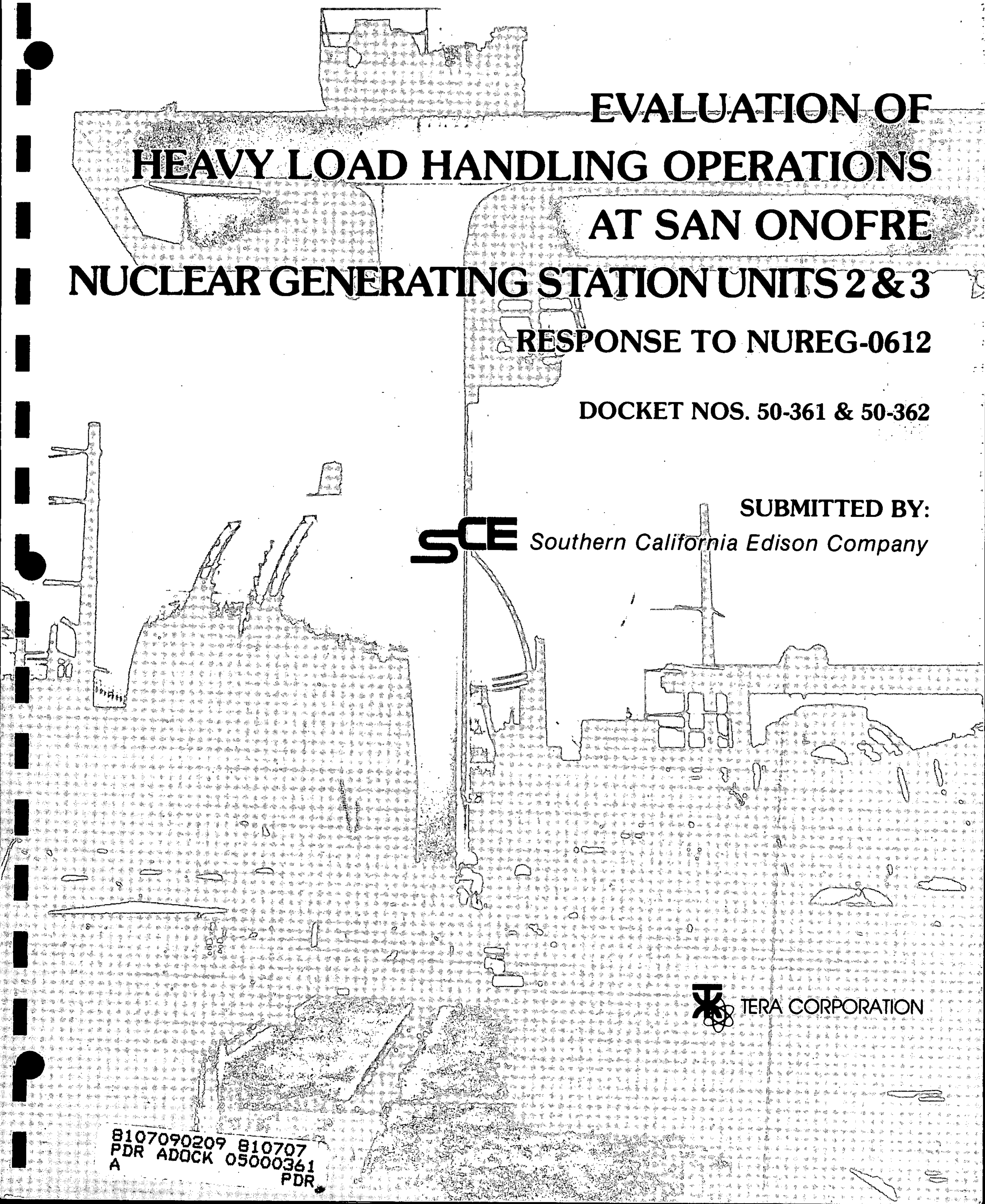
EVALUATION OF HEAVY LOAD HANDLING OPERATIONS AT SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 & 3

RESPONSE TO NUREG-0612

DOCKET NOS. 50-361 & 50-362



SUBMITTED BY:

SCE Southern California Edison Company

TERA CORPORATION

CONTROL OF HEAVY LOADS FOR SAN ONOFRE NUCLEAR GENERATING STATION UNITS 2 AND 3

Submitted to:

Southern California Edison
P.O. Box 800
Rosemead, CA 91770

June 10, 1981

TERA CORPORATION

2150 Shattuck Avenue
Berkeley, California 94704
415-845-5200

Berkeley, California
Dallas, Texas
Bethesda, Maryland
Baton Rouge, Louisiana
Del Mar, California
New York, New York
San Antonio, Texas
Denver, Colorado
Los Angeles, California

CONTROL OF HEAVY LOADS
RESPONSE TO NUREG-0612
SONGS 2/3

The NRC's letter of December 22, 1980, requested a review of the controls for handling heavy loads at SONGS 2/3, the implementation of certain recommendations regarding these controls, and the submittal of information to demonstrate that the recommendations have been implemented. The information was to be submitted in two installments on June 22 and September 22, 1981. This report is in response to the first installment of required information as specified in Section 2.1 of Enclosure 3 of the December 22, 1980 letter.

CONTROL OF HEAVY LOADS
RESPONSE TO NUREG-0612
SONGS 2/3

ITEM I: Report the results of your review of plant arrangements to identify all overhead handling systems from which a load drop may result in damage to any system required for plant shutdown or decay heat removal (taking no credit for any interlocks, technical specifications, operating procedures, or detailed structural analysis).

RESPONSE: The fixed overhead handling systems of sufficient capacity to be of interest at SONGS 2/3 are listed in Table I along with their locations and capacities. Plant arrangement drawings were reviewed and plant walk throughs were conducted to determine if any of the handling systems listed above could carry a heavy load over components in systems required for plant shutdown or decay heat removal. The location of components of interest with respect to the handling systems was determined by review of these plant arrangement drawings, review of the fire zone descriptions previously submitted to the NRC as part of the "Fire Hazards Analysis Report" for SONGS 2/3 (Amendment 4, December 1980), and the area surveys. The fire zone descriptions identify the safety-related components within fire zones and the location of the fire zones within the plant.

This review revealed that ten of the handling systems listed in Table I could carry heavy loads over an open reactor vessel, over spent fuel in the spent fuel pool, or over components in systems required for plant shutdown or decay heat removal. A brief description of each of the ten cranes is provided below. The remaining cranes in Table I were determined to be free of any interaction with safe shutdown equipment and therefore did not require further consideration.

(1) Polar Crane: The containment polar crane consists of two crane girders and a trolley with a 205-ton main hoist and 30-ton auxiliary hoist. Circular rails supported from the containment walls at elevation 105 feet support the crane girders and provide for 360° of rotation. The hoists can be operated from the cab located on one end of the bridge or from the

TABLE I

HEAVY LOAD HANDLING SYSTEMS
SONGS 2 & 3

Handling System	Capacity (tons)	Location
*Polar Crane	205 (30)	Containment
*Cask Handling Crane	125 (10)	Fuel Handling Bldg.
*Turbine Gantry Crane	225 (60)	Turbine Bldg.
*New Fuel Handling Crane	5	Fuel Handling Bldg.
*AFW Pump Bridge Crane	5	Condensate Storage Tank Bldg.
*CCW Pump Monorail	3	Safety Equipment Bldg. (30'6" el.)
*SI Pump Monorails	4	Safety Equipment Bldg. (8' and 30'6" el.)
*Diesel Bldg. Cranes	3	Diesel Bldg.
*Charging Pump Monorails	5	Auxiliary Bldg. (9' el.)
Turbine Feed Pump Crane	15	Turbine Bldg.
Seaweed Removal Jib Crane	4	Intake Structure
Hot Machine Shop Crane	3	Radwaste Area (79'6" el.)
Truck Bay Crane	25	Auxiliary Bldg. (63' el.)
Truck Bay Crane	1	Auxiliary Bldg. (63' el.)
Cartridge Filter Removal Crane	1	Radwaste Area (37' el.)

*Overhead handling systems which required further evaluation

TABLE I

(CONT.)

Handling System	Capacity (tons)	Location
Condenser Waterbox Removal Crane	10	Turbine Bldg. (7' el.)
Waste Gas Compressor Removal Crane	2	Auxiliary Bldg. (63'6" el.)
Blowdown Filter Removal Crane	1	Turbine Bldg. (32' el.)
Crud Tank Filter Block Removal Crane	3	Radwaste Area (37' el.)
Crud Tank Vent Filter Block Removal Crane	3	Radwaste Area (37' el.)

operating deck with a pendant control. The polar crane was manufactured by PACECO. The polar crane is used for lifts involving the reactor vessel head and internals and to lift the reactor coolant pump motors if necessary. Because certain of the lifts are performed when the head is off of the reactor vessel, this crane falls within the NUREG-0612 evaluation guidelines.

(2) Cask Handling Crane: The cask handling crane is located in the fuel handling building at elevation 63 feet 6 inches. The crane trolley has a 125-ton main hoist and 10-ton auxiliary hoist and runs between two bridge girders. The hoist is operated from the cab on one end of the bridge. The crane is used for lifting the spent fuel cask between the shipping-receiving area, the cask decontamination pit, and the cask loading pit. It is also used to lift the spent fuel pool gate at the south end of the spent fuel pool for maintenance purposes. The lift of the pool gate represents a potential interaction with spent fuel in the spent fuel pool.

(3) Turbine Gantry Crane: The turbine gantry cranes travel on rails spanning the operating decks of the turbine generator buildings for Units 2 and 3 and the intake structure area. The upper bridge structure consists of cantilevered bridge girders that permit run-out of all hooks beyond the rail centerline. A trolley with a 225-ton capacity main hoist and 60-ton capacity auxiliary hoist is provided as well as an independent 20-ton capacity accessory hoist. The principal heavy loads handled by this crane consist of components of the turbine-generator units. In addition, the salt water cooling pump components may be lifted periodically for maintenance purposes. Because the salt water cooling pumps are classified as safe shutdown equipment, load handling activities by this crane represent a potential interaction per NRC guidelines.

(4) New Fuel Handling Crane: The new fuel handling crane is a single girder underhung bridge crane spanning the new fuel storage area. The crane is equipped with a mechanically operated interlocking device that allows the bridge to be interlocked with a monorail section. The 5-ton capacity hoist

traveling on the monorail section can travel over the north edge of the spent fuel pool and is used to lift the spent fuel pool gate at this end of the pool. This lift represents a potential interaction with spent fuel.

(5) Auxiliary Feed Water (AFW) Pump Bridge Crane: The AFW Pump Crane is a single girder underhung bridge crane spanning the three auxiliary feedwater pumps. The 5-ton capacity hoist is used to lift components of the AFW pumps for maintenance purposes. Because the AFW pumps are classified as safe shutdown equipment, load handling activities by this crane represent a potential interaction under NRC guidelines.

(6) Component Cooling Water (CCW) Pump Monorail: The CCW Pump Monorail runs above the three closed cooling water pump rooms. The arrangement of this handling system is shown in Figure 1. Each CCW pump is located in a separate room with a concrete hatch in the ceiling to allow lifting of the motor by the monorail. The 3-ton capacity hoist performs lifts of the reinforced concrete hatches and the pump motors. Because the CCW pumps are classified as safe shutdown equipment, load handling activities by this crane represent a potential interaction under NRC guidelines.

