TRANSSHIPMENT OF
SAN ONOFRE UNIT 1
SPENT FUEL

SAN ONOFRE NUCLEAR GENERATING STATION

UNITS 1, 2 AND 3

DECEMBER 1987

TABLE OF CONTENTS

A. INTRODUCTION

The Spent Fuel Pool at San Onofre Unit 1 is designed to store 216 spent fuel assemblies. Currently there are 67 spaces available for future storage. During each refueling, 52 assemblies are removed from the core and placed in the spent fuel pool. The next refueling outage for San Onofre Unit 1 is in August 1988 (Cycle X refueling).

Following the Cycle X refueling outage, only 15 unfilled spaces will remain. Therefore, the plant will not be capable of refueling at the following refueling outage which is scheduled in 1990 unless additional space is made available by transshipment. In addition, In-Service Inspection of the reactor vessel which requires unloading the entire core is necessary during the 1990 refueling outage. If the spent fuel is not removed from the spent fuel pool prior to the 1990 refueling outage, operation of San Onofre Unit 1 would cease.

SCE is planning to rerack the San Onofre Units 2 and 3 Spent Fuel Pools. Following the reracking there will be sufficient space in the Units 2 and 3 Spent Fuel Pools for the San Onofre Unit 1 spent fuel until the expiration of the Unit 1 license in 2004. During the licensing of San Onofre Units 2 and 3, it was recognized that the new units would be used to store Unit 1 spent fuel. Therefore, Units 2 and 3 were licensed to accept Unit 1 spent fuel.

In the following sections of this report, the previously approved method for shipping spent fuel will be briefly described. This will provide some historical background and obvious reasons why this method is considered inefficient and undesirable. The proposed method of transshipping spent fuel from Unit 1 to Units 2 and 3 will be described. In contrast to the previous method, this is more efficient and reliable. In order to proceed with the transshipment process the relevant issues regarding movement of a spent fuel cask at Unit 1 must be discussed. This report addresses the cask to be used, the Unit 1 turbine gantry crane and its use on the turbine building, the effects of the cask on the decontamination pad and the spent fuel pool and movement of the loaded cask from Unit 1 to Units 2 and 3. Finally, a discussion of the approvals associated with the storage of Unit 1 fuel in the Units 2 and 3 spent fuel pools is also provided.

B. EXISTING SPENT FUEL SHIPPING

San Onofre Unit 1 was approved by the NRC to ship spent fuel utilizing an air pallet system in conjunction with the turbine gantry crane. The air pallet is a low profile load movement device consisting of a steel superstructure, air bearings, air distribution manifold and a control and instrumentation system, conservatively designed to accommodate casks weighing up to 100 tons (See Figure 1). Overall length, width and height of the pallet are 100 inches, 82 inches and 8 inches, respectively. The air pallet weighs approximately 2-1/2 tons. Tie-down anchors and a shear ring are located in a circle centered around the base of the cask. When not in the energized mode (i.e., not riding on an air film), the pallet rests on structural load bars. This system was designed and approved by the NRC to carry a 30 ton single element spent fuel cask including lifting rig at San Onofre Unit 1. The steps involved in the spent fuel shipment were as follows (See Figure 2):

1. At the south end of the turbine building, the turbine gantry crane lifts the spent fuel cask and places it on the air pallet. (Points A and B on Figure 2.)

2. The turbine gantry crane then lifts and places the cask and air pallet as a unit onto the south extension of the turbine building. (Point C on Figure 2.)

3. The air pallet travels down the west side of the turbine deck to the spent fuel building at the north extension of the turbine building.

4. The air pallet is moved into the decontamination area and the turbine gantry crane lifts the cask from the air pallet. (Point D on Figure 2.)

5. The air pallet is moved out of the decontamination area and the cask is placed on the decontamination pad.

6. The turbine gantry crane lifts and places the cask in the cask handling area of the spent fuel pool. (Point E on Figure 2.)

7. A spent fuel element is loaded into the cask and the cask is returned to the decontamination pad.

8. Once decontaminated, the cask is placed on the air pallet for transport to the south extension of the turbine building.

The details of this method of shipping spent fuel are described in SCE's March 21, 1975 submittal. This submittal indicates that certain structural modifications would be necessary for the south and north extensions of the turbine building. In addition, a turbine deck load bearing test would be performed every four years to ensure the structural integrity of the turbine deck on the west side. The NRC's January 15, 1976 Safety Evaluation approved the use of the air pallet for shipping spent fuel. It also approved the technical specification for performing the turbine deck load bearing test, and as part of the San Onofre Unit 1 license, required that shipments of spent fuel should not resume until the modifications had been completed and the initial turbine deck load bearing test was performed. The license amendment did allow spent fuel shipments during cold shutdown without these modifications.

AIR PALLET

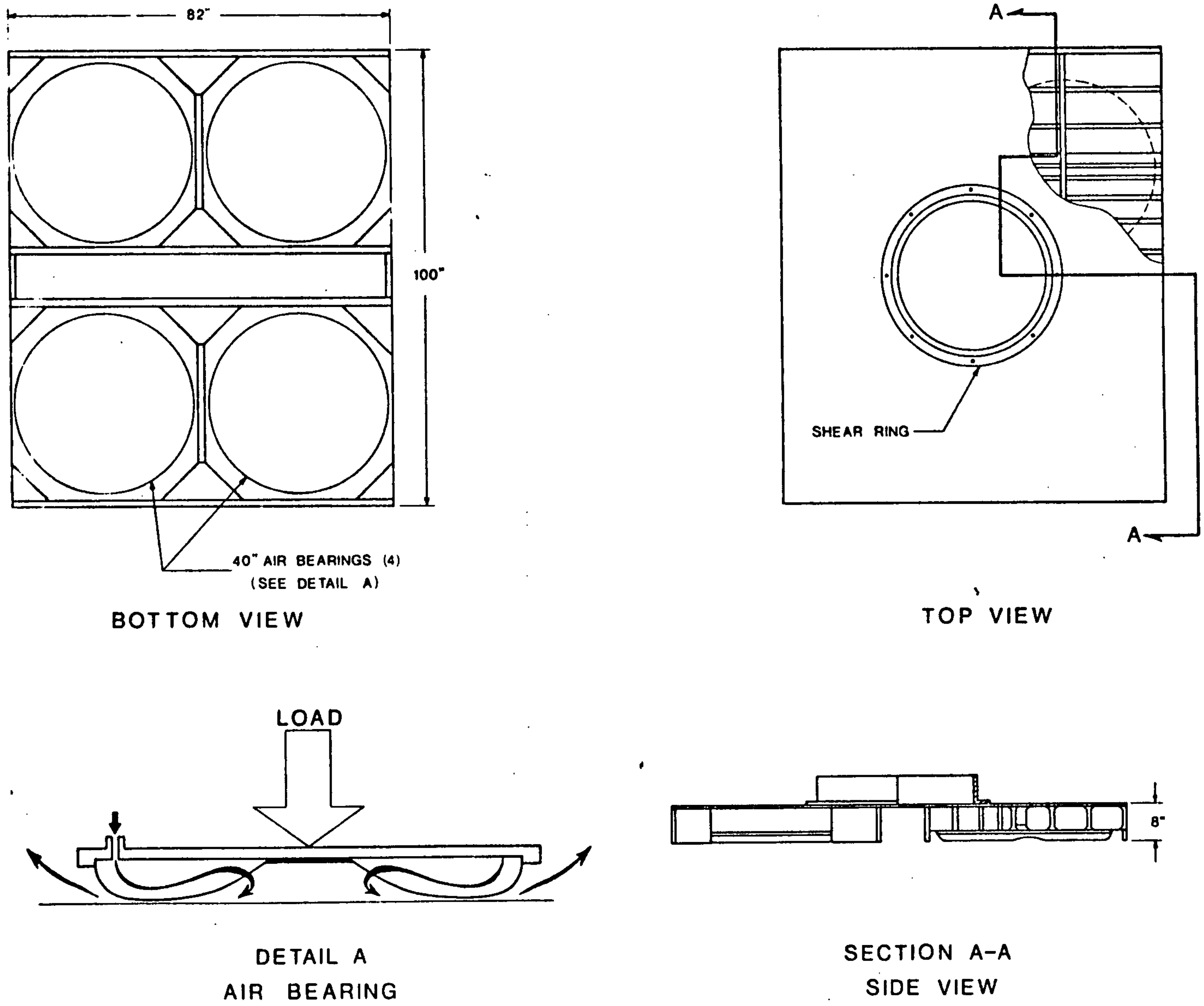
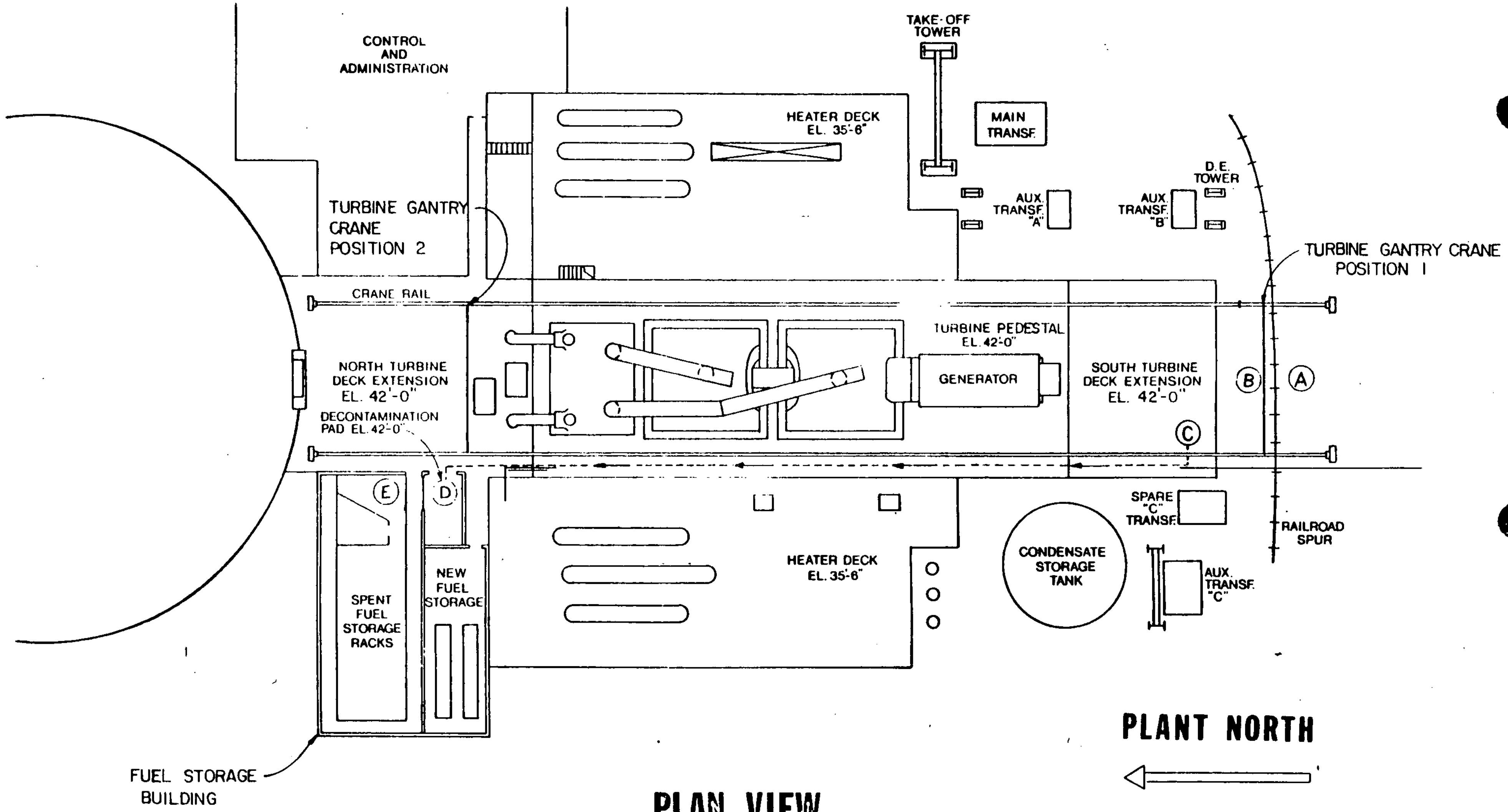


