of the new SFP racks	Drag guage	Size of Fuel Element	< 500 lbs.
1 Ton Trolley - 30" MS Relief HDR D.2.H, E.1.B E.2.A	Safety Valve Maintenance	Safety Valves	20"x20"x59-½"	1257 lbs

OVERHEAD HANDLING SYSTEM	PRIMARY FUNCTION	ITEM(S) HANDLED	DIMENSION OF ITEM HANDLED	WEIGHT OF ITEM HANDLED
1 Ton Trolley above SFP Special & In-service Purge Filter E.1.A	Removal of Aux. Bldg General Exhaust Fan	Aux. Bldg. General Exhaust Fan #11	45 3/4" dia x 55"	1900 lbs.
3 Ton new Fuel Handling Crane E.I.E.	Aid in receipt of new fuel	New Fuel Elements	8"x8"x13'	1650 lbs.
Manipulator Crane E.1.C, E.2.B	Manuver Reactor Fuel Assemblies	1) Fuel Assembly 2) TV Cameras 3) Tests	Various	1260 lbs.
Spent Fuel Pool Crane E.1.D	Handles new & spent fuel	1) Fuel	8"x8"x13'	1650 lbs.
		2) Divider Gates	2'-6"x3/4"x27'-0"	2660 lbs
Turbine Bldg. Crane F.A. & F.B. SPECIAL LIFTING DEVICES 1) Load Spreader for L.P. Turbine Spindle = 10,000 lbs.	Turbine and Various other Turbine Bldg. Equip.	HP Cover	14'x20'	81,700 lbs.
		LP#1 Outer Casing	28'x30'	122,300 lbs.
		LP#2 Outer Casing	28'x30'	122,300 lbs.
		LP#1 Inner Cyl.#1	8'x18'	50,000 lbs.
		LP#2 Inner Cyl.#1	8'x18'	50,000 lbs.
		LP#1 Inner Cyl.#2	20'x20'	90,000 lbs.
		LP#2 Inner Cyl.#2	20'x20'	90,000 lbs.
		HP Rotor	8'x24'	70,000 lbs.
		LP Rotor	15'x30'	160,000 lbs.
		Condensate Pumps & Motor	64" Dia.x26'-6" Lg. 56" Dia.x110" Lg.	18,600 (pump) 12,000 (motor)
		Vertical Cooling Water Pumps	44.5" Dia.x6'-1"Lg. 61" Dia.x 44'-6" Lg.	6,400 (motor) 14,670 (pump)
		Smaller Turbine Parts Valves, etc.		
		Spare Rotor Stands	6'x6'x8'	12,500 lbs.
		Load Block	Irreg. Shape	7,000 lbs.

OVERHEAD HANDLING SYSTEM	PRIMARY FUNCTION	ITEMS(S) HANDLED	DIMENSION OF ITEM HANDLED	WEIGHT OF ITEM HANDLED
Auxiliary Building Crane F-C	Fuel & Various Aux. Bldg. Equip.	1) New Fuel Shipping Containers	47"x45"x191" Lg.	6,600 lbs.
		2) Heat Exchanger Removal Hatches	7'-2"x7'-8"x2'-0"Thk	16,600 lbs.
		3) Heat Exchanger Bundles	12-3/4" O.D.x8'-11" Lg.	1,100 lbs.(Seal water)
			14" O.D. x 13'-5"Lg.	1,900 lbs.(Let-down)
		4) Load Block	Irreg. Shape	7,000 lbs.
Containment Polar Cranes F-D-E	Reactor Vessel & Various Containment Bldg. Equip.	1) Missile Shields		
		a) Reactor	10'-6"x1'-0"x24'-6"	56,200 lbs.
		b) Pressurizer	18'x1'-0"x15'-0" (Irreg shape)	40,500 lbs.
	SPECIAL LIFTING DEVICES	2) Vessel Head	157¼" Dia.x30" High	80,925 lbs.
		3) Upper & Lower Internals	10'-6" Dia.x10'-0" High	50,000 lbs.
				171,500 lbs.
	1) Vessel Head Lifting Rig	4) Vessel Studs (In handling box)	46" x 40"	7,200 lbs.
	2) Upper Internals Lifting Rig	5) In-Service Insp.Tool	Irreg. Shape	4,000 lbs.
	3) Reactor Coolant Pump Lifting Rig	6) Reactor Coolant Pump		
		a) Motor	78.6" Dia.x202.7"Lg.	79,500 lbs.
		b) Pump	92" Dia.x112.5"Lg.	55,200 lbs.
		c) Fly Wheel	75" Dia.	13,200 lbs.
		7) Load Block	Irreg. Shape	15,000 lbs.
		8) Pressurizer Safety Valves	17"x49" Lg.	685 lbs.