(7, 8) Safety Injection (SI) Pump Monorails: A total of five separate 4-ton capacity monorails service the safety injection pumps located in Rooms 002, 005 and 015 of the Safety Equipment Building. Individual monorails are located in each of the three pump rooms and can only interact with the equipment in each room. Two additional monorails are located above the pump rooms in Rooms 017 and 020. The Room 020 monorail is located above the equipment hatch in the ceiling of Room 005 and is used to lift the hatch and to lift components out of the pump room. The physical arrangement of this monorail limits any interaction to the one pump room and equipment. The monorail in Room 017 runs above the equipment hatches in the ceilings of Rooms 002 and 015. It is used to lift the hatches and to lift components out of the rooms below. The arrangement allows equipment lifted out of Room 015 to be carried over the equipment hatch

of Room 002. Because safe shutdown equipment is located in the three pump rooms, load handling activities by these cranes represent a potential interaction under NRC guidelines.

(9) Diesel Building Cranes: The diesel building cranes are 3-ton capacity underhung bridge cranes. There are two cranes, each located over one of the diesel-generator units which are housed in completely separate compartments. The cranes are used to lift various components of the diesels for maintenance. Because the diesels are safe shutdown equipment, load handling operations by these cranes represent a potential interaction under NRC guidelines.

(10) Charging Pump Monorails: Three 5-ton capacity monorails are provided in each unit to service the charging pumps. Each pump and monorail is located in a separate compartment such that lifts performed in one compartment would not interact with equipment located in the adjacent compartments. Because the charging pumps and other support equipment located in these rooms are classified as safe shutdown equipment, load handling operations by these cranes represent a potential interaction under NRC guidelines.

ITEM 2: Justify the exclusion of any overhead handling system from the above category by verifying that there is sufficient physical separation from any load-impact point and any safety-related component to permit a determination by inspection that no heavy load drop can result in damage to any system or component required for plant shutdown or core decay heat removal.

RESPONSE: As discussed in Item 1 and indicated in Table 1, eleven cranes were excluded from evaluation based upon our verification that there was sufficient physical separation from any load impact point to damage safe shutdown equipment. The following cranes can also be excluded from further detailed consideration.

(1) As indicated in Item 1 above, there are separate diesel building cranes, each serving a redundant diesel-generator. Therefore, the drop of a load from one of the cranes could do no more than damage a single diesel-generator that had already been removed from service for maintenance or repair. Because the remaining diesel generator is completely redundant, safe shutdown can still be achieved even in the event of a loss-of-offsite power.

(2) As indicated in Item 1 above, there are separate monorails in each of the charging pump compartments. The drop of a load from any one of the three monorails could do no more than damage a single charging pump that had already been removed from service for maintenance or repair. Safe shutdown of the plant can be accomplished with the remaining two charging pumps. Accordingly, a heavy load drop from any of the three monorails would not result in loss of an operable charging pump and therefore would not prevent the charging system from accomplishing its safety function.

ITEM 3: With respect to the design and operation of heavy load-handling systems in the containment and spent-fuel-pool area and those load-handling systems identified in 2.1-1 above, provide your evaluation concerning compliance with the guidelines of NUREG-0612, Section 5.1.1. The following specific information should be included in your reply:

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

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

RESPONSE:

(1) Containment Polar Crane: The containment polar crane is designed to provide maximum coverage of the containment cross section for heavy load handling operations. Restricted areas and safe load paths have been defined to assure that crane operations are conducted in a safe manner. Figure 2 shows the general arrangement of the containment at the operating deck. Figure 3 shows two restricted areas for crane operation in the vicinity of the tops of the steam generators and main steam lines. Limit switches on the crane trolley, bridge, and main and auxiliary hoists prevent crane operation unless both hooks are in the completely retracted position. A by-pass is provided that will allow any drive to operate within the restricted zones at a maximum of 20% of rated speeds.

Figure 2 illustrates a defined area over the reactor vessel over which loads are not to be carried except under certain situations. With the exception of the reactor vessel head, cable support structure, upper guide structure and attachments thereto, heavy loads will be restricted from passing over this area when the reactor vessel head is removed. The restrictions will be specified in appropriate limitation procedures for the particular operation being performed.

Figures 2 and 4 illustrate the load paths to be followed for lifts of the reactor coolant pump motors. Lifts involving reactor coolant pump 2A

must be evaluated since the shutdown cooling suction line is located in the vicinity of the pump. This will be evaluated in the September 22, 1981 submittal.

(2) Cask Handling Crane: The cask handling crane is used to lift the spent fuel cask and the spent fuel pool gate. Neither of these loads is carried over the spent fuel pool or directly over equipment required for safe shutdown or for removal of decay heat. The principal features of load handling operations are illustrated in Figures 5, 6 and 7 which illustrate a plan view and two vertical views of the Fuel Handling Building. The spent fuel cask is deposited and loaded in the cask storage pool which is a separate pool provided exclusively for that purpose. The pool is separated from the spent fuel storage pool by a 4 ft. thick reinforced concrete wall, and the water contents of the two pools can be isolated by the bulkhead gate located on the spent fuel pool side, away from the cask-lowering path.

The prescribed path for the cask travel is as shown shaded in the plan drawing (Figure 5). The primary purpose of this path is to assure that the cask approaches and egresses the pool along the E-W direction. This direction of travel was selected to preclude tilting of the cask toward the spent fuel pool if the cask were to drop and strike an edge of the cask storage pool; under the prescribed direction of travel the primary thrust upon tilting would be westwardly into the cask pool without any tendency toward the spent fuel pool.

The prescribed path is enforced by administrative control and critical path limit switches provided in the crane. If these limit switches were subject to unauthorized override, the prescribed path of approach into the cask pool is also enforced by physical barriers consisting of the wall around the cask wash down area and the demarcation posts located on the operating floor, all illustrated in the plan drawing (Figure 5).

The travel of the cask over the operating floor is restricted to a maximum lifted height of 6 inches above the floor. This restriction is enforced by administrative control and by a critical path limit switch provided in the crane. Two additional high-lift limit switches (drum and load-block type) are provided to preclude hoisting of the crane load block against the upper head block, and a low-lift limit switch is provided to assure the minimum turns of rope around the drum when the crane hook is fully lowered.

The only essential equipment located below the cask handling area are the heat exchangers and pumps for the removal of decay heat from the spent fuel pool. This equipment is totally protected from a cask drop since it is located two levels below the 4 ft. thick operating floor which is designed to withstand a cask drop from a 6 in. height.

Cask drop during transfer of the cask in or out of the cask loading pool could damage the liner plate of the pool and affect its watertightness. However, any attendant water loss in the cask pool would not adversely affect the spent fuel pool since the lowest water reached in the pool would still provide a 2 ft. cover over the stored fuel. This water level is dictated by the bottom elevation of the connecting slot between the cask pool and the spent fuel pool, and it affords sufficient cover to maintain cooldown of spent fuel under that extreme event.

Lifts of the bulkhead gate are carried out at the edge of the spent fuel pool. The cask handling crane trolley is at its extreme northern position to lift the gate out of the pool. After lifting, the gate is moved away from the spent fuel pool to the cask handling area for maintenance operations. The physical arrangement of the crane precludes its being carried over the spent fuel pool.

(3) Turbine Gantry Crane: The salt water cooling pumps are located below the travel path of the turbine gantry cranes. Figure 8 illustrates the plan view of the crane and location of the saltwater cooling pumps. The

saltwater cooling system is required for safe shutdown as it supplies cooling water to the component cooling water heat exchangers. There are four, 100% capacity pumps provided for each unit. Two of the pumps are located in the Unit 2 intake structure and two are located in the Unit 3 intake structure resulting in an arrangement as shown on Figure 9. The piping is interconnected so that each redundant component cooling heat exchanger for each unit can be supplied by a salt water cooling pump located in either intake structure.

The physical separation of the salt water cooling pumps prevents a load drop event that could disable all of the pumps for either unit. To provide additional assurance, the operating procedure for the turbine gantry crane will define the area over the salt water cooling pumps as a restricted area for movement of the pump components and hatches. Lifts of the salt water cooling pumps and hatches will be performed such that a load lifted out of one pump house structure will not be carried over the salt water cooling pumps in the opposite structure. To provide protection to the salt water cooling lines, the turbine gantry crane operating instruction will restrict to the extent possible movement of heavy loads to the west side of the intake structure.

(4) New Fuel Handling Crane: The arrangement of the new fuel handling crane in the Fuel Handling Building is shown in Figure 10. The monorail section runs to the edge of the spent fuel pool to allow lifting of the gate at the north end of the pool. Therefore, the load path for this lift is defined by the monorail track and precludes this load from being carried over the spent fuel pool.

(5) AFW Pump Bridge Crane: The arrangement of the AFW Pump Bridge Crane includes girders that span the two electric and one turbine driven AFW pumps. The crane is used to lift components of the AFW pumps for maintenance and repair. Normally these lifts are performed in place such that loads are not moved from the immediate vicinity of the pump being

maintained. Infrequently it may be necessary to remove one of the AFW pumps or motors for major repair or replacement. This would involve lifting and translation of the load to the east end of the pump room with the bridge crane and removal of the load through a hatch in the ceiling by a mobile crane positioned outside the building. Lifts of this type involving the middle and west AFW pumps would necessitate movement of the load over one or both of the other AFW pumps. Several options are being considered to assure safe load handling operations and the selected approach will be described in the September 22, 1981 report to the NRC.

(6) <u>CCW Pump Monorail</u>: This monorail runs above the hatches in the ceilings of each CCW pump compartment (see Figure 1). Maintenance on the pumps involves removal of the equipment hatch and lifting the pump component out of the room. The load path is defined by the monorail itself. A lift of one of the three CCW pumps and movement to the west end of the monorail, could require the load to travel over one or two of the other pumps compartments. The operating procedure for this crane will require that a load will only be carried over an adjacent pump room when its equipment hatch is in place. This will assure that the drop of a heavy load associated with maintenance on one CCW pump will not damage either of the two remaining CCW pumps.

(7) <u>SI Pump Monorails</u>: Within the pump rooms, each monorail runs above the pump or pumps located within the room. The monorail in Room 017 runs above the ceiling hatches in pump rooms 002 and 015 (see Figure 1). Therefore, the load paths are defined by the monorail itself. Pump rooms 002 and 005 contain the following safe shutdown equipment:

- Shutdown cooling system cable, equipment
- HVAC LPSI room cable, fan, LPSI pump
- Component cooling water valves
- Emergency chilled water system valves.

These rooms also contain a containment spray pump and a HPSI pump. Pump room 015 contains the following safe shutdown equipment:

- Shutdown cooling system cable, equipment
- Component cooling water valves
- Emergency chilled water system valves.

Room 015 also contains an HPSI pump.

Only one LPSI pump is required for safe shutdown and each pump and its support equipment is located in a completely separate room. Accordingly, the drop of a heavy load from any one of the monorails could not result in a loss of minimum LPSI capability. To further limit any damage to safe shutdown equipment, the operating procedure for these monorails will include the following requirements.

- Lifts of heavy loads out of Rooms 002 and 015 using the monorail in Room 017 will only be performed with the adjacent equipment hatch in place; i.e., a lift out of Room 015 will require the Room 002 hatch to be installed.
- Lifts of heavy loads within the pump rooms will be carried out to minimize movement of loads over safe shutdown equipment.