Figure 1

SAN ONOFRE NUCLEAR GENERATING STATION UNIT 1



PLAN VIEW

Figure 2

C. PROPOSED METHOD OF SPENT FUEL SHIPMENT

The proposed method of shipping spent fuel elements from San Onofre Unit 1 to Units 2 and 3 will involve the use of the San Onofre Unit 1 turbine gantry crane. The air pallet system will not be used. The spent fuel shipping cask will be restrained on the horizontal beam of the west A-frame leg of the turbine gantry crane for travel along the turbine deck. In addition, a multi-element cask on the order of 70 to 100 tons will be used. All transshipment will be performed only during Unit 1 plant shutdowns (Modes 5 and 6).

The steps involved in the transshipment process would be as follows (these steps can be followed on Figures 3, 4 and 5):

1. An empty spent fuel cask will be on either a tractor trailer (low boy) or a railroad car parked under the turbine gantry crane at Unit 1 (Point A on Figure 3). (For purposes of this discussion, it is assumed that a tractor trailer is the transport method of choice, as the railroad path is very similar.)

2. The turbine gantry crane will lift the cask from the tractor trailer and place it on the horizontal beam of the west A-frame leg of the turbine gantry crane (Point B on Figure 3). Once in place, the cask will be secured from lateral movements and tipping (the method of securing the cask is discussed in the section on the Turbine Gantry Crane). The crane hook will remain attached to the cask.

3. The turbine gantry crane will travel to the north extension of the turbine building alongside the decontamination (decon) pad. Once the cask is released from the A-frame, the turbine gantry crane will place the cask on the decon pad and unhook while preparations are made to lower the cask into the spent fuel pool (Point C on Figure 3). The crane is able to reach into the Fuel Storage Building through a sliding panel on the roof.

4. The cask will be lifted by the turbine gantry crane and placed in the cask handling area of the pool. Once lowered, the crane will be unhooked (Point D on Figure 3).

5. After the designated spent fuel assemblies have been placed in the cask, the turbine gantry crane will return the cask to the decon pad. The cask will be decontaminated and prepared for transshipment.

6. The cask will be lifted by the turbine gantry crane, placed on the horizontal beam of the west A-frame leg and secured again. The crane will move to the south end of the turbine building.

7. The cask will be placed on the tractor trailer by the turbine gantry crane and secured. Once the tractor trailer exits the Unit 1 protected area it will be escorted by armed security officers while it is in transit outside the protected area. The tractor trailer will reenter the protected area through the Units 2 and 3 gate (Figure 4).

8. The tractor trailer will then proceed to the Unit 2 or Unit 3 Fuel Handling Building truck bay (Figure 4).

9. The Unit 2 or 3 cask handling crane will lift and transport the cask to the decon area, where the cask will be prepared to be placed in the cask pool. The cask crane will then move the cask to the cask pool for unloading (Figure 5).

10. After unloading, the cask crane will return the empty cask to the decon area for decontamination and preparation for transport back to Unit 1 where the process is repeated.

The transshipment process will be controlled by one procedure that ties in the Maintenance activities of cask handling, the Health Physics responsibilities of decontamination and operational radiation surveys, the administrative and technical responsibilities for control of the fuel movement and the Quality Assurance and Quality Control responsibilities for overseeing the evolution.

The activities will be supervised by a Maintenance Supervisor. The project will be coordinated by a Refueling Engineer. The work will be controlled and documented by SO123-X-9.0, "Transshipment of Spent Fuel." The lifts of the cask will be controlled by SO123-I-1.13, "Turbine Gantry Crane Checkout and Operation," SO1-I-7.27, "Cranes, Rigging, and Lifting Controls," and SO23-I-3.32, "Cask Handling Crane Checkout and Operation."