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Attachment III

ATTACHMENT IV

COMPARISON OF E.O.C.I. AND C.M.A.A.

The Following Comparison Highlights
The Areas Wherein E.O.C.I. is Deficient
If a Whiting Crane is to Meet C.M.A.A. #70

by James Luszyk

COMPARISON OF E.O.CI. and C.M.A.A.

E.O.C.I.	C.M.A.A.
4.B. States "exact distance" C-C.	1.4.2 Tolerance added to C-C runway rails ± 1/8".
5.B. Current @ runway shall not be less than 95% of the voltage for which crane is designed.	1.5.2 Refers to 5.13 - Voltage @ runway conductor shall not be more than 105% nor less than 94% of specified system voltage supply.
6. States "capacity plates attached to crane."	1.6.1 Added "capacity plate attached to both sides of the crane in a position visible from operating floor."
7. States "allowable stress to be 20% of assumed average ultimate strength."	1.7.1 Excludes gearing from load carrying parts. Allowable stress to be 20% of published average ultimate strength.
8.	1.8.2 Added "features of ANSI B30.2.0.
Appendix A	2. Added crane classification criteria.
16. Material to be ASTM-A7	3.1 Material to be ASTM-A36
17. Welding per AWS recommendations.	3.2 Welding per AWS D14.1 with the exception of Section 705.
18.A	3.3.1 Excluded the use of riveted box girders.
18.B.1.a.3 States 15% of rated capacity shall be minimum impact allowance.	3.3.2.1.1.3 Impact allowance shall be ½% of the load per foot per minute of hoist speed but not less than 15% of rated capacity.
18.B.1.b.1 Lateral load to be 5%.	3.3.2.1.2.1 Lateral load defined by Class 2½% Class A 5% Class B, C, and D 10% Class E
18.B.1.b.2 Wind load to be 10 lbs. per square foot of projected area.	3.3.2.1.2.2 Wind load to be 5 lbs. per square foot of projected area. Also includes 1.6 factor for multiple surfaces and 1.2 for single surface.
18.B.2 Does not mention wind loading in combined bending stresses.	3.3.2.2 Combined bending stress to include stress due to wind load on outdoor cranes.

Continued . . . . . .

COMPARISON OF E.O.C.I. and C.M.A.A.

E.O.C.I.	C.M.A.A.
18.C.1.a 1/b shall not exceed 55 1/h not stipulated h/t shall not exceed 240 or the value given by 85 $(K+1)\sqrt{\frac{16000}{fc}}$ unless longitudinal stiffeners are used in the compression area of web plates. No criteria given for longitudinal stiffener.	3.3.3.1.1 1/b shall not exceed 60 1/h shall not exceed 25 h/t shall not exceed 188 or the value given by $81(K+1)\sqrt{\frac{17.6}{fc}}$ without longitudinal stiffeners. Ratio is adjusted when longitudinal stiffeners are used.
---	3.3.3.1.2 Criteria for longitudinal stiffeners added.
18.C.1.b. Allowable tension 16 ksi Allowable comp. 16 ksi when b/c ≤ 41, reduced stresses specified Allowable shear 12 ksi Allowable bearing not specified ---	3.3.3.1.3 Allowable tension 17.6 ksi Allowable comp. 17.6 ksi when b/c ≤ 38, reduced stresses specified. Allowable shear 13.2 ksi Allowable bearing 26.4 ksi Allowable stress range for repeated loads added
---	3.3.3.1.4 Criteria for longitudinal stiffeners added
18.C.2 Riveted box girder section not in CMAA	3.3.3.1.5.3 Not applicable
---	3.3.3.2 Not applicable
18.C.3 Allowable tension I-beam girder 16 ksi Allowable maximum comp. I-beam girder 16 ksi Allowable shear I-beam girder 12 ksi	3.3.3.3 Allowable tension I-beam girder 17.6 ksi Allowable maximum comp. I-beam girder 17.6 ksi Allowable shear I-beam girder 13.2 ksi
18.C.4 Box girder of double I-beam per I-beam design data to 19.C Minimum truck drop not be excessive. Allowable stresses not specified for bridge end trucks.	3.3.3.4 Box girder of double I-beam per box section design stresses 3.4.3 Minimum truck drop specified @ 1" Allowable vertical stress w/o impact Tension 14.4 ksi Comp. 14.4 ksi Shear 10.8 ksi Impact and duty cycle should be considered for Class D and E cranes.