ITEM 3c: A tabulation of heavy loads to be handled by each crane which includes the load identification, load weights, its designated lifting device, and verification that the handling of such load is governed by a written procedure containing, as a minimum, the information identified in NUREG-0612, Section 5.1.1(2).

RESPONSE: The requested information is provided in Tables 2 through 8.

TABLE 2
POLAR CRANE HEAVY LOADS

Load	Safety Class[1]	Weight (Tons)	Applicable Operating Procedures	Lifting Device
Reactor Vessel Head	1	190 (with lifting rig)	*	Reactor Vessel Head Lifting Rig
Reactor Head Cable Support Structure	1,3[2]	35	*	Slings
CEDM Cooling Duct	3	11	*	Reactor Vessel Head Lift Tripod
Upper Guide Structure	1	73	*	Upper Guide Structure Lift Rig
Core Support Barrel	3	76	*	Core Support Barrel Lift Rig
CRDM Missile Shield Blocks	3	22.5	*	Slings
Pool Seal Ring	3	9	*	Reactor Vessel Head Lift Tripod
Head Stud Tensioners	3	1.1	*	Slings
Reactor Coolant Pump Motor	2	58	*	Slings

1. Safety classes define when the lifts are made with respect to the vessel head being in place or removed, fueled or defueled. They are defined as follows.

Class 1 - Loads of greater than the weight of a single fuel assembly (about 1,500 lbs.) that must be carried over fuel in an open reactor vessel.

Class 2 - Loads of greater than about 1,500 lbs. that could be lifted and moved by the containment crane when the head is off and fuel is in the reactor vessel but are not required to be moved over the reactor vessel.

Class 3 - Loads of greater than about 1,500 lbs. that are normally lifted only when the reactor vessel head is in place or the reactor is defueled.

2. The cable support structure is moved in two steps during removal and replacement. The first step moves it to its temporary storage location over the refueling storage canal. The second step, occurring after removal and storage of the reactor vessel head, moves the cable support structure to its permanent storage location on the refueling deck.

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

TABLE 3

CASK HANDLING CRANE

Load	Approx. Weight (lbs.)	Applicable Procedure	Lifting Device
Irradiated Fuel Shipping Cask	125 tons	*	Spreader beam Clean Lifting Yoke Contaminated Extension Yoke Assembly
Spent Fuel Pool Gate	3,500	*	Sling
Hatch Cover	12,000	*	Sling

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

TABLE 4

TURBINE GANTRY CRANE[1]

Load	Approx. Weight	Applicable Procedure	Lifting Device
Low Pressure Turbine Rotor	218.5 tons (including lifting device)	*	Turbine Rotor Lifting Beam
Salt Water Cooling Pump Motor	5,900 lbs.	*	Sling

1 The turbine gantry crane will be used to lift a wide variety of loads. The two loads specified in the table represent the heaviest load (the rotor) and the load which must be lifted over the Salt Water Cooling Pump area.

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

TABLE 5

NEW FUEL HANDLING CRANE

Load	Approx. Weight (lbs.)	Applicable Procedure	Lifting Device
Spent Fuel Pool Gate	3,500	*	Sling
New Fuel[1] Shipping Container	4,000 (empty) 6,900 (full)	N/A[1]	N/A
Hatch Cover	4,000	N/A[1]	Sling

[1] The loads are handled only in the new fuel handling area.

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

TABLE 6

AFW PUMP BRIDGE CRANE

Load	Approx. Weight (lbs.)	Applicable Procedure	Lifting Device
AFW Pump Motor (Elec.)	9,700	*	Sling
AFW Pump (Elec.)	6,500	*	Sling
AFW Pump (Turbine)	5,000	*	Sling

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

TABLE 7

CCW PUMP MONORAIL

Load	Approx. Weight (lbs.)	Applicable Procedure	Lifting Device
CCW Pump Motor	5,960	*	Sling
Hatch Cover	4,200	*	Sling

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

TABLE 8

SAFETY INJECTION PUMP MONORAILS

Load	Approx. Weight (lbs.)	Applicable Procedure	Lifting Device
HPSI Motor	5,760	*	Sling
LPSI Pump	7,645	*	Sling
LPSI Motor	5,590	*	Sling
Containment Spray Pump	7,645	*	Sling
Containment Spray Motor	5,590	*	Sling
Hatch Cover	5,840	*	Sling

*Procedures are being developed consistent with the scheduled operation date to govern handling of this load and to meet the requirements of NUREG-0612.

ITEM 3d: Verification that lifting devices identified in 2.1.3-c., above, comply with the requirements of ANSI N14.6-1978 or ANSI B30.9-1971 as appropriate. For lifting devices where these standards, as supplemented by NUREG-0612, Section 5.1.1(4) or 5.1.1(5), are not met, describe any proposed alternatives and demonstrate their equivalency in terms of load-handling reliability.

RESPONSE: With regard to lifts identified in 2.1.3.c., above, that utilize slings, plant procedures will require that sling selection and use be in accordance with ANSI B30.9.

With regard to special lifting devices, there are 3 identified in 2.1.3.c., above, that are used in lifts over an open reactor vessel. These are:

1) Reactor Vessel Weld Inservice Inspection Tool Lifting Device (Reactor Vessel ISI Tool)

2) The Reactor Vessel Closure Head Lifting Rig (RV Head Lifting Rig)

3) The Upper Guide Structure Lifting Rig

The Reactor Vessel ISI Tool is lightweight, about 1,500 lbs, fabricated of principally aluminum and therefore, not considered a heavy load.

For the reasons listed below, the detailed comparison of the other two devices to ANSI N14.6-1978 was limited to Sections 3.2 and 5.

1) All of the devices listed above were designed prior to the existence of both ANSI N14.6-1978 and the NRC's decision (in NUREG-0612) to apply the standard to these types of devices. In this regard, there are a number of sections in the standard that are difficult to apply in retrospect. These are those entitled Designer's Responsibilities (Section 3.1); Design Considerations (Section 3.3); Fabricator's Responsibilities (Section 4.1); Inspector's Responsibilities (Section 4.2); and Fabrication Considerations (Section 4.3). Because documentation is not available to assure that all of the subparts of these sections were met, they have not been addressed item by item for the purpose of identifying and justifying exceptions. Our

review included information provided by the designer, including drawings and procurement specifications. The information indicated that sound engineering practices were utilized by the designer and that requirements were placed on the fabricator and inspector by the designer for the purpose of assuring that the designer's intent was accomplished. On this basis, there is reasonable assurance that the intent of the sections listed above was in fact accomplished in the design, fabrication, inspection and testing of these devices.

2) Section 1.0, Scope, Section 2.0, Definitions, Section 3.4, Design Considerations to Minimize Decontamination Effects in Special Lifting Device Use, Section 3.5, Coatings, and Section 3.6, Lubricants are not pertinent to the load handling reliability of the devices and therefore have not been addressed for the purpose of identifying and justifying exceptions.

3) Section 6 is applicable to lifting devices used for critical loads. A critical load is defined in the standard as:

> "Any lifted load whose uncontrolled movement or release could adversely affect any safety related system when such system is required for unit safety or could result in potential offsite exposures comparable to the guideline exposures outlined in Code of Federal Regulations, Title 10, Part 100."

None of the loads lifted using the 2 lifting rigs identified above have as yet been determined to be critical loads. Such a determination would require an analysis of the consequences of various load drop scenarios. Since such analyses are not required to be performed until the 9-month report to the NRC (due September 22, 1981), it is premature to designate certain loads as critical loads and accordingly to apply Section 6 of ANSI N14.6-1978 to their designated lifting devices.

The detailed comparison of each of the 2 lifting rigs to Sections 3.2 and 5 of ANSI N14.6-1978, as supplemented by NUREG 0612, Section 5.1.1(4), revealed that the devices comply, but with certain exceptions. Below, each of the devices is described and the exceptions to ANSI N14.6-1978 are identified and their effect in load handling reliability is discussed.

Description of the Reactor Head Lifting Rig

The Reactor Head Lifting Rig (Figure 11) consists of a welded and bolted structural steel frame with rigging for removal and storage of the reactor head. The device, an annular ring girder, is left attached to three lifting lugs, which are an integral part of the reactor head. This lifting rig, used in conjunction with the polar crane, is composed of a removable three-part lifting frame and a three-part column assembly attached to the reactor vessel closure head. The column assembly supports the three hoists for handling the hydraulic tensioners, the studs, washers and nuts, and links the lifting frame with the reactor vessel head. The lifting sling (tri-pod) is removed and stored on the head laydown pad on the operating deck when not in use.

Description of the Upper Guide Structure Lifting Rig

The Upper Guide Structure Lifting Rig (Figure 12) is a structural frame device, designed for removal and installation of the reactor upper internals. The lifting rig consists of a delta spreader beam that supports three columns providing attachment points to the upper guide structure. Attachment to the upper guide structure is accomplished manually from the working platform. The integral in-core instrumentation hoist connects to an adaptor that is manually attached to the in-core instrumentation support plate. The in-core instrumentation is then lifted by the crane hook. The upper clevis assembly, which is common to this and the core support barrel lifting rig, is installed prior to lifting of the structure by the crane hook. Correct positioning is assured by attached bushings that mate to the reactor vessel guide pins.

Exceptions to ANSI N14.6-1978

This evaluation is not complete due to a need to obtain additional information from the fabricator. However, the following exceptions have been identified and any additional exceptions will be reported in the September 22, 1981 report required by NUREG-0612.

Exception 1: The special lifting devices were not subjected to a load test equal to 150% of the maximum load to which the device is to be subjected prior to their initial use as required by Section 5.2.1 of ANSI N14.6-1978. Instead, the Head Lifting Rig and the Internals Lifting Rig have successfully lifted loads equivalent to 125% of their rated load with no signs of deformation or overstress.

In the case of the Head Lifting Rig, the operating procedures will effectively preclude overloading the special lifting devices beyond the 100% rated load. Inspection and maintenance procedures for these devices following each use will provide assurance that no latent defects are present up to the stress levels to which the devices are limited by procedures. Also, these lifting devices are not subjected to any use or loads other than the design loads. They are sole-purpose devices, dedicated to only one use and therefore not subjected to abuse or to a deteriorating environment. Based on the procedures which assure against overloading, inspections to detect against incipient failures or deformation and dedicated usage, the fact that none were initially load tested to 150% of the rated load is judged to have no significant effect on the lifting devices' current load handling reliability.

Exception 2: Plant procedures do not now specify a visual inspection by maintenance or other nonoperating personnel at intervals not to exceed 3 months in length as required by Section 5.3.7 of ANSI N14.6-1978 for the Reactor Head Lifting Rig and the Upper Guide Structure Lifting Rig. Between usage, these rigs are stored in a specific location under controlled environment. The devices are inspected by qualified personnel at specific intervals. This will include a visual, dimensional and NDE inspection prior to each use, unless the device has received such inspections within the last 12 months. In any event, a visual examination prior to each use will be performed. Based on this controlled use, storage, handling and inspections, the equivalency in load-handling reliability provided by Section 5.3.7 is demonstrated.

Exception 3: With regard to the Reactor Head Lifting Rig and the Upper Guide Structure Lifting Rig, there are several components whose inspection in

accordance with all of the requirements of Section 5.3.1(2) on an annual frequency is impractical. These components are those that require disassembly not normally performed or removal of protective coatings. The proposed inspection of all critical load bearing components, including exceptions for these rigs, will be indicated in maintenance procedures.

The basis for the extended intervals on several of the rigs' components is again the controlled use, storage and handling of the rigs. Further, all of the items being proposed for inspection on the longer frequency will be inspected to the extent practical on the shorter frequency using available techniques.