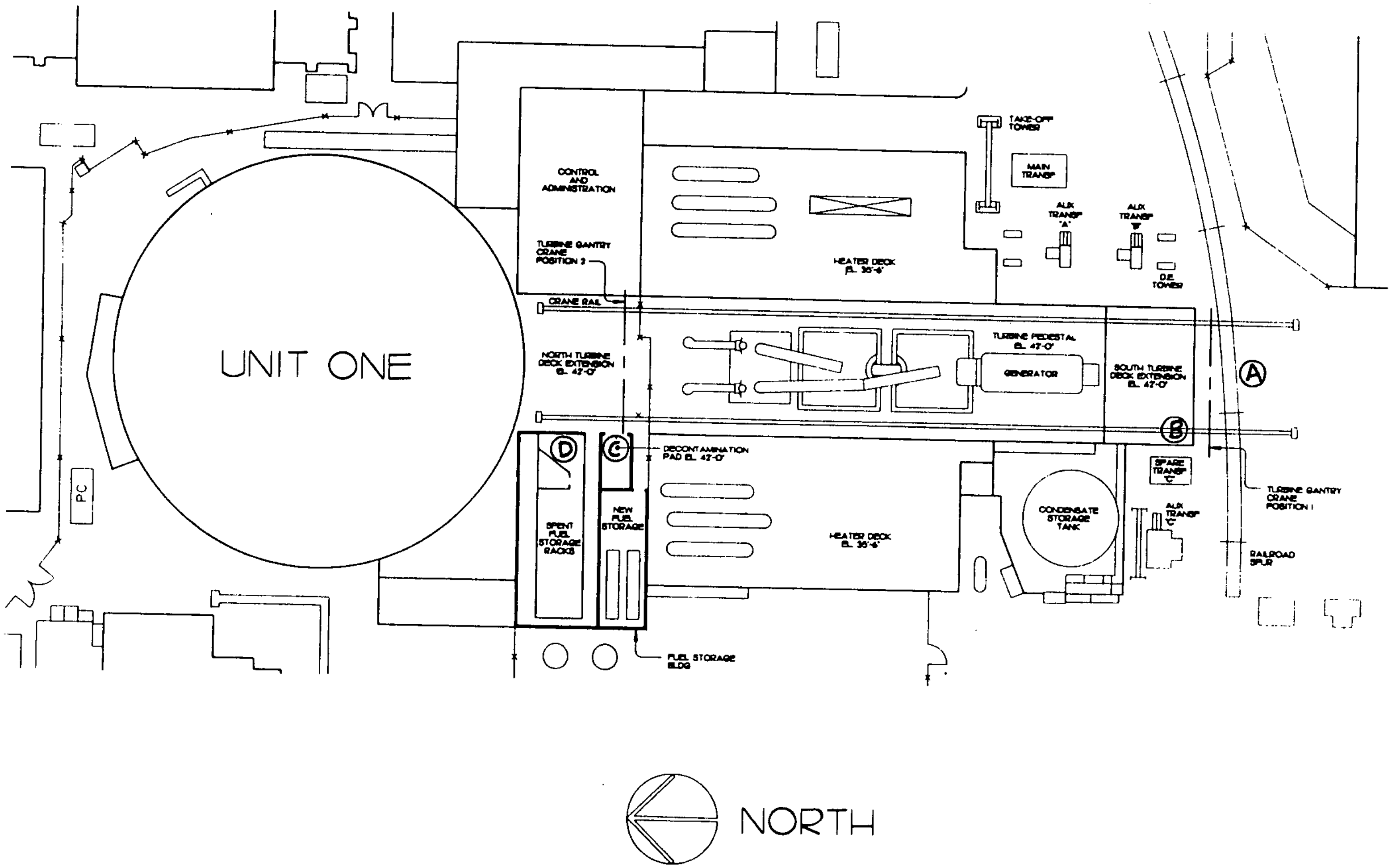

UNIT ONE
PC
CONTROL AND ADMINISTRATION
TURBINE GANTRY CRANE POSITION 2
CRANE RAIL
NORTH TURBINE DECK EXTENSION EL 42'-0"
HEATER DECK EL 36'-6"
TAKE-OFF TOWER
MAIN TRANSF
AUX TRANSF "A"
AUX TRANSF "B"
D.E. TOWER
TURBINE PEDESTAL EL 42'-0"
GENERATOR
SOUTH TURBINE DECK EXTENSION EL 42'-0"
A
B
C
D
DECONTAMINATION PAD EL 42'-0"
SPENT FUEL STORAGE RACKS
NEW FUEL STORAGE
HEATER DECK EL 36'-6"
CONDENSATE STORAGE TANK
SPARE TRANSF "C"
AUX TRANSF "C"
TURBINE GANTRY CRANE POSITION 1
RAILROAD SPUR
FUEL STORAGE BLDG
NORTH

Figure 3

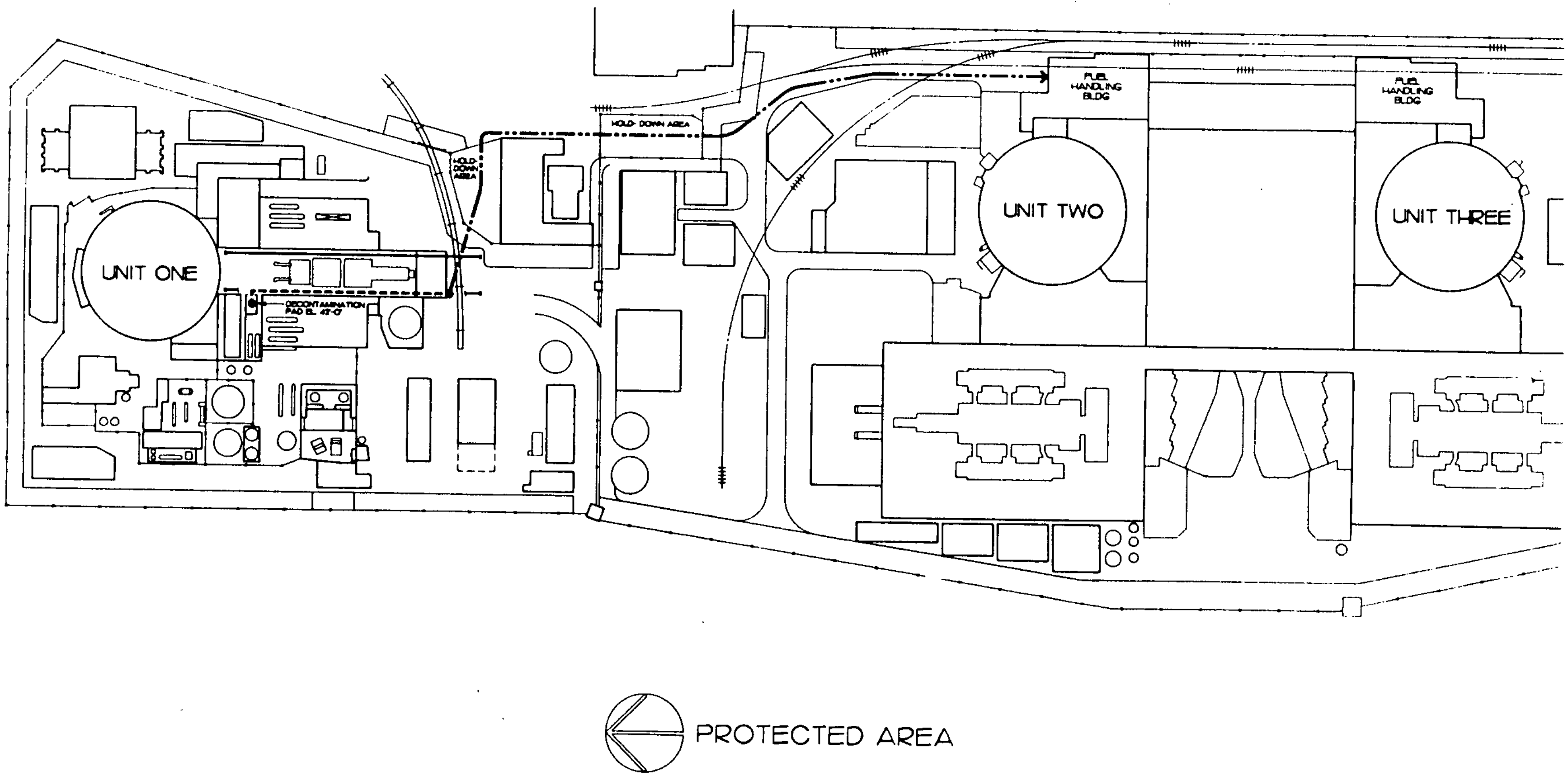
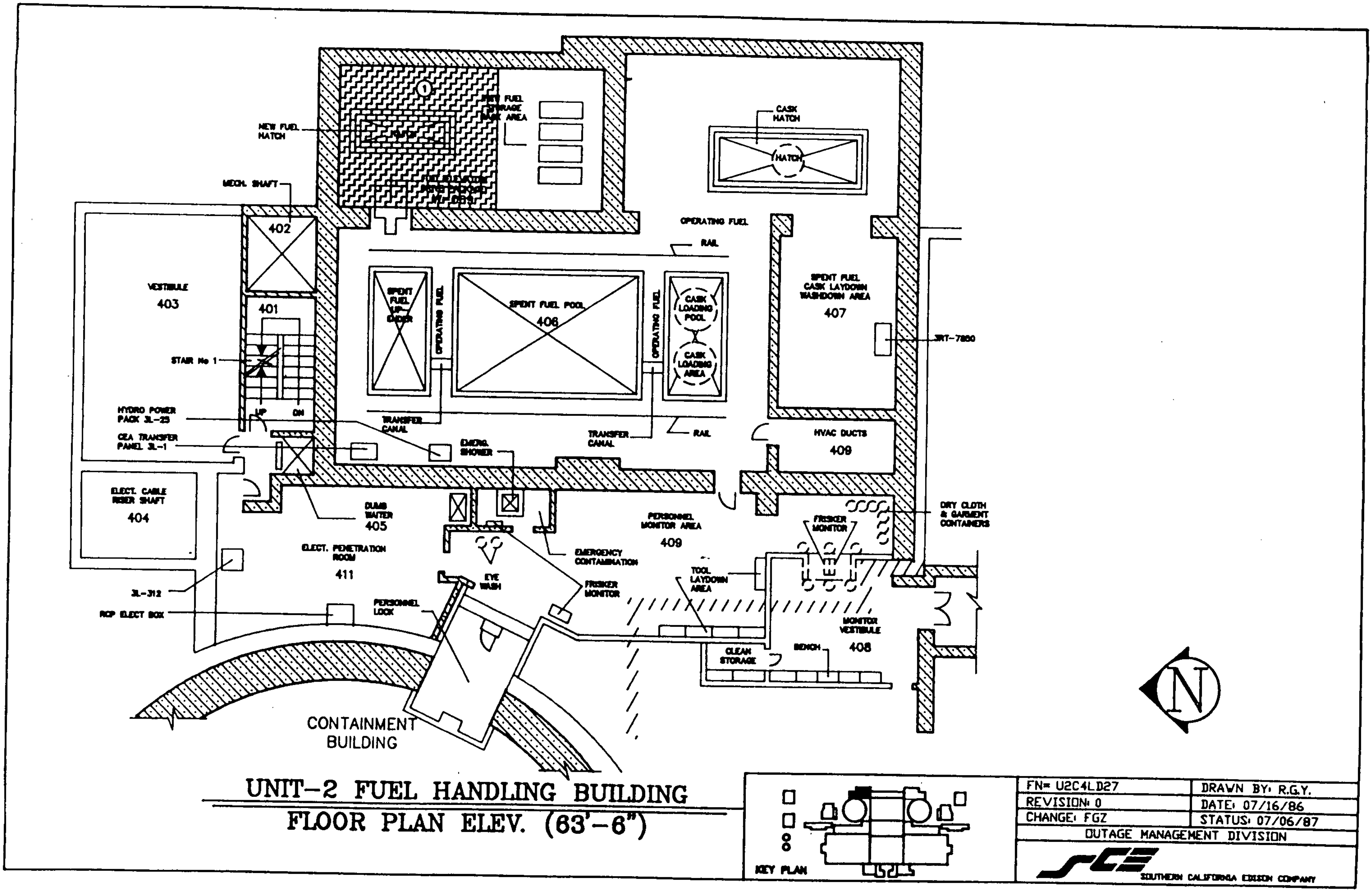