Continued . . . . . .

COMPARISON OF E.O.C.I. and C.M.A.A.

E.O.C.I.	C.M.A.A.
20.	3.5 Added: All footwalks shall be designed for a live load of 50 lbs./ft.^{2}. Allowable stresses: Tension 20.0 ksi, Comp. 20.0 ksi, Shear 13.0 ksi
21.A	3.6.1 Added: Cab shall be braced to prevent swaying. Cab support bolts should be in shear. Cab shall have a suitable warning device.
21.B	3.6.2 Added: All cabs should be provided with a seat unless otherwise specified.
22.	3.7 Same as 3.4.3 above - Plus: When b/c ≥ 38, the allowable comp. stress is to be proportioned down.
---	3.8 Rail stipulation data added.
---	3.9 Gantry crane design considerations added.
---	3.10 Repeated load conditions added. Table 3.10-1 Figure 3.10.1
25.A States simply cast iron.	4.3.1 Sheaves shall be minimum ASTM Grade A48-64 or later, Class 40 cast iron, or equal.
26.A The drum shall be made of high grade cast iron, or equal. Shall be designed to withstand maximum bending and crushing loads.	4.4.1 The drum shall be steel or minimum ASTM Grade A48-64 or later, Class 40 cast iron, or equal. Shall be designed to withstand combined crushing and bending.
---	4.4.3.1 Recommended minimum drum groove to be 3/8 x rope diameter was added.
---	4.4.3.2 Recommended minimum drum groove pitch to be 1.14 rope diameter or rope diameter + 1/8", whichever is smaller was added.

Continued . . . . . .

COMPARISON OF E.O.C.I. and C.M.A.A.

E.O.C.I.	C.M.A.A.
27.	4.5 All gearing design criteria was added.
30.B Anti-friction bearing B-10 life to be: Class A & B 1000 hours Class C 2000 hours Class D 5000 hours Class E 10000 hours	4.6.2 Anti-friction bearing B-10 life to be: Class A & B 3000 hours Class C 5000 hours Class D 15000 hours Class E 25000 hours
31.A.1.b Bridge brake with cab on trolley requires 50% motor torque.	4.7.2.2 Bridge brake with cab on trolley requires 75% motor torque.
31.B.1 Minimum torque ratings not specified.	4.7.4.2 Minimum torque ratings of hoist holding brake to be as follows: 125% when control brake is not mechanical 100% when control brake is mechanical 100% when two holding brakes are used
---	4.7.4.4 Hot metal cranes having power control braking shall have at least two holding brakes.
---	4.8 Bridge drive criteria added. Figure 4.8.1
28.	4.9.1 Spacing between bridge cross-shaft bearing adder per Table 4.9.1
---	4.9.2 Cross-shaft design criteria added Table 4.9.2.
29.A	4.10.1 Cross-shaft coupling material specifications added
32.A	4.11.1 Tolerance on wheels added
---	4.11.4 Specification of clearance between the wheel flanges and rail head were added.
---	4.12 Specifications for bumpers and stops were added.
---	5.2.4 Specification of rated motor voltage added.
---	5.2.5 Motor recommendations for Class D & E added.

Continued . . . . . .

COMPARISON OF E.O.C.I. and C.M.A.A.