ITEM 3e: Verification that ANSI B30.2-1976, Chapter 2-2, has been invoked with respect to crane inspection, testing, and maintenance. Where any exception is taken to this standard, sufficient information should be provided to demonstrate the equivalency of proposed alternatives.

RESPONSE: Procedures for the inspection, testing, and maintenance of the Polar, Turbine Gantry and Cask Handling crane will be developed to satisfy the criteria in ANSI B30.2-1976, Chapter 2-2.

The criteria in ANSI B30.2 are not easily applied to such handling systems as monorails and hand-driven hoists. Accordingly, ANSI B30.11-1973, "Monorail Systems and Underhung Cranes" and ANSI B30.16-1973, "Overhead Hoists" will be used in developing the inspection, test, and maintenance procedures for the New Fuel Handling, the Safety Injection Pump and the CCW Pump, and the Auxiliary Feedwater Pump underhung crane.

ITEM 3f: Verification that crane design complies with the guidelines of CMAA Specification 70 and Chapter 2-1 of ANSI B30.2-1976, including the demonstration of equivalency of actual design requirements for instances where specific compliance with these standards is not provided.

RESPONSE: Evaluations were performed of the handling system designs for those systems not excluded in Items 1 and 2 above using the design criteria in applicable current standards. The following summarize the results of these evaluations.

(1) Polar Cranes: These polar cranes were built prior to the issuance of ANSI B30.2 (1976), and CMAA-70 (1975). These cranes were procured, designed and fabricated by PACECO Corporation in accordance with the criteria in specification number S023-209-1 of Bechtel Corporation, dated August 20, 1973. This specification called for the cranes to be built in compliance with CMAA-70 (October 1971) which is essentially equivalent to the 1975 revision of CMAA-70. Areas in which uncertainties remained after review of the Bechtel design specification were clarified by review of PACECO's structural and mechanical drawings for the cranes and in telephone conversations with PACECO technical personnel. In evaluating the ability of these cranes to handle heavy loads, it should be noted that each (with a special trolley) was subjected to two 625-ton lifts of steam generators during plant construction, loads far in excess of those handled during normal plant operations.

(2) Cask Handling Cranes: These cranes were built prior to the issuance of ANSI B30.2 (1976) and CMAA-70 (1975). The cranes were procured, designed and fabricated by Whiting Corporation in accordance with the criteria in Bechtel Power Corporation Specification Number SO23-209-3, dated May 23, 1974; Addendum no. 1, dated May 15, 1975; and addendum no. 2, dated December 15, 1976. The design specification called for compliance with the current version of CMAA-70 (October 1971) which is essentially equivalent to the 1975 revision of CMAA-70. Our approach in evaluating these cranes was to identify sections relevant to load drop

prevention in ANSI B30.2 (1976), determine if the requirements in these sections are more stringent than those of CMAA-70 and then establish whether the crane design satisfies these requirements.

Based on our evaluation, we find that the cask handling crane design complies with the guidelines of CMAA-70 (1975) and ANSI B30.2 (1976).

(3) Turbine Gantry Cranes: These cranes were built prior to the issuance of ANSI B30.2 (1976) and CMAA-70 (1975). The cranes were procured, designed, and fabricated by PACECO Corporation in accordance with Bechtel Power Corporation specification number SO23-209-2, dated September 5, 1973, and addenda nos. 1, 2, 3, 4 and 5, dated October 25, 1973; January 25, 1975; March 17, 1976; May 5, 1976; and October 10, 1977, respectively. The design specification called for compliance with the then current version of CMAA-70 (October 1971), which is essentially equivalent to the 1975 version of CMAA-70. Our approach in evaluating these cranes was to identify sections relevant to load drop prevention in ANSI B30.2 (1976), determine if the requirements in those sections were more stringent than those of CMAA-70, and then establish whether the crane design satisfied these requirements.

A modification in the standards of the American Welding Society that was made during the late 1970's pertains to control of hydrogen in weld rods used in crane fabrication. Compliance with these standards, AWS D1.1 "Structural Welding Code" and AWS D14.1 "Specifications for Welding Industrial and Mill Cranes," is required by CMAA-70 and ANSI B30.2 1976).

Appendix 4L of the Bechtel specifications required preheating for welding rods in a manner consistent with the current AWS standards. We therefore conclude that the SONGS 2/3 turbine gantry crane design complies with the guidelines of CMAA-70 (1975) and ANSI B30.2 (1976) in the area of welding, as well as in all other areas having relevance to load drop prevention.

(4) New Fuel Handling Monorail

This handling system consists of a bridge crane interlocked to a monorail. Only the monorail portion needed to be evaluated since it is used to remove the gate in the spent fuel pool. The monorail track, supports, switch, and carrier were designed and fabricated by American Monorail of California and the 5-ton hoist for the system was designed and fabricated by Harnischfeger. The cranes were procured in accordance with Bechtel Power Corporation specification number SO23-411-11, dated December 11, 1974, and Addenda nos. 1, 2, 3, 4, and 5. Since the design requirements of CMAA-70 were not applicable to all portions of the system, the design requirements of MMA-73, "Specification for Underhung Cranes and Monorail Systems," were also specified, with MMA-73 to take precedent in areas of conflict with CMAA-70. No exceptions to CMAA-70 and MMA-73 design standards were taken.

(5) Auxiliary Feedwater Pump Underhung Crane (5-ton), Safety Injection Pump Monorails (4-ton) and Component Cooling Water Pump Monorail (3-ton).

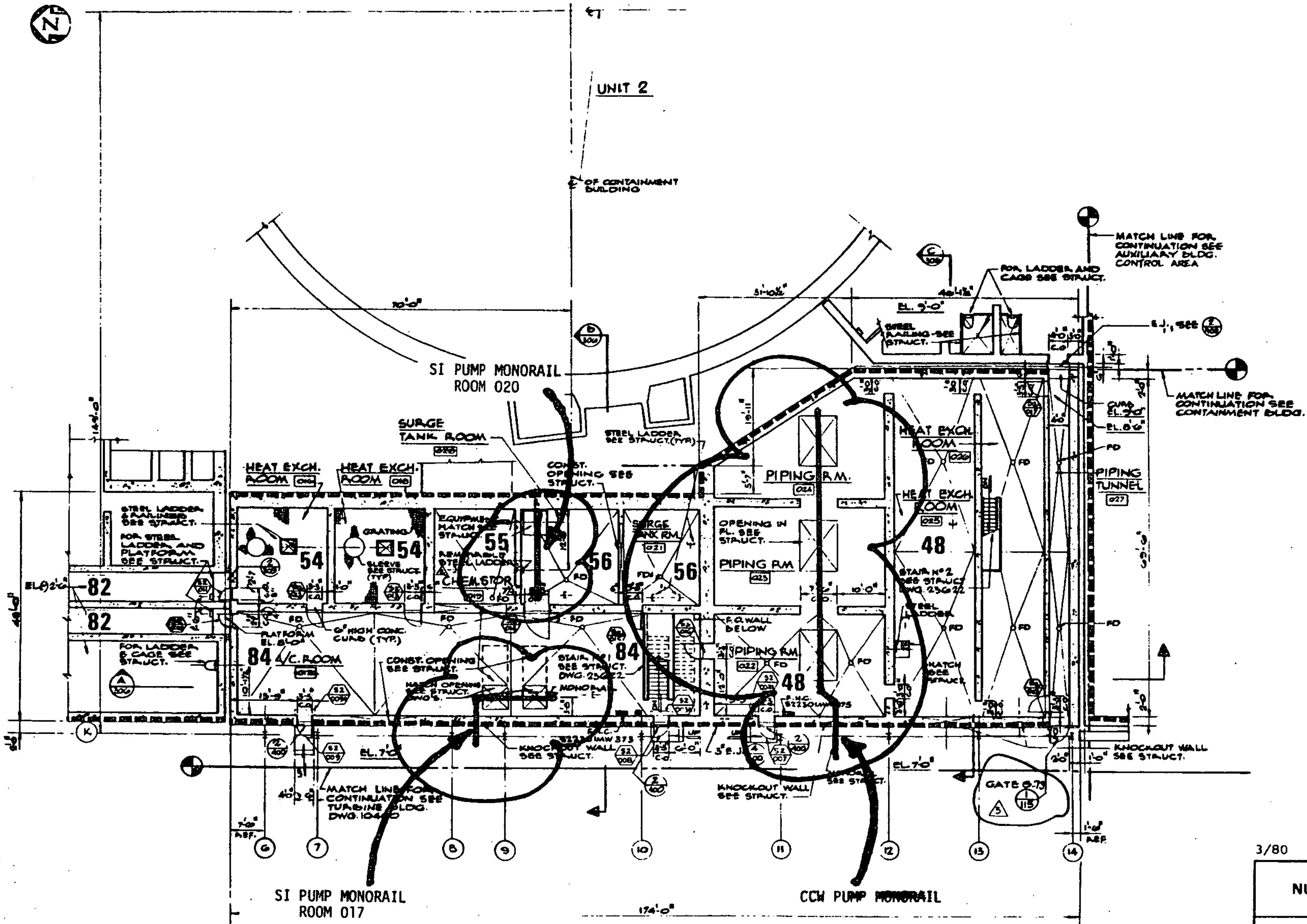
All of these handling systems were designed and fabricated to similar standards. Since the criteria in ANSI B30.2 (1976) and CMAA-70 are not directly applicable to underhung cranes, monorails and their hoists, the designs of these handling systems were compared to the criteria in applicable standards, i.e., ANSI B30.11, "Monorail Systems and Underhung Cranes, 1973," and ANSI B30.16 "Overhead Hoists, 1973." The hoists and trolleys for these handling systems were designed and fabricated by Chester Co. The monorails and underhung crane are single I-beam type girders. The monorails and underhung crane were designed and fabricated by American Monorail and installed by Bechtel.

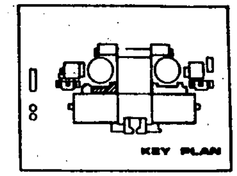
Some additional information is required from the fabricator to complete the comparison of these handling systems to the applicable design standards. The only major item to be resolved is the level of proof test to

which the handling systems were subjected. The standard requires 150% of rated load. Any exceptions will be reported in the September 22, 1981 report required by NUREG - 0612.

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

RESPONSE: Procedures for the qualification and training of crane operators are being developed consistent with the scheduled operating date and will meet the provisions of ANSI B30.2-1976.