UNIT ONE
HOLD-DOWN AREA
HOLD- DOWN AREA
DECONTAMINATION PAD EL. 47-0"
FUEL HANDLING BLDG
UNIT TWO
FUEL HANDLING BLDG
UNIT THREE
PROTECTED AREA

Figure 4



NEW FUEL HATCH
MECH. SHAFT
CASK HATCH
HATCH
OPERATING FUEL
RAIL
402
VESTIBULE
403
401
STAIR No 1
SPENT FUEL UPENDER
OPERATING FUEL
SPENT FUEL POOL
406
CASK LOADING POOL
CASK LOADING AREA
SPENT FUEL CASK LAYDOWN WASHDOWN AREA
407
HYDRO POWER PACK 3L-23
CEA TRANSFER PANEL 3L-1
UP
DN
TRANSFER CANAL
EMERG. SHOWER
HVAC DUCTS
409
ELECT. CABLE RISER SHAFT
404
DUMB WAITER
405
PERSONNEL MONITOR AREA
409
DRY CLOTH & GARMENT CONTAINERS
FRISKER MONITOR
ELECT. PENETRATION ROOM
411
EMERGENCY CONTAMINATION
3L-312
RCP ELECT BOX
EYE WASH
PERSONNEL LOCK
TOOL LAYDOWN AREA
MONITOR VESTIBULE
408
CLEAN STORAGE
BENCH
CONTAINMENT BUILDING
N
UNIT-2 FUEL HANDLING BUILDING
FLOOR PLAN ELEV. (63'-6")
KEY PLAN
FN= U2C4LD27
REVISION: 0
CHANGE: FGZ
DRAWN BY: R.G.Y.
DATE: 07/16/86
STATUS: 07/06/87
OUTAGE MANAGEMENT DIVISION
SOUTHERN CALIFORNIA EDISON COMPANY

Figure 5

D. CASK

A single element 23 ton cask was used with the air pallet system for fuel shipment. SCE is planning to use a multi-element cask for transshipment. The following are typical casks which may be used:

A. Nuclear Assurance Corporation

NAC	25 Ton	1 Element
NL 1/2	25 Ton	1 Element
NAC	100 Ton	24 Element

B. General Electric

GE-IF-300	70 Ton	7 Element

C. Transnuclear

TN-896	40 Ton	3 Element

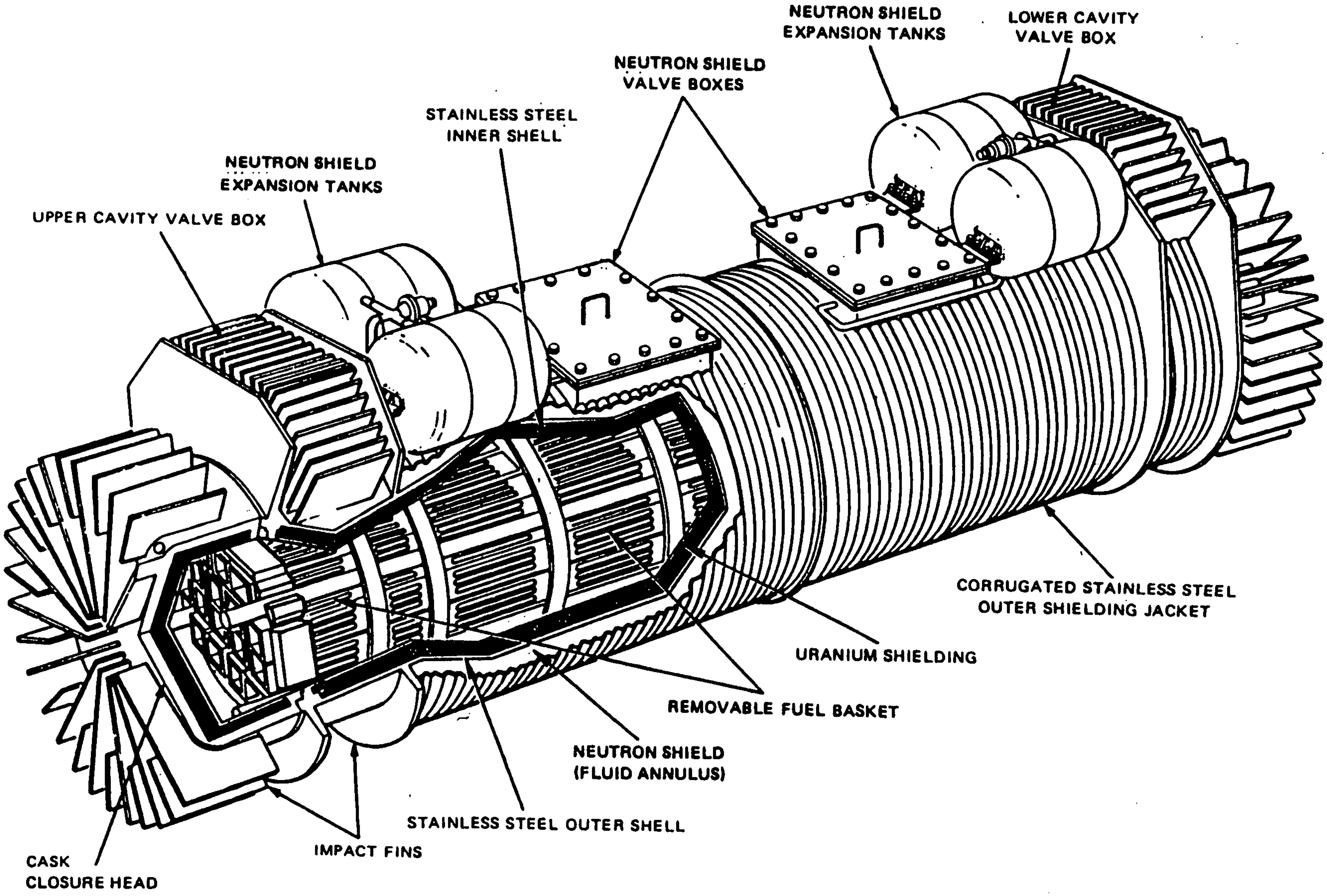
D. Westinghouse

MC-10	100 Ton	24 Element

The two 100 ton casks actually weigh more than 100 tons when fully loaded, however, if used, they will be kept at a weight less than 100 tons by loading with less than the maximum number of spent fuel assemblies.

Figure 6 depicts the GE-IF-300 70 ton cask, which is expected to be the cask used in the initial activities. This cask has a Certificate of Compliance for Radioactive Materials Packages. In the event a different cask is to be used in the future, it will also have a Certificate of Compliance; or in the case of a nonlicensed cask, NRC approval will be obtained for its use in the transshipment process.