E.O.C.I.	C.M.A.A.
---	5.2.6 Squirrel cage motor design criteria added.
---	5.2.8 Rated motor voltage criteria added.
---	5.3.3 Requirement that holding brakes shall have adjustment added.
---	5.4.2 Specification of combination control added.
---	5.4.3 Specification for remote control added.
---	5.4.5.1 Magnetic control contactor criteria added.
---	5.4.5.2 Squirrel cage motor contactor rating and criteria added.
---	5.4.5.3 Minimum size contactor based on service class added.
---	5.4.5.4 Minimum number of acceleration contactors, timers, and speed points added.
---	5.4.5.5 Plugging protection specifications added.
---	5.4.5.6 Squirrel cage full voltage control limitations added.
---	5.4.5.7 Multi-motor drive contactor criteria added.
---	5.4.6 Static control criteria added.
37. Resistors shall not be less than Class 150 for Class A, B, C, or D and not less than Class 160 for Class E.	5.5.1 Resistors shall not be less than Class 150 for Class A, B, or C and not less than Class 160 for Class D or E.
---	5.5.2 - 5.5.4 Additional resistor criteria.
---	5.6.2 Criteria for crane without spring return controllers added.
---	5.6.4 Specifications for disconnecting means added.

Continued . . . . . .

COMPARISON OF E.O.C.I. and C.M.A.A.

E.O.C.I.	C.M.A.A.
38.A	5.6.5 Added "overloads are required in two phases of AC motors. Each DC motor requires one inverse time element overload."
---	5.6.6 Requirement for line contactor on DC cab cranes added.
---	5.6.7 - 5.6.8 Criteria for radio control cranes added.
---	5.6.9 Criteria for automatic cranes added.
---	5.6.10 Requirement for concurrence with ANSI B30.2 added.
Appendix C	5.7 Sketch 5.7 Criteria for direction of hook movement indication added.
---	5.8 Criteria for floor operated pendant pushbutton stations added.
---	5.10 Criteria for electrical installation added.
---	5.13 Criteria for runway voltage drop added.
43.	5.14 Requirement for two sets of current collectors on magnet cranes added.

ATTACHMENT V

Manipulator Crane

The manipulator crane is a rectilinear bridge and trolley crane with a vertical mast extending down into the refueling water. The bridge spans the refueling cavity and runs on rails set into the floor along the edge of the refueling cavity. The bridge and trolley motions are used to position the vertical mast over a fuel assembly in the core. A long tube with a pneumatic gripper on the end is lowered out of the mast to grip the fuel assembly. The gripper tube is long enough so the upper end is still contained in the mast when the gripper end contacts the fuel. A winch mounted on the trolley raises the gripper tube and fuel assembly up into the mast tube. The fuel is transported while inside the mast tube to its new position. The manipulator can lift only one fuel assembly at a time.

All controls for the manipulator crane are mounted on a console on the trolley. The bridge is positioned on a coordinate system laid out on one rail. The electrical readout system on the console indicates the position of the bridge. The trolley is positioned with the aid of a scale on the bridge structure. The scale is read directly by the operator at the console. The drives for the bridge, trolley, and winch are variable speed and include a separate inching control on the winch. Electrical interlocks and limit switches on the bridge and trolley drives protect the equipment. In an emergency, the bridge, trolley, and winch can be operated manually using a handwheel on the motor shaft.

Safety features are incorporated in the system as follows:

a) Travel limit switches on the bridge and trolley drives

b) Bridge, trolley, and winch drives which are mutually interlocked to prevent simultaneous operation of any two drives

c) A position safety switch, the GRIPPER TUBE UP position switch, which prevents bridge and trolly main motor drive operation except when it is actuated.

d) An interlock which prevents the opening of a solenoid valve in the air line to the gripper except when zero suspended weight is indicated by a force gage. As back-up protection for this interlock, the mechanical weight actuated lock in the gripper prevents operation of the gripper under load even if air pressure is applied to the operating cylinder.

e) The EXCESSIVE SUSPENDED WEIGHT switch, which opens the hoist drive circuit in the up direction when the loading is in excess of a preset limit.

f) An interlock on the hoist drive circuit in the up direction, which permits the hoist to be operated only when either the OPEN or CLOSED indicating switch on the gripper is actuated.

g) An interlock of the bridge and trolley drives, which prevents the bridge drive from traveling beyond the edge of the core unless the trolley is aligned with the refueling canal centerline. The trolley drive is locked out when the bridge is beyond the edge of the core.

Suitable restraints are provided between the bridge and trolley structures and their respective rails to prevent derailing and the manipulator crane is designed to prevent disengagement of a fuel assembly from the gripper in the event of a Design Basis earthquake.