GENERAL NOTES:

1. FOR INFORMATION DETAILS AND DIMENSIONS OTHER THAN ROOM & DOOR NUMBERS (UNLESS OTHERWISE NOTED) SEE STRUCTURAL DRAWINGS
2. FOR EXACT LOCATION OF FLOOR DRAINS AND SUMPS SEE MECHANICAL DRAWINGS
3. THE NUMBER SHOWN AT F.H.C. INDICATES PLANT TAG NUMBER

LEGEND

- DOOR NUMBER - SEE DOOR SCHEDULE SHEET 10307
- ROOM NUMBER SEE FINISH SCHEDULE SHEET 10307
- CONC. WALL
- MATCH LINE

ALL WATER TIGHT DOORS SHALL BE QUALITY CLASS II

LEGEND

FIRE BARRIERS

- 3 HOUR RATED
- 2 HOUR RATED
- 1 HOUR RATED

PORTABLE EXTINGUISHERS

H_2O, CO_2, DRY

- FIRE HOSE STA. OR WHEELED EXT
- HAND EXTINGUISHER

3/80 Amendment 3

SAN ONOFRE
NUCLEAR GENERATING STATION
Units 2 & 3

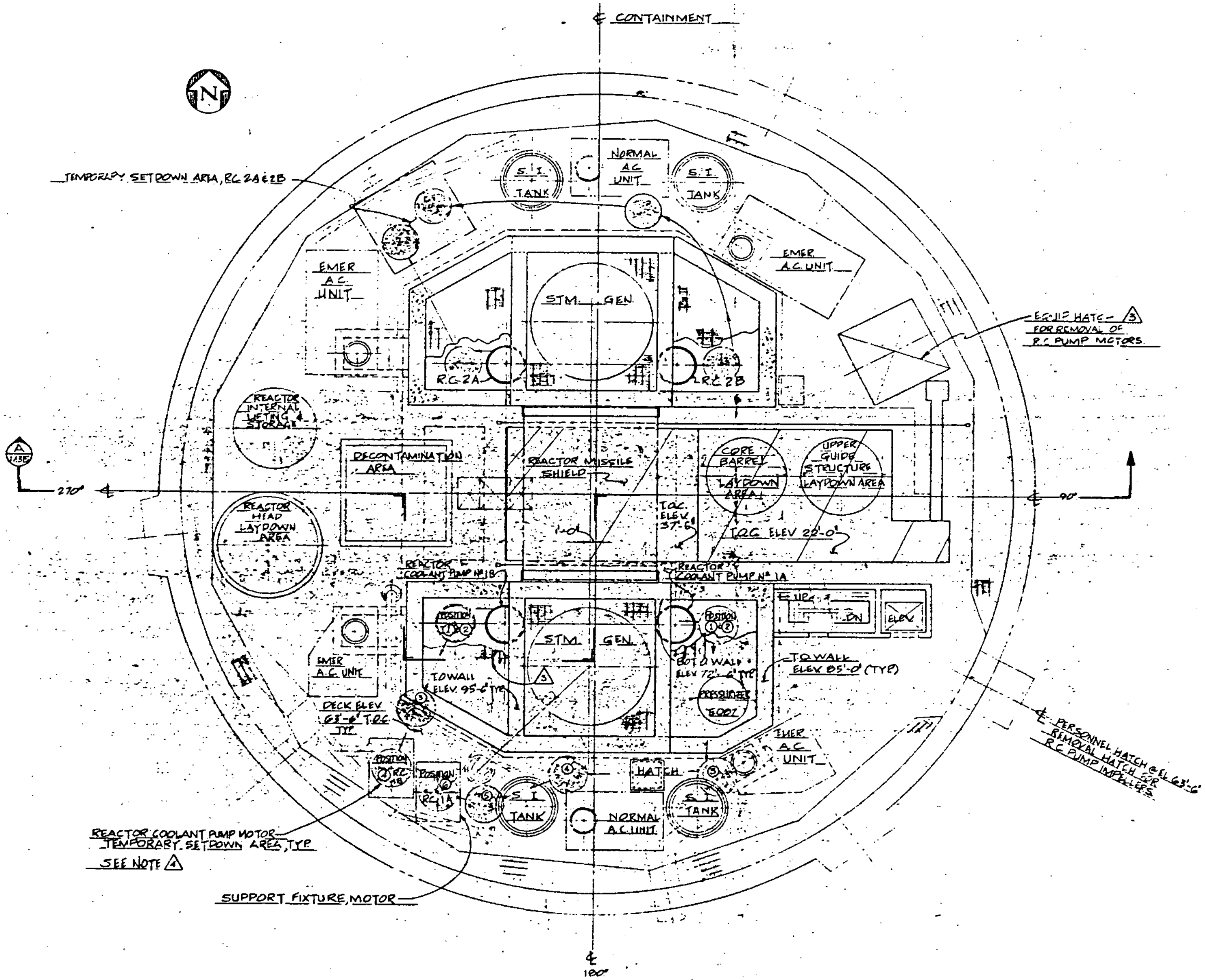
SAFETY EQUIPMENT BUILDING
UNIT 2
EL. 8'-0"

PLAN AT ELEVATION 8'-0"

SCALE: 1/8" = 1'-0"

TERA CORPORATION

FIGURE I



PLAN @ ELEV 63'-6" & ABOVE

SCALE: 1/8" = 1'-0"