Cask weights of 70 tons and 100 tons were evaluated for the proposed method of transshipment. Modifications were designed specifically for the GE-IF-300 70 ton cask with allowances to support a 100 ton cask. If a 100 ton cask is used in the future, strengthening of the decontamination area slab will be required.



IF-300 Irradiated Fuel Shipping Cask

Figure 6

E. TURBINE GANTRY CRANE

The turbine gantry crane (Figure 7) will be used for the transshipment process at San Onofre Unit 1. The cask will be lifted at the south end and the north end of the turbine building by the crane. The cask will travel between the north and south ends on the horizontal beam of the west A-frame of the turbine gantry crane. The west A-frame will be modified to securely hold the cask in place.

The cask will be positioned on a platform built into the horizontal beam of the turbine gantry crane west leg (Figure 8). The platform will have a support that will prevent the cask from sliding off the platform during the move. The cask will also be restrained by cables within the crane leg attached to the cask to prevent tipping. The crane main hook will not be released during the cask movement by the crane along the Turbine Building. Thus, the spent fuel cask will be supported by two independent systems during its movement along the deck.

The turbine gantry crane type is a double leg, through-leg design manufactured by Harnischfeger. It is designed for a maximum load of 125 tons and is load tested for 100 tons. During the construction of the crane, all applicable regulations and codes were observed including the Specification and General Information for Standard Industrial Service, Electric Overhead Traveling Cranes of the Electric Overhead Crane Institute and the standards of the AISC. The crane support members are made of structural steel which conform to the Standard Specifications for Structural Steel for Bridges and Buildings, Serial Designation A36 of the American Society for Testing Materials.

The designed safety factor for the mechanical and structural components of the crane is 5 to 1 based on ultimate strength. The crane as a whole is designed so that for the design conditions of loading, the ratio of the righting moment to the overturning moment is not less than 2:1. The east leg is counter weighted so as to allow a 100-ton lift on the west cantilever and maintain this factor of safety against overturning. The wire ropes used on the main hoist are extra high strength steel ropes with wire cores. Their designed safety factor based on ultimate strength at their rated load is 5 to 1. The above factors apply at the rated 100-ton load on the main hoist.

TURBINE GANTRY CRANE

SAN ONOFRE NUCLEAR GENERATING STATION UNIT 1

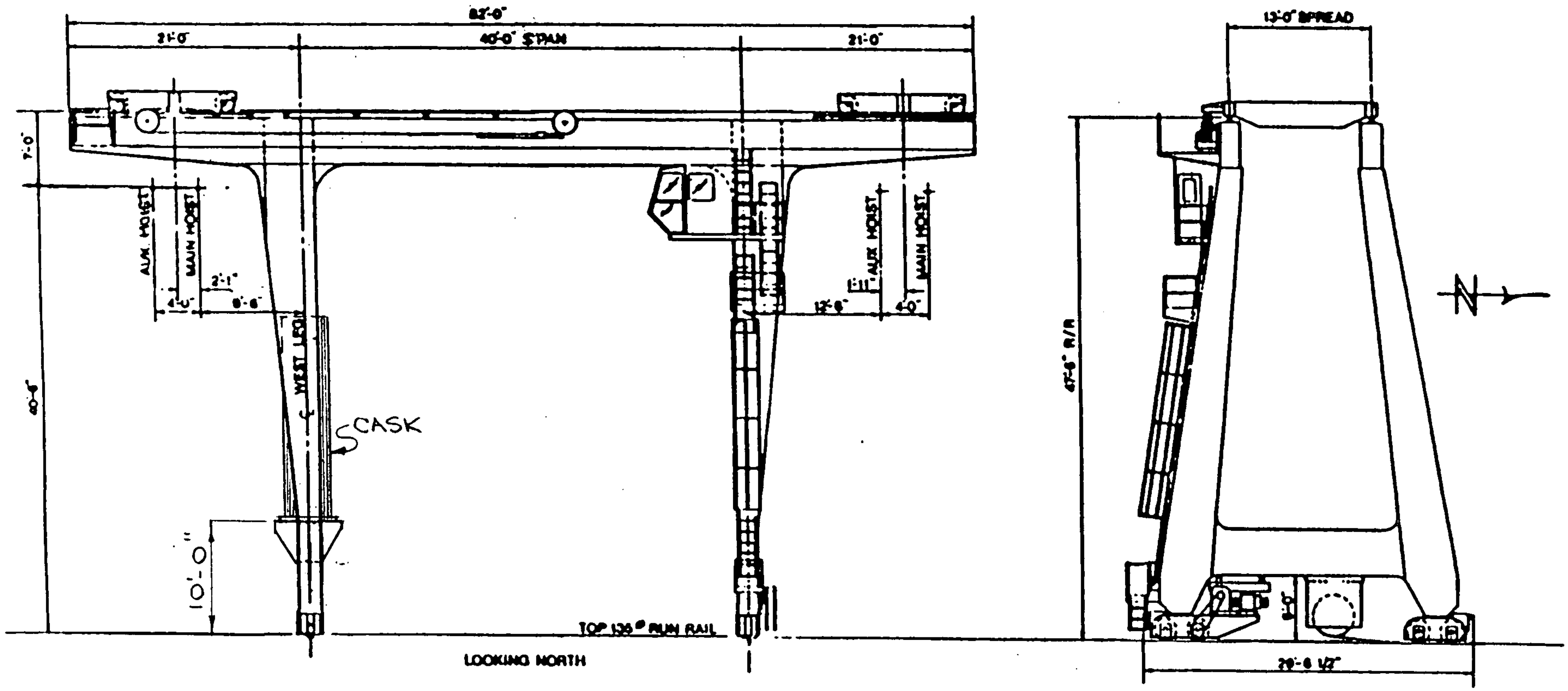
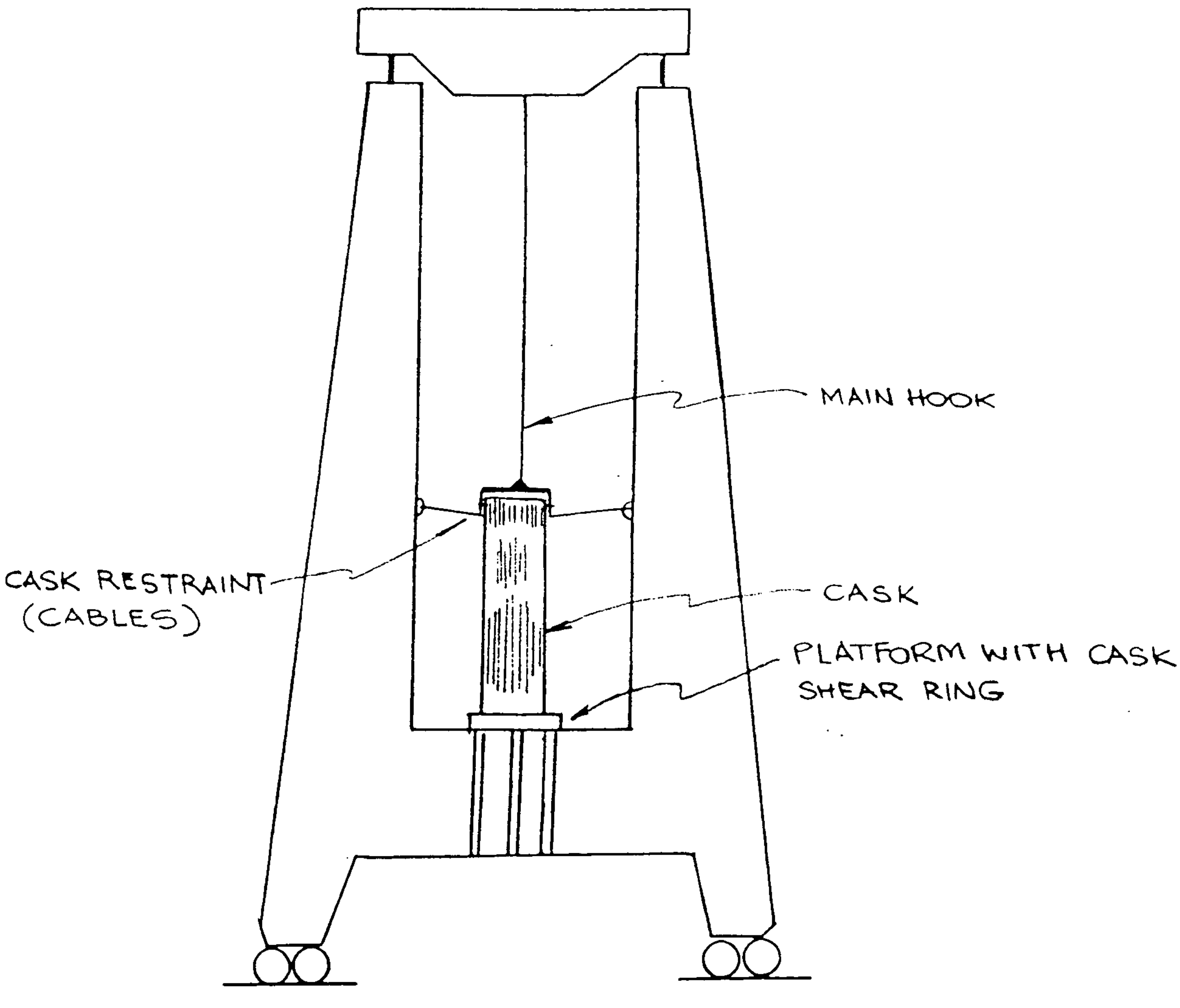