FIGURE 2
CONTAINMENT ARRANGEMENT
RESTRICTED AREA
REACTOR COOLANT PUMP LOAD PATH

TERA CORPORATION

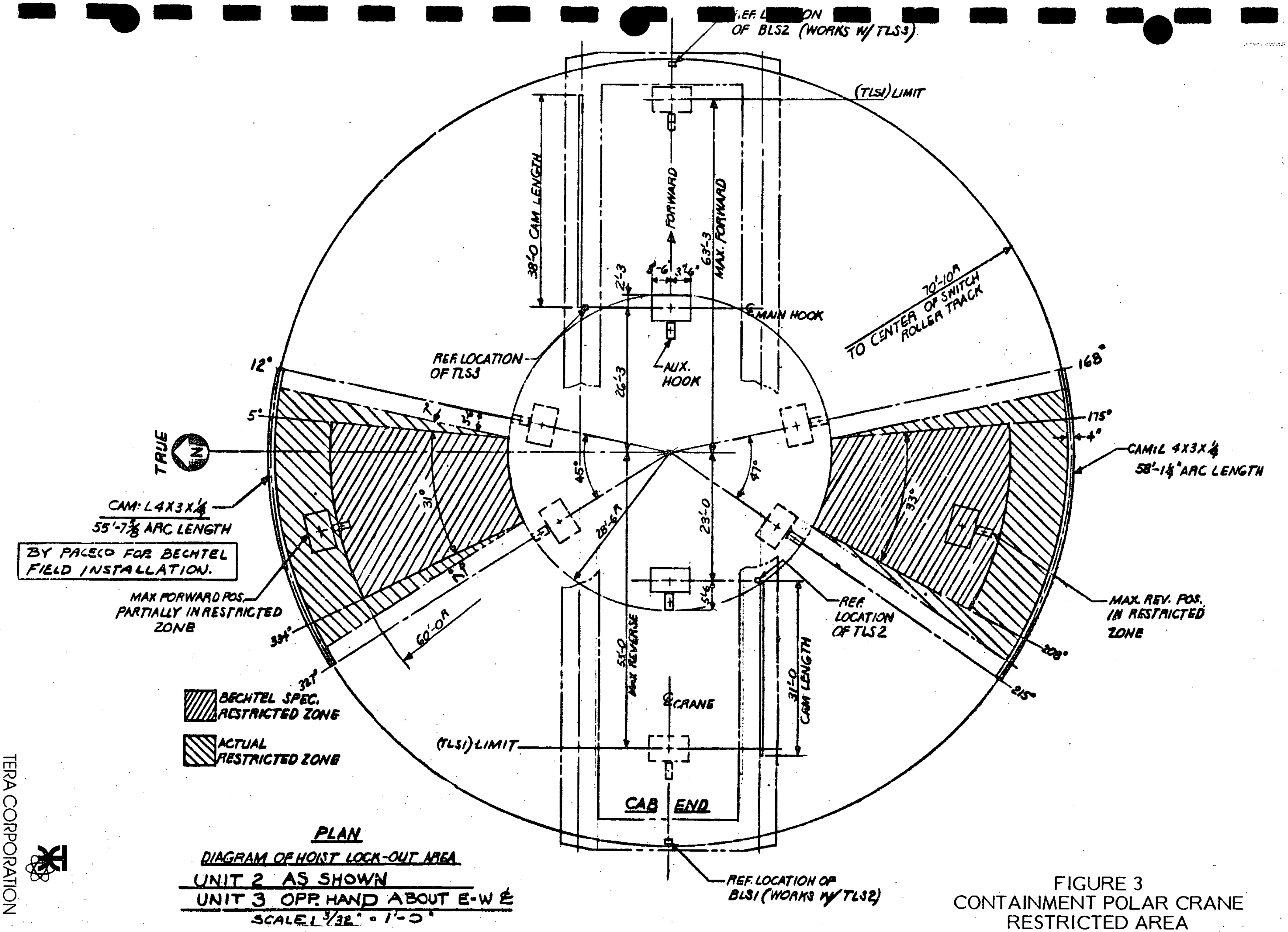


FIGURE 3
CONTAINMENT POLAR CRANE
RESTRICTED AREA

TERA CORPORATION

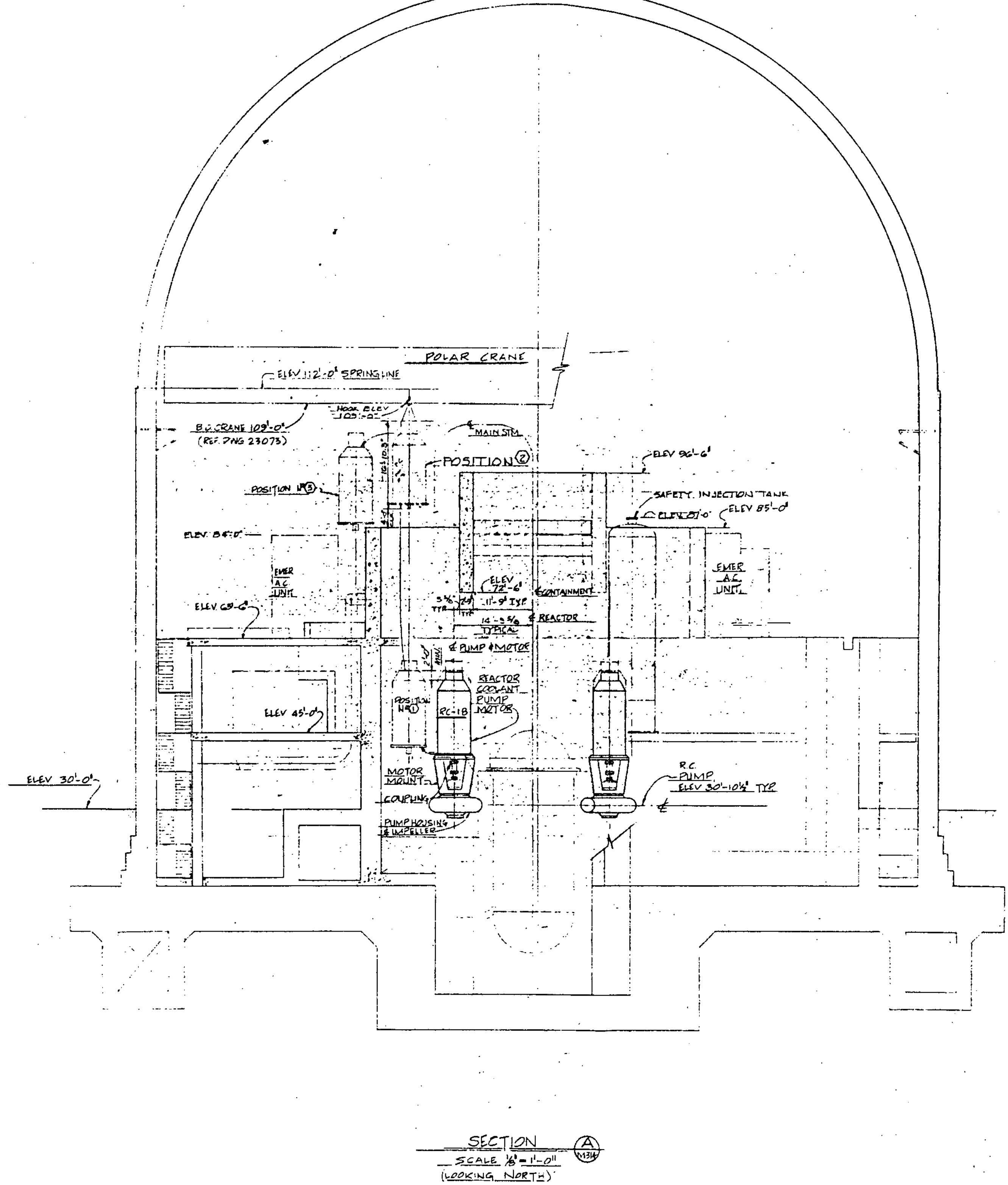
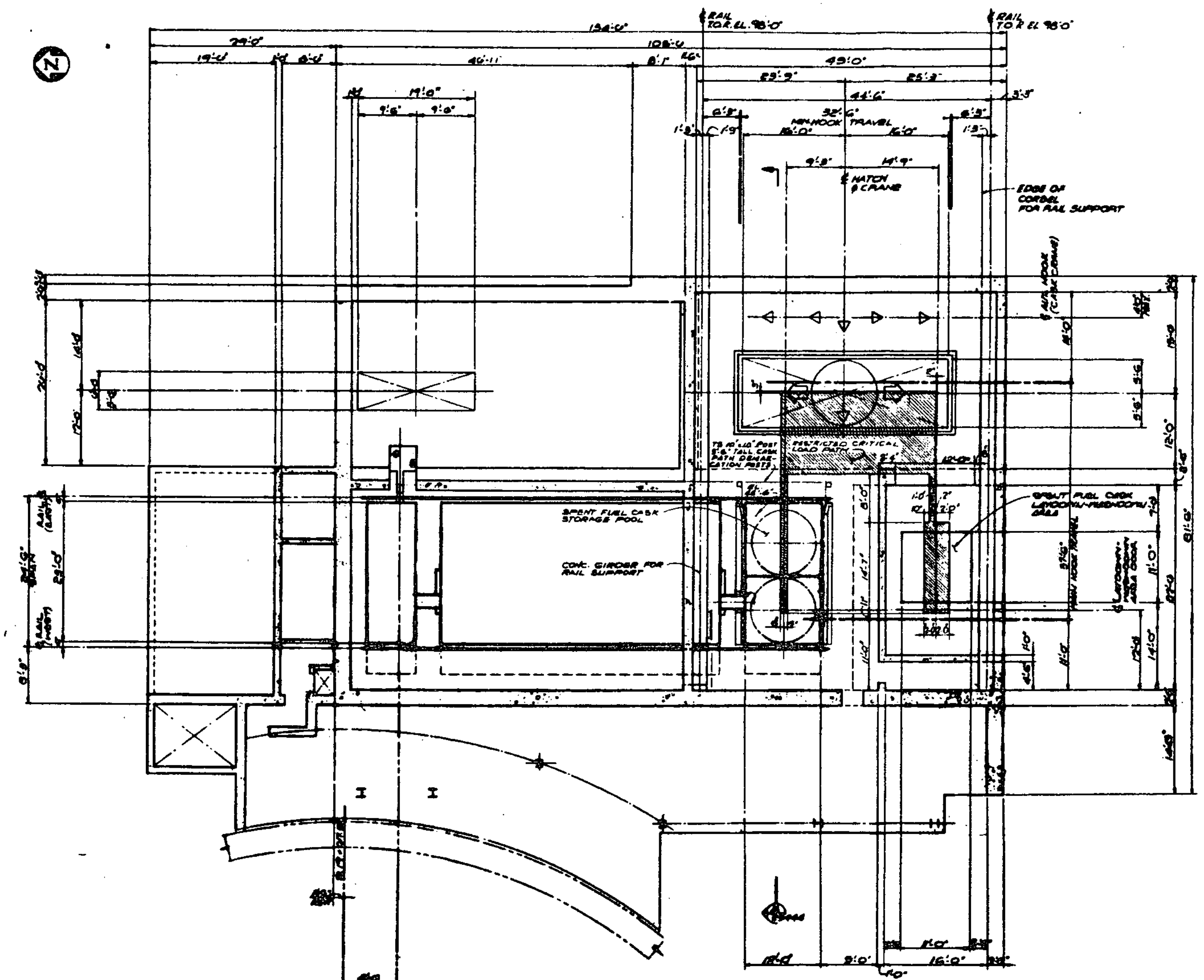


FIGURE 4
REACTOR COOLANT PUMP LOAD PATH

TERA CORPORATION



PLAN AT EL. 63'-6" U.N.O.

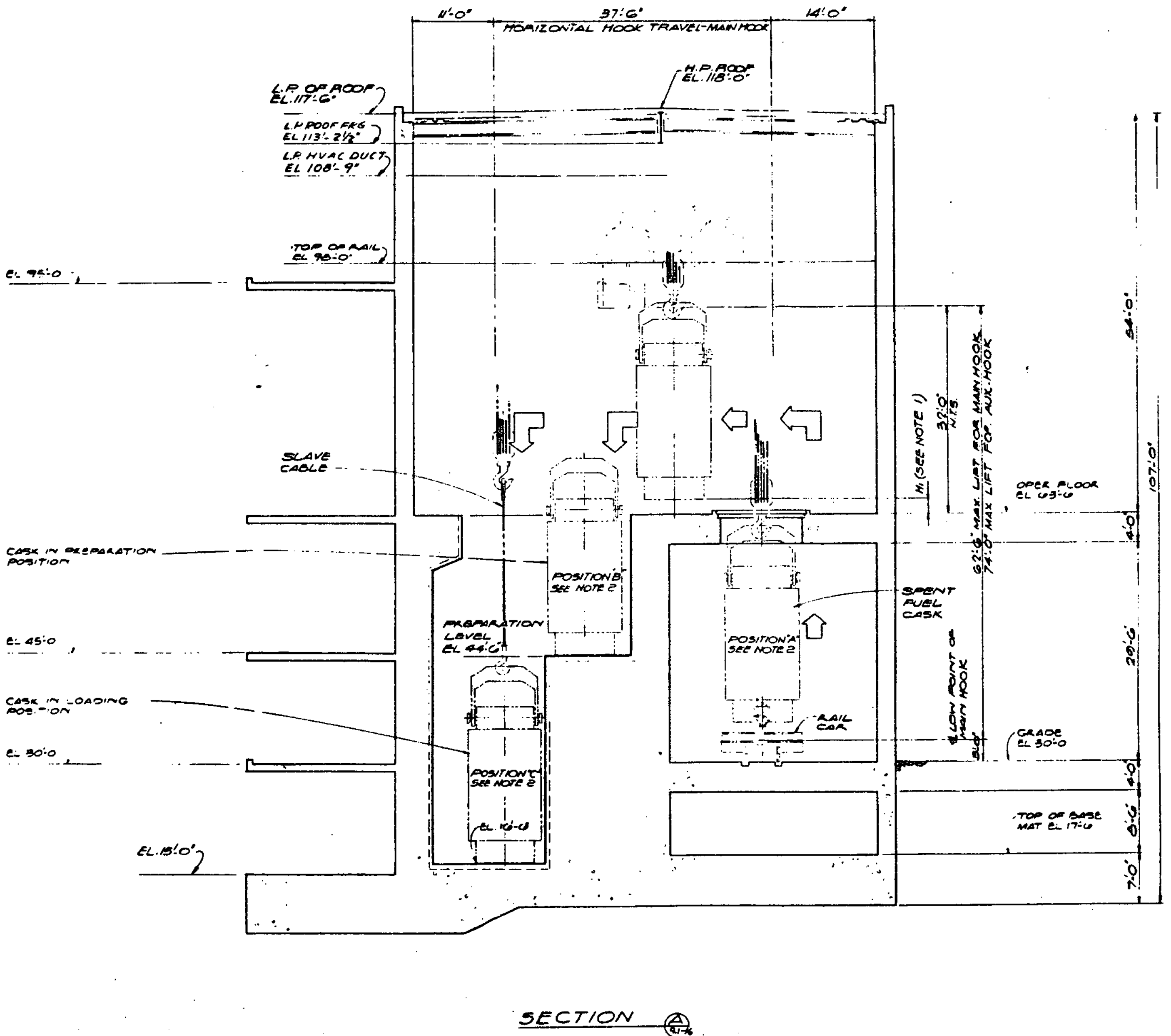
NOTES

1. ⇦ DEPICTS TRAVEL PATH OF MAIN HOOK (CASK CRANE).
2. ◁ DEPICTS TRAVEL PATH OF AUX. HOOK (CASK CRANE).
3. CASK CRANE UNIT 3 AS SHOWN UNIT 3 OPPOSITE HAND ABOUT E-W AXIS.
4. FOR TECHNICAL DESCRIPTION OF RESTRICTED CRITICAL LOAD PATH AND CRITICAL PATH LIMIT SWITCHES FOR RESTRICTING HORIZ. AND VERT. TRAVEL OF MAIN HOOK SEE WHITING CORP. DWG. S023-209-3-60.

SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3
FUEL HANDLING BUILDING CASK HDLG. CRANE TRAVEL CLEARANCE REQ'MTS - PLAN

FIGURE 5

TERA CORPORATION



NOTES

1. LIMIT SWITCH FOR RESTRICTING HEIGHT H1 TO A MAX. OF 9'-6" IS REQUIRED. SWITCH SHALL BE FIELD-ADJUSTABLE ACCORDING TO HEIGHT OF LIFTED LOAD.

2. CASK HANDLING PROCEDURE

POSITION A: CASK - RAISED FROM SHIPPING POSITION TO OPER. FLOOR LEVEL. THEN CASK TRAVELS HORIZONTALLY TO CASK PIT AREA OF POOL.

POSITION B: CASK - LOWERED INTO PREPARATION LEVEL OF POOL WHERE CASK HEAD WILL BE LOOSENED AND SLAVE CABLE ATTACHED.