Figure 7



PROPOSED CASK PLATFORM
ON SHEAR LEG

Figure 8

F. HEAVY LOADS HANDLING ISSUES

The NRC and SCE reviewed the "Heavy Loads" issues for San Onofre Unit 1 under the guidance of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." The guidance contained in NUREG-0612 identified seven general guidelines to provide the defense-in-depth appropriate for the safe handling of heavy loads at nuclear power plants. The heavy load handling guidelines have been reviewed for San Onofre Unit 1, and the details of this review are documented in the Technical Evaluation Report (TER) and Safety Evaluation (SE) enclosed with the NRC letter dated November 5, 1985. The San Onofre Unit 1 spent fuel cask handling methodology was not reviewed in detail as part of this NRC evaluation due to the fact that spent fuel cask handling had previously been reviewed in 1975. Since that time, SCE has opted to use a larger spent fuel cask and has reevaluated the seven NUREG-0612 heavy load handling guidelines to assure that the larger spent fuel cask is handled in a manner consistent with the NUREG-0612 guidance.

The seven general NUREG-0612 guidelines are:

- Guideline 1 - Safe Load Paths
- Guideline 2 - Load Handling Procedures
- Guideline 3 - Crane Operator Training
- Guideline 4 - Special Lifting Devices
- Guideline 5 - Lifting Devices (Not Specifically Designed)
- Guideline 6 - Cranes (Inspection, Testing and Maintenance)
- Guideline 7 - Crane Design

NUREG-0612 states that the seven guidelines should be satisfied for all overhead handling systems that handle heavy loads in the vicinity of the reactor vessel, near spent fuel in the spent fuel pool or in other areas where a load drop may damage safe shutdown systems. Spent fuel cask handling at San Onofre Unit 1 falls into the latter two categories. The review of the spent fuel cask handling methodology as it relates to the seven guidelines is as follows.

Guideline No. 1

"Safe load paths should be defined for the movement of heavy loads to minimize the potential for heavy loads, if dropped, to impact irradiated fuel in the reactor vessel and in the spent fuel pool, or to impact safe shutdown equipment. The path should follow, to the extent practical, structural floor members, beams, etc., such that if the load is dropped, the structure is more likely to withstand the impact. These load paths should be defined in procedures, shown on equipment layout drawings, and clearly marked on the floor in the area where the load is to be handled. Deviations from defined load paths should require written alternative procedures approved by the plant safety review committee."

SCE Evaluation

The chosen load path for the new spent fuel cask will be the same as for the old cask, that is, directly out of the spent fuel pool, onto the decon pad, directly out of the Fuel Storage Building to the turbine gantry crane and down the turbine deck. This load path is chosen due to its direct nature, accessibility, and to follow, to the extent practical, structural members. Along the load path, equipment required for maintaining shutdown is located in the area of the decontamination pad. Between the crane West A-frame leg and the decontamination pad, cable trays containing circuits for equipment which may be used during shutdown are located below the turbine deck in the turbine building. The shutdown equipment which has circuits located in these cable trays include a residual heat removal pump, component cooling water pumps and a salt water cooling pump. It has been determined that without this equipment safe shutdown can be maintained with redundant equipment. This is discussed in Section H, Decontamination Pad. Spent fuel assemblies are not located within the load path for the spent fuel cask. The illustration of this load path will be included in the spent fuel cask handling procedure. Since any floor markings of the load path would be obscured by the cask during the lifting process, it is not appropriate to have any deck or floor markings, but consistent with the SE, TER and SCE's procedures, as a minimum a second person will be assigned to walk down the lifts and be in radio contact with the crane operator.

Guideline No. 2

"Procedures should be developed to cover load handling operations for heavy loads that are or could be handled over or in proximity to irradiated fuel or safe shutdown equipment. At a minimum, procedures should cover handling of those loads listed in Table 3-1 of NUREG-0612. These procedures should include: identification of required equipment; inspections and acceptance criteria required before movement of load; the steps and proper sequence to be followed in handling the load; defining the safe path; and other special precautions."

SCE Evaluation

As indicated in past SCE correspondence, there exists a heavy load handling program at San Onofre Unit 1 that addresses the general prerequisites, precautions, inspections and acceptance criteria required before movement of a heavy load. The procedure S0123-X-9.0, "Transshipment of Spent Fuel", covers the handling of spent fuel casks at San Onofre Unit 1 and this procedure will be developed to account for the new cask, the revised cask handling process, the safe load path, additional or different inspection requirements for the cask lift rig, and any other special precautions.

Guideline No. 3

"Crane operators should be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976, 'Overhead and Gantry Cranes' [12]."

SCE Evaluation

The crane operator training was reviewed as part of the TER and SE, therefore an additional review for the purposes of determining the acceptability of the spent fuel cask handling methodology is not necessary. The crane operators will be trained on any special requirements of the new spent fuel cask handling methodology.

Guideline No. 4

"Special lifting devices should satisfy the guidelines of ANSI N14.6-1978, 'Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500kg) or More for Nuclear Materials' [13]. This standard should apply to all special lifting devices which carry heavy loads in areas as defined above. For operating plants certain inspections and load tests may be accepted in lieu of certain material requirements in the standard. In addition, the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 should be based on the combined maximum static and dynamic loads that could be imparted on the handling device based on characteristics of the crane which will be used. This is in lieu of the guideline in Section 3.2.1.1 of ANSI N14.6 which bases the stress design factor on only the weight (static load) of the load and of the intervening components of the special handling device."

SCE Evaluation

The new spent fuel cask lifting device will meet the guidelines of ANSI N14.6-1978, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 Pounds (4500kg) or More for Nuclear Materials." As previously stated in SCE's August 29, 1985 letter to the NRC, after the initial 150% proof load test, SCE may opt to perform NDE in lieu of periodic (every 5 years) load testing. The choice will be dependent upon SCE's availability of test options. It is noted that the initial proof load test of the lifting device will be a 150% proof load test.

Regarding the Guideline No. 4 discussion of the stress design factor stated in Section 3.2.1.1 of ANSI N14.6 being based upon the combined maximum static and dynamic loads that could be imparted on the handling device based upon the characteristics of the crane which will be used, refer to the information discussed under the NRC review of Guideline No. 5 in the TER. The TER indicates that the dynamic load induced by the San Onofre Unit 1 turbine gantry crane is sufficiently small so as to remove it from consideration. This is based upon the already required 3 to 1 maximum yield strength to weight ratio and 5 to 1 ultimate strength to weight ratio required by Section 3.2.1 1 of ANSI N14.6-1978, and the consideration that the maximum expected dynamic load induced by the turbine gantry crane is only 3.7% of the static load. Therefore, only the weight (static load) of the load and intervening components of the spent fuel cask lift rig need be considered.

Guideline No. 5

"Lifting devices that are not specifically designed should be installed and used in accordance with the guidelines of ANSI B30.9-1971, 'Slings' [14]. However, in selecting the proper sling, the load used should be the sum of the static and maximum dynamic load. The rating identified on the sling should be in terms of the 'static load' which produces the maximum static and dynamic load. Where this restricts slings to use on only certain cranes, the slings should be clearly marked as to the cranes with which they may be used."

SCE Evaluation

Since Guideline No. 4 relating to specifically designed lifting devices applies to the new spent fuel cask handling methodology, this guideline does not apply and no additional review is required.

Guideline No. 6

"The crane should be inspected, tested, and maintained in accordance with Chapter 2-2 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' with the exception that tests and inspections should be performed prior to use where it is not practical to meet the frequencies of ANSI B30.2 for periodic inspection and test, or where frequency of crane use is less than the specified inspection and test frequency (e.g., the polar crane inside a PWR containment may only be used every 12 to 18 months during refueling operations, and is generally not accessible during power operation. ANSI B30.2, however, calls for certain inspections to be performed daily or monthly. For such cranes having limited usage, the inspections, test, and maintenance should be performed prior to their use)."

SCE Evaluation

The crane inspection, testing and maintenance was reviewed as part of the TER and SE and an additional review for the purposes of determining the acceptability of the spent fuel cask handling methodology is not necessary. The new spent fuel cask is a lesser weight (70-100 tons) than the existing largest load (108 tons), so the existing proof load tests of the turbine gantry crane are acceptable. All other inspection, testing and maintenance issues associated with the turbine gantry crane remain applicable to the new spent fuel cask handling methodology. Handling of the cask and use of the turbine gantry crane at San Onofre Unit 1 and the cask handling crane at San Onofre Units 2 and 3 will be controlled by SO1-I-7.27, "Turbine Gantry Crane Checkout and Operation", SO123-I-1.13, "Cranes, Rigging, and Lifting Controls", and SO23-I-3.32, "Cask Handling Crane Checkout and Operation".

Guideline No. 7

"The crane should be designed to meet the applicable criteria and guidelines of Chapter 2-1 of ANSI B30.2-1976, 'Overhead and Gantry Cranes,' and of CMAA-70, 'Specifications for Electric Overhead Traveling Cranes' [15]. An alternative to a specification in ANSI B30.2 or CMAA-70 may be accepted in lieu of specific compliance if the intent of the specification is satisfied."

SCE Evaluation

The turbine gantry crane design issues were addressed in SCE's submittals of April 1, 1982 and October 21, 1982. These submittals provided a point by point comparison of the applicable ANSI B 30.2-1976 and CMAA-70 design criteria to the turbine gantry crane design. The information in these submittals was reviewed by the NRC in the TER and SER, and found to be acceptable. Since the design allowables and strength ratings are based upon the maximum design load of 108 tons, they remain applicable to handling a spent fuel cask of 100 tons or less, and therefore no further review of the turbine gantry crane is necessary.

The above evaluations of each of the seven NUREG-0612 guidelines as they relate to the new spent fuel cask handling methodology provide sufficient assurance that the heavy loads issues will be appropriately addressed. Accordingly, as a result of heavy load handling issues relating to the new spent fuel cask handling methodology, appropriate revisions will be made to existing San Onofre Unit 1 crane and cask handling procedures.

G. TURBINE BUILDING

The turbine building is located immediately south of the containment. It is composed of five distinct structures, the north turbine deck extension, south turbine deck extension, the west and east reheater decks and the turbine pedestal (See Figure 3 and Figure 9).

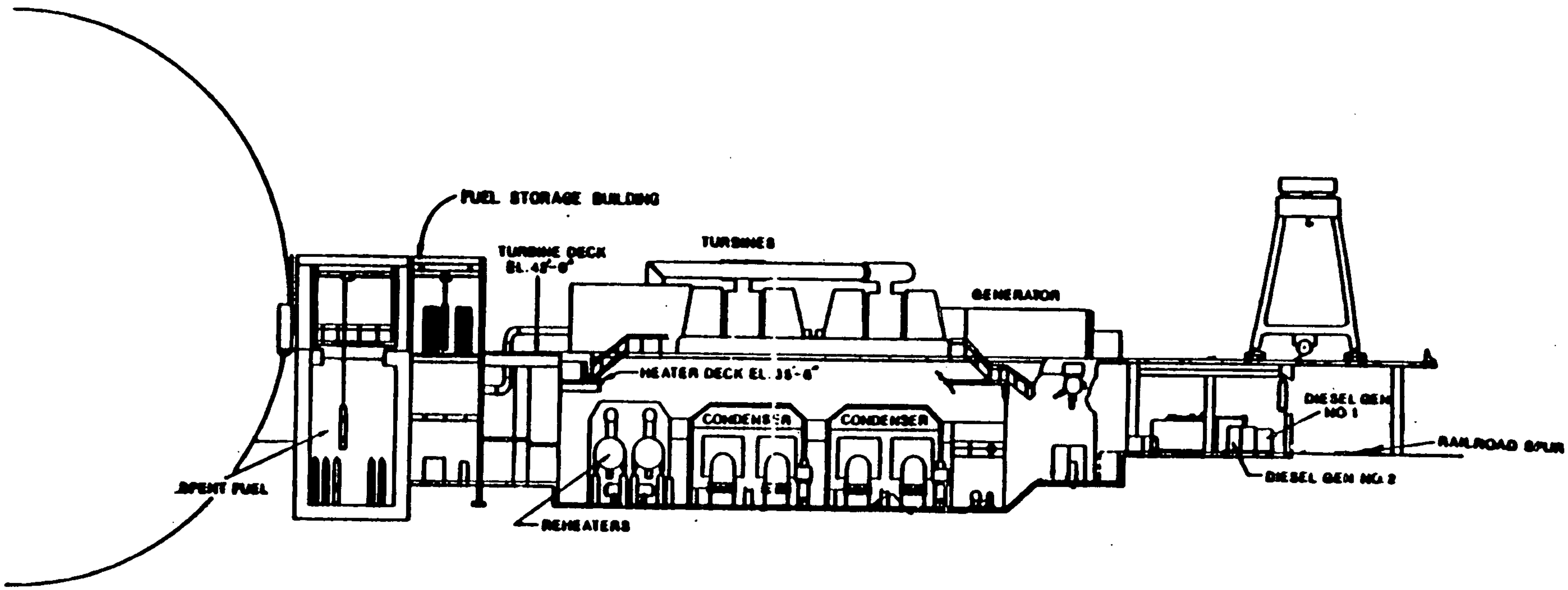
The San Onofre Unit 1 turbine building has been reevaluated and upgraded to withstand a .67g modified Housner seismic event. This reevaluation included the effects of the turbine gantry crane on the dynamic response of the structure. Additional evaluations were performed to determine the load on the crane that would be acceptable. These evaluations concluded that the turbine gantry crane may be located on the turbine pedestal or the south turbine deck extension during plant operation (Modes 1-4) with a 35 ton load and that the turbine gantry crane cannot be located on the north turbine deck extension during Modes 1-4. During plant shutdown (Modes 5-6), the turbine gantry crane can be located on the turbine pedestal or the south turbine deck extension with a 100 ton load; and the turbine gantry crane can be located on the north turbine deck extension with a 10 ton load.

Since the seismic design of the turbine building limits the location and load use of the turbine gantry crane for continuous use, deviations from these conditions are permitted for only very limited time periods. The turbine gantry crane will be allowed on the turbine building with loads in excess of the seismic evaluated loads for a total accumulated time of only 1% per year. This comes to approximately 87 hours for a year. During Modes 1-4 the time will be recorded if the crane is located on the north turbine deck extension, with or without a load, and when the crane is located on the turbine pedestal or the south turbine deck extension with a load in excess of 35 tons. During Modes 5 and 6 the time will be recorded when the turbine gantry crane is located on the north turbine deck extension with a load in excess of 10 tons. Once the 87 hours per year have been logged the turbine gantry crane will not be used outside the locations and loads limited by the seismic evaluation until the next year. The purpose of using a 1% time limit is to minimize the possibility of having a seismic event concurrent with the turbine gantry crane being located in a position other than that found acceptable in the seismic evaluation.

During plant operation the turbine gantry crane is not normally used. During shutdowns and refuelings the turbine gantry crane is used in support of the outage. Thus the 87 hour limit will be used almost entirely during plant shutdown. Beginning with the next scheduled plant shutdown, transshipment of spent fuel will be performed on a regular basis during scheduled shutdowns such as refueling and midcycle outages. Therefore it is expected that the majority of the crane use will be associated with spent fuel transshipment during plant shutdown (Modes 5 and 6).

Drop of the cask on the turbine deck is being precluded by carrying the cask securely attached to the turbine gantry crane west A-frame horizontal beam in conjunction with the hook during crane movement over the turbine deck.

SAN ONOFRE NUCLEAR GENERATING STATION UNIT 1



SECTION VIEW

Figure 9

H. DECONTAMINATION PAD

The decontamination pad is located inside the Fuel Storage Building adjacent to the spent fuel pool. The pad consists of a 9" thick reinforced concrete slab with a 9" thick concrete covering over structural steel beams. The turbine gantry crane will be moved directly opposite the decontamination pad with the cask located in the west A-frame leg. The crane will remove the cask and place it on the decontamination pad. Following loading of the cask in the spent fuel pool area and decontamination, the cask will be lifted from the decontamination pad and placed on the west A-frame.

The decontamination pad was evaluated seismically with the cask located on the pad. The reason for this evaluation is that the spent fuel cask will be on the decontamination pad for extended periods. The evaluation cannot assure that the pad would maintain its integrity during a design seismic event with the load of the cask. Under these conditions the pad could fail and damage the area below. Located below the decontamination pad is an open area of the turbine building outside the 480V Switchgear Room which is on the lower floor of the Fuel Storage Building. Cable trays containing cable for safety-related equipment pass under the decontamination pad and into the 480V Switchgear Room. This switchgear room contains equipment which provides power to components being fed from the 480V Switchgears 2 and 3. Redundant components fed from 480V Switchgear 1 are powered from a separate location in the 4160V Switchgear Room. The 4160V Room is on the ground floor of the Control/Administration Building on the east side of the north turbine building extension. This room would maintain its integrity as a result of a seismic event.