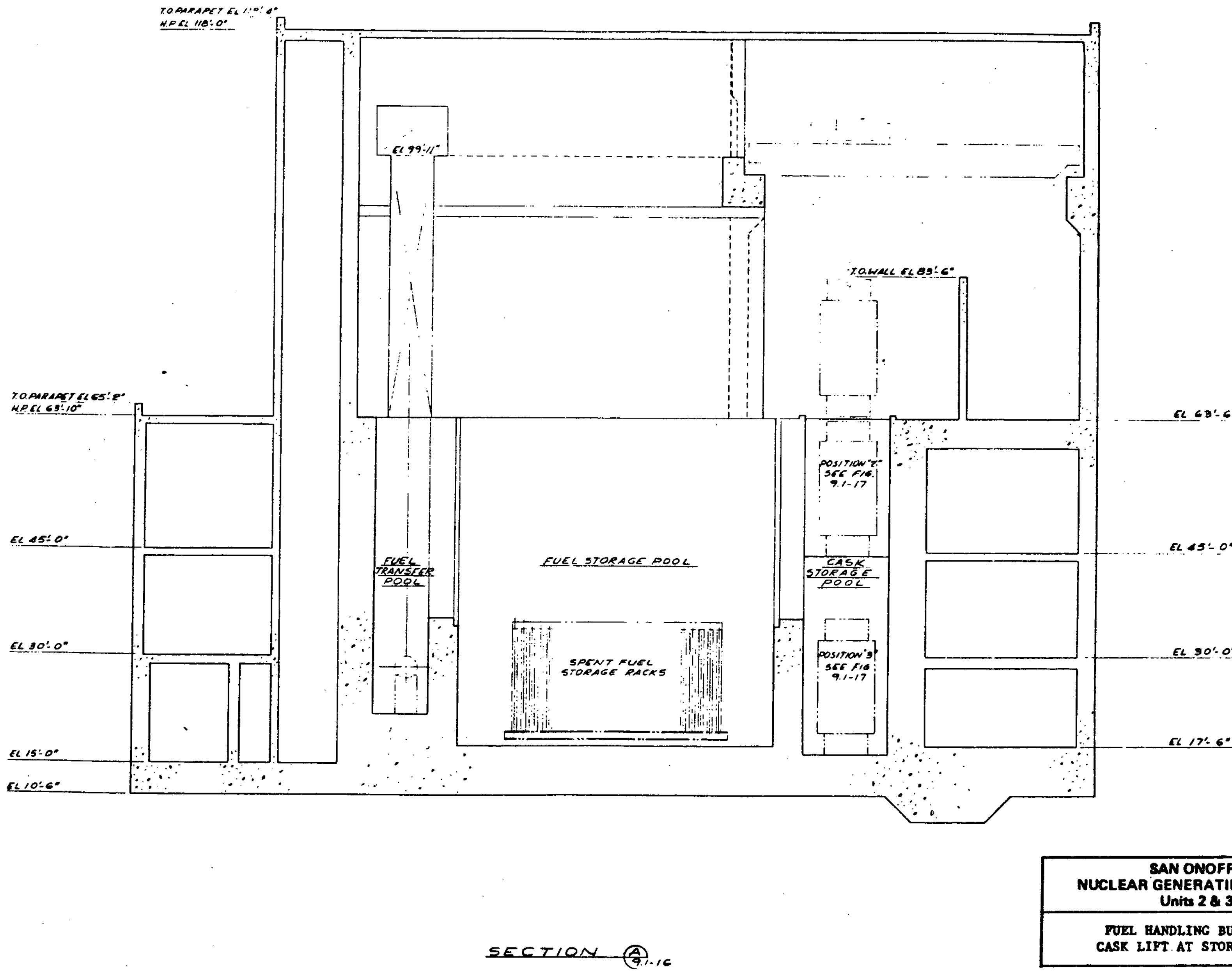
POSITION C: CASK - LOWERED INTO LOADING LEVEL OF POOL WHERE HEAD WILL BE REMOVED AND SPENT FUEL LOADED