As part of the Fire Hazards Analysis for San Onofre Unit 1 which was submitted to the NRC by letter dated February 19, 1987 it was postulated that the 480V Switchgear Room would be lost due to a fire. As a consequence the availability of equipment to safely shutdown the plant was evaluated. The results indicate that redundant shutdown equipment would be available. The only redundant equipment which would be affected would be the control cable for a Component Cooling Water Pump. This cable is routed in a cable tray entering the 480V Switchgear Room. The capability to start the pump locally is available and component cooling water can be maintained.

Therefore, using the results of the Fire Hazards Analysis, following a seismic event it is assured that the plant can be maintained in a safe shutdown condition. Since failure of the decontamination pad would not affect the 480V Switchgear Room completely, it is considered conservative to use the results of the Fire Hazards Analysis. It is noted that for the Fire Hazards Analysis the plant is in an operational mode, whereas, during transshipment the plant will be shutdown.

The decontamination pad was also evaluated for the unlikely event of the drop of a cask on the pad. As previously indicated all precautions will be taken to prevent the possibility of a cask drop. This is discussed above relative to each of the guidelines in Section F, Heavy Loads Handling Issues. Procedures currently exist which describe the heavy load handling program. These procedures will be revised to include the cask, lift rig, cask handling, lift inspection requirements and any other needs associated with the transshipment. As a result it is assured that the probability of a drop of the cask is sufficiently low.

In the event the cask were dropped on the decontamination pad, the area immediately below the pad would be affected. As with the seismic event, cable trays outside the 480V Switchgear Room could be affected. As previously discussed relative to the seismic event, loss of these cable trays would not prevent maintaining the plant in a safe shutdown condition.

I. SPENT FUEL POOL

The spent fuel pool is located in the Fuel Storage Building and has a rectangular geometry which is divided by interior walls into three areas. The three areas are the spent fuel storage area, the fuel transfer area, and the spent fuel cask handling area. The side walls, bottom slab, and interior walls are reinforced concrete of thickness 4 feet 0 inches (min.), 4 feet 9 inches (min.), and 2 feet 6 inches, respectively. There is a 0.120 inch stainless steel membrane liner on the pool bottom and a 0.06 inch stainless steel membrane liner on all sides of the pool. A 2 foot 6 inch thick partition separates the spent fuel storage area and the fuel transfer and cask handling areas.

Nominal pool water depth is 39 feet in the cask handling area with the pool surface at plant elevation 41 feet. The water depth is monitored with high level (plant elevation 41 feet 4 inches) and low level (plant elevation 40 feet 8 inches) control room annunciation. Minimum water shielding above the stored fuel is 25 feet 3 inches.

Makeup water for the spent fuel pool can be provided via the spent fuel cooling water return line by either the refueling water filter pump (80 gpm) from the refueling water storage tank (240,000 gallons) or the primary plant makeup pumps (2 at 100 gpm each) from the primary plant makeup tank (150,000 gallons). In addition, the fire protection water system could also be utilized to provide makeup water to the spent fuel pool. The fire protection water pumps (2 at 1000 gpm each) could provide makeup water from the service water reservoir (3,000,000 gallons) or the circulating water system (through the 1000 gpm screen wash pumps) via hydrants located at strategic points in the plant and fire hoses (100 gpm each). Makeup water to the spent fuel pool could also be provided by gravity flow from the condensate storage tank (240,000 gallons) through the fill/drain connection with fire hoses. Plant personnel operate makeup and drainage equipment as necessary to maintain the pool water level within annunciation limits. Any leakage from the spent fuel pool can be detected by accumulation of water in the leak detection monitor sump located at plant grade, outside and adjacent to the north wall of the Fuel Storage Building.

Spent fuel cask handling is performed by the turbine gantry crane and is limited to the east end of the spent fuel pool. Fuel element handling is performed by the fuel handling crane. A removable roof hatch provides turbine gantry crane access for handling the cask in this area. Drops of the cask in the cask handling area are minimized by the controls discussed above in the Section F, Heavy Loads Handling Issues.

In order to prevent damage to the liner in the cask handling area, a stainless steel plate will be installed at the bottom of the cask handling area. The steel plate will minimize the potential for damage of the liner due to cask handling activities and will evenly distribute the load of the cask over the liner in the cask handling area. In order to provide an added measure of protection in the unlikely event of a cask drop in this area the plate is sized to withstand a vertical cask drop in the cask handling area of the spent fuel pool. The concrete slab and the liner plate of the cask area of the pool will be protected by the new steel plate. As a result of the postulated cask drop, it is expected that the concrete slab will crack. However, spalling on the back face of the slab or leakage through the concrete is not expected to occur.

J. TRANSPORT BETWEEN UNIT 1 AND UNITS 2 AND 3

The spent fuel cask will be moved on a tractor trailer (or railroad car) between the Unit 1 south turbine deck extension and the Units 2 and 3 Fuel Handling Buildings. The tractor trailer will exit the Protected Area, will be escorted while in the Owner Controlled Area and into the Unit 2 for reentry into the Protected Area, and then move east of the Unit 2 Diesel Generator Building towards the Fuel Handling Buildings loading bays (See Figure 4). Members of the Station Security Organization will escort the cask and trailer while it is in the Owner Controlled Area.

When moving from the south turbine deck extension through the protected area the tractor trailer does not travel over any underground safety-related equipment, components or systems. When traversing the Owner Controlled Area the trailer passes over a communication duct bank. However, the top of the concrete duct bank which carries cable for the Public Address system is located 7'-5" below the grade. The duct bank is buried sufficiently to be safe from this heavy load.

After reentering the Protected Area, the tractor trailer will travel along the road east of the Unit 2 Diesel Generator Building, Maintenance Building and the auxiliary transformer area. The cask cradle and the trailer are designed so that the cask will not roll from the cradle and hit the safety related Fuel Handling Building. There is no safety-related equipment, component or system located underground in the vicinity of the tractor trailer route that would be impacted by the combined tractor trailer and cask.

K. SAN ONOFRE UNITS 2 AND 3

The San Onofre Units 2 and 3 Spent Fuel Pools have been evaluated for storage of the San Onofre Unit 1 spent fuel. This is described in Section 9.1.2, Spent Fuel Storage, of the San Onofre Units 2 and 3 FSAR where it is stated:

> "The Unit 1 fuel assembly will be stored without the use of any spacers or adapters in any of the spent fuel rack locations. The weight of the Unit 1 fuel assembly is less and its center of gravity is located at a lower elevation than that of a Unit 2 or 3 fuel assembly. These effects will decrease the rack stresses imposed by Unit 1 fuel when compared with Unit 2 or 3 fuel."

During the evaluation of the reracking of San Onofre Units 2 and 3, the storage of Unit 1 spent fuel will be included.

L. CONCLUSION

The San Onofre Unit 1 spent fuel pool will be essentially full following the next refueling outage in August 1988. Unless the spent fuel is shipped to the adjacent San Onofre Units 2 and 3 spent fuel pools, operation of the unit will cease in 1990. It is proposed that transshipping of the spent fuel should begin as soon as possible (i.e. in the next midcycle outage).

In order to transship the spent fuel the turbine gantry crane at San Onofre Unit 1 will be used to lift and transport the spent fuel shipping cask. The heavy loads handling program at San Onofre Unit 1 will be revised to incorporate the transshipment procedure. This involves developing a procedure for the transshipment, SO123-X-9.0, Transshipment of Spent Fuel, and revising, as necessary, procedures SO123-I-1.13, Turbine Gantry Crane Checkout and Operation, SO1-I-7.27, Cranes, Rigging, and Lifting Controls, and SO23-I-3.32, Cask Handling Crane Checkout and Operation, to include the cask, lift rigs, lifts and inspections. With all the necessary procedural precautions taken, the movement and lift of the spent fuel cask will be conducted in a safe manner.

The seismic design of the turbine building did not include the turbine gantry crane with a spent fuel cask located on the north turbine deck extension. In order to minimize the possibility of a seismic event concurrent with the crane on the turbine building, the use of the turbine gantry crane with a load in excess of the turbine building design is being limited to 1% (or 87 hours) per year. This limit provides assurance that the cask will be on the crane for a minimum amount of time while the crane is on the north turbine building extension. In addition all transshipments will only be performed during Unit 1 plant shutdowns (Modes 5 or 6).

Lifts of the cask will occur in the Fuel Storage Building over the north and south turbine deck extensions, decontamination pad and the cask handling pool. These lifts were evaluated and a drop during these lifts is not considered probable due to the procedural controls that will be implemented. In the unlikely event that a cask is dropped it was concluded that the plant could be maintained in a safe shutdown condition and the spent fuel pool integrity will be maintained.

Therefore, it can be concluded that the transshipment of spent fuel from San Onofre Unit 1 will be conducted in a safe and reliable manner. With the NRC approval of this methodology transshipment of spent fuel will begin with the midcycle outage scheduled for February, 1988.

9095F