SECTION A

SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3
FUEL HANDLING BUILDING CASK CRANE HOOK HEIGHT REQUIREMENTS

FIGURE 6

TERA CORPORATION

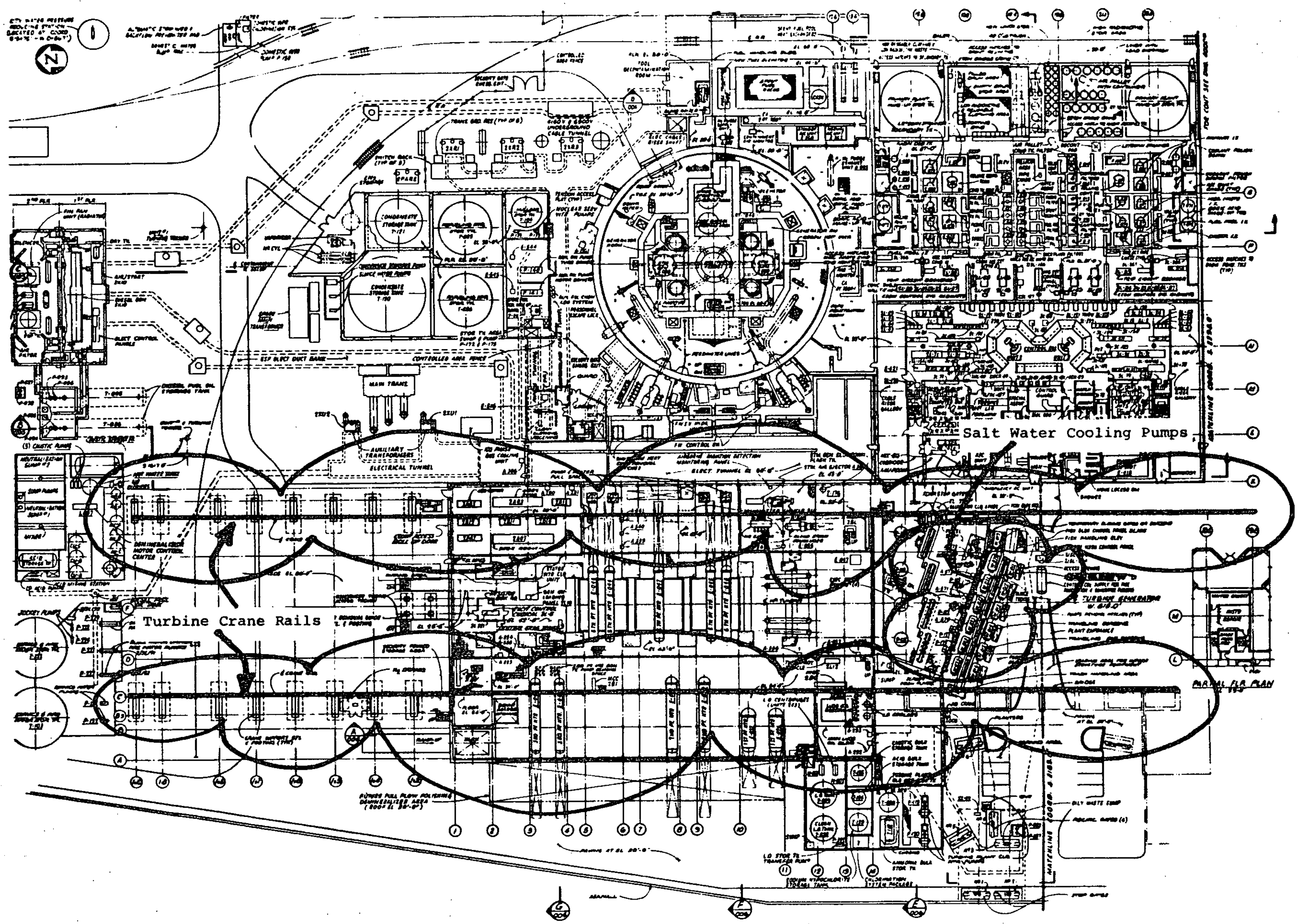


SAN ONOFRE
NUCLEAR GENERATING STATION
Units 2 & 3

FUEL HANDLING BUILDING
CASK LIFT AT STORAGE POOL

FIGURE 7

TERA CORPORATION



Salt Water Cooling Pumps
Turbine Crane Rails
PARTIAL FLR PLAN

FIGURE 8

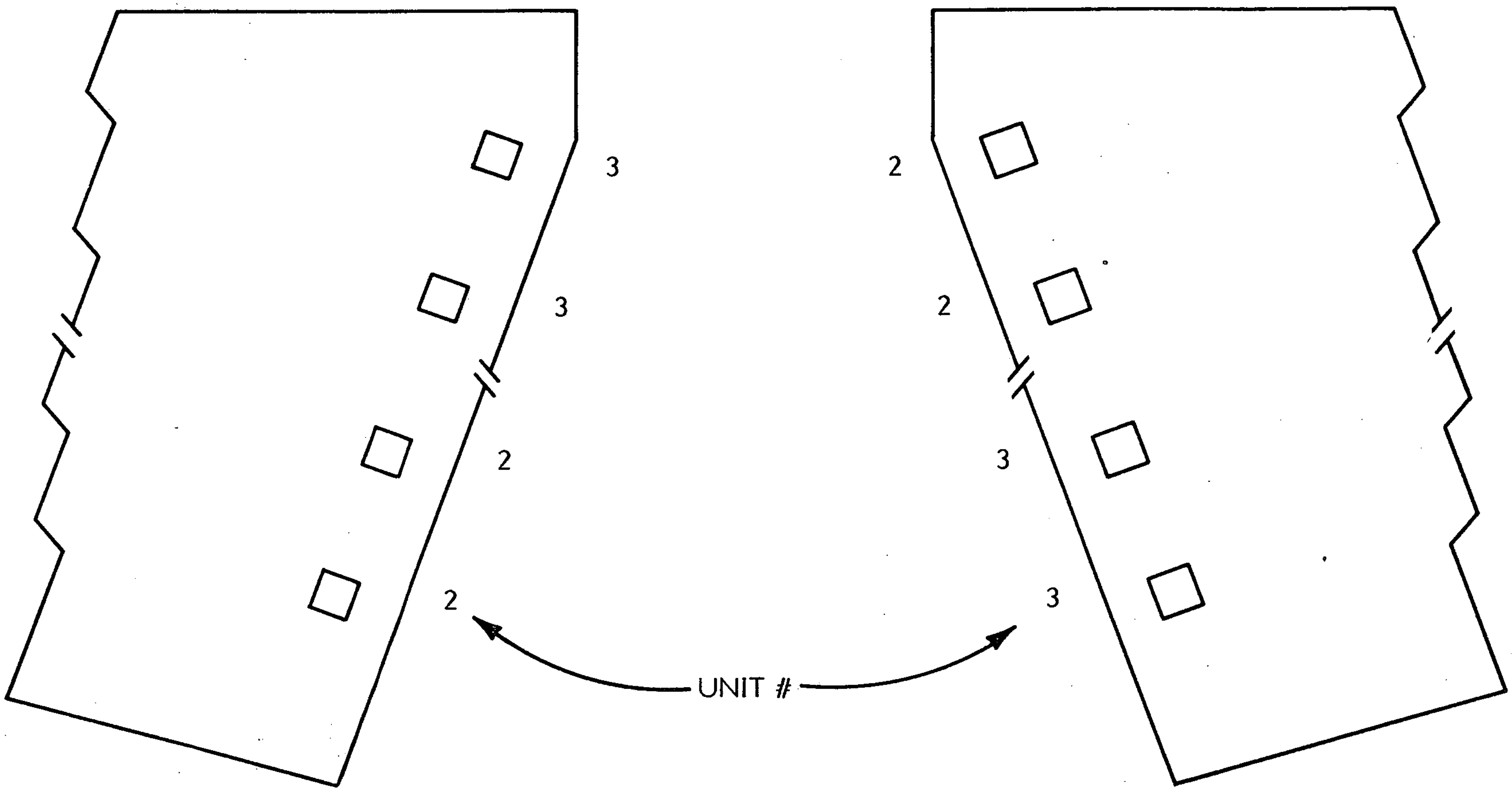


FIGURE 9
SALT WATER COOLING PUMPS
SCHEMATIC

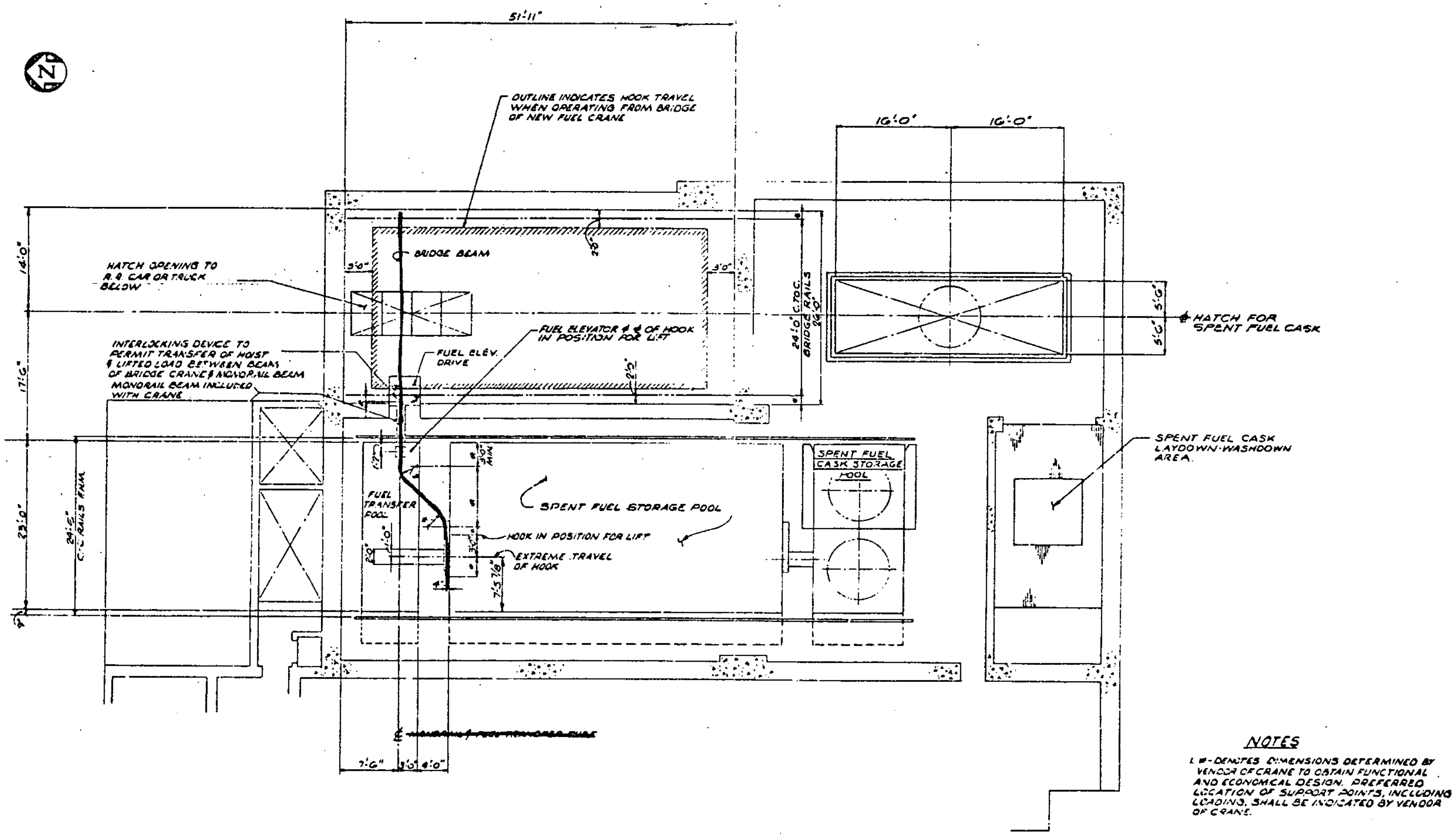
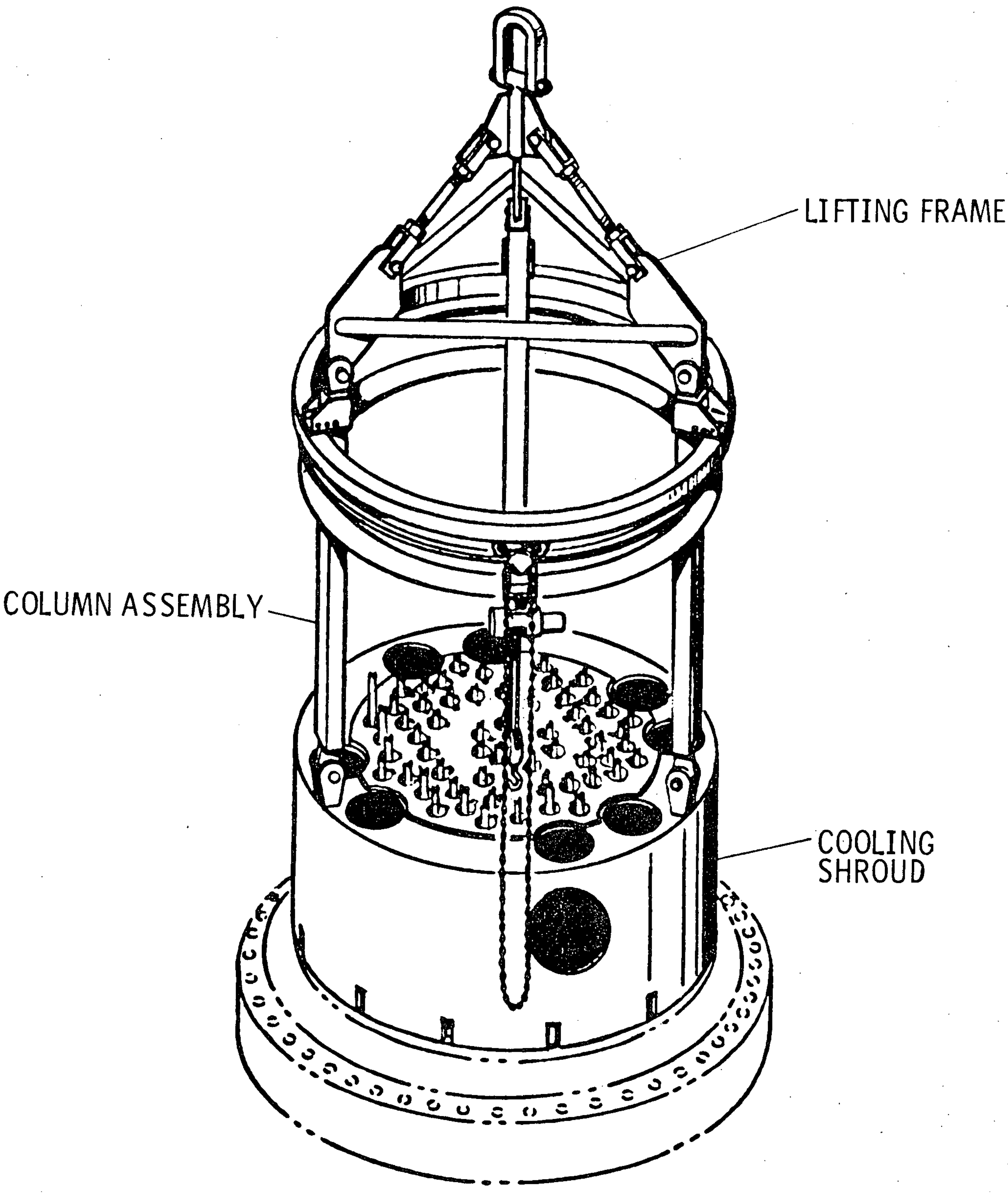


FIGURE 10
NEW FUEL HANDLING CRANE - MONORAIL

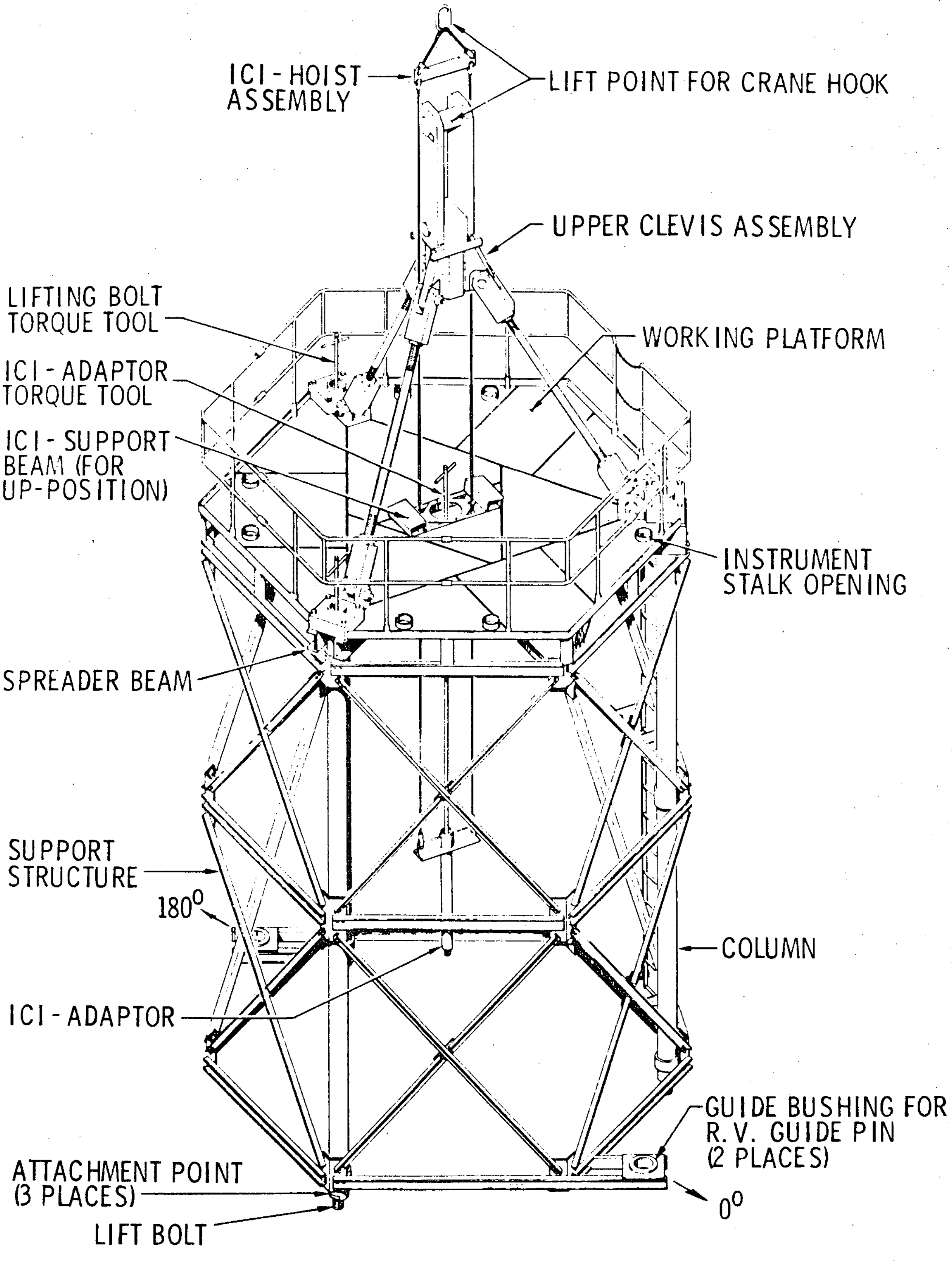
TERA CORPORATION



SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3
REACTOR VESSEL HEAD LIFT RIG

FIGURE 11

TERA CORPORATION



SAN ONOFRE NUCLEAR GENERATING STATION Units 2 & 3
UPPER GUIDE STRUCTURE LIFT RIG

FIGURE 12

TERA CORPORATION

PDR

ADDS

DATE: 8107090209

207A