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October 29, 1985
ST-HL-AE-1465
File No.: G9.17

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Responses to DSER/FSAR Items
Regarding Section 9.1

Dear Mr. Knighton:

The attachment enclosed provides STP's response to Draft Safety Evaluation Report (DSER) or Final Safety Analysis Report (FSAR) items.

The item numbers listed below correspond to those assigned on STP's internal list of items for completion which includes open and confirmatory DSER items, STP FSAR open items and open NRC questions. This list was given to your Mr. N. Prasad Kadambi on October 8, 1985 by our Mr. M. E. Powell.

The attachment includes mark-ups of FSAR pages which will be incorporated in a future FSAR amendment unless otherwise noted below.

The items which are attached to this letter are:

Attachment	Item No.*	Subject
1	F 9.1-1	Update of Section 9.1 to reflect spent fuel rack configuration

* Legend
D - DSER Open Item C - DSER Confirmatory Item
F - FSAR Open Item Q - FSAR Question Response Item

L1/DSER/aao

B001
1/1

If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

MEP/bl

Attachments: See above

L1/DSER/aao

cc:

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Revised 9/25/85

L1/DSER/aao

9.1 FUEL STORAGE AND HANDLING

Facilities for the receipt and storage of new fuel and the storage and transfer of spent fuel are housed in the Fuel-Handling Building (FHB). A separate and independent FHB is provided for each unit of the STP. Each FHB is designed as a controlled-leakage seismic Category I structure. The design of the FHB Heating, Ventilating and Air Conditioning System is discussed in Section 9.4.2. The structural design considerations are described in Section 3.8.4.

9.1.1 New Fuel Storage

9.1.1.1 Design Bases. The new fuel storage pit is a reinforced concrete pit and an integral part of each seismic Category I FHB. This pit provides temporary dry storage for approximately one-third core (66 fuel assemblies) of new fuel. The fuel is stored in racks (Figure 9.1.1-1) composed of individual vertical cells fastened together to form three 2 x 11 modules which may be bolted to anchors in the floor and walls of the new fuel storage pit. The new fuel racks are classified as seismic Category I components, as defined by Regulatory Guide (RG) 1.29, and American Nuclear Society (ANS) Safety Class (SC) 3 (see Section 3.2).

The new fuel racks are designed with a center-to-center spacing of 21 in. This spacing provides a minimum of 12 in. between adjacent fuel assemblies. This separation is sufficient to maintain a subcritical array assuming optimum moderation. Space between storage positions is blocked to prevent insertion of fuel. All rack surfaces that come into contact with the fuel assemblies are made of annealed austenitic stainless steel, and the support structure is painted carbon steel.

The racks are designed to withstand normal operating loads, as well as to remain functional with the occurrence of a Safe Shutdown Earthquake (SSE). The new fuel racks are designed to withstand a maximum uplift force of 5,000 pounds and to meet the requirements of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section III, Appendix XVII.

[redacted] [In Addition, space is provided for the storage of fuel during refueling inside the Reactor Containment Building (RCB). See Section 9.1.2 1 for a description of the racks.

The new fuel storage pit access hatch is a three-section cover. This cover will minimize the introduction of dust and debris into the pit. The cover is designed to withstand the impact force of a new fuel assembly dropped from the maximum elevation allowed by the 2-ton hoist of the FHB overhead crane.

9.1.1.2 Facilities Description. The FHB abuts the south side of the
C[redacted]6 [~~Reactor Containment Building~~ (RCB) and is adjacent to the west side of the Mechanical-Electrical Auxiliaries Building (MEAB) of each unit. The locations of the two FHBs are shown in the station plot plan on Figure 1.2-3. For general arrangement of the new fuel storage facilities, refer to Figures 1.2-3~~7~~(9) through 1.2-4~~0~~(8).

New fuel assemblies are received in the receiving area of each FHB and temporarily stored in the shipping containers in the new fuel handling area. In the new fuel handling area, each new fuel assembly is removed from its shipping container and inspected visually to confirm the assembly has not been damaged during shipment. The new fuel assemblies are transported from the inspection area to the new fuel storage pit or to the new fuel elevator by the

15/2-ton, dual-service FHB crane. The 2-ton hoist of this crane is designed to handle new fuel assemblies. New fuel handling is discussed in detail in Section 9.1.4. Use of the 2-ton hoist of the 15/2- ton crane or of the fuel-handling machine to handle new fuel ensures that the design uplift of the racks will not be exceeded.

The new fuel storage pit is situated in the approximate center of each FHB. The floor of the new fuel storage pit is at El. 50 ft 3 in. The new fuel storage pit access hatch is provided with a three-section protective cover at El. 68 ft. The fuel assemblies are loaded into the new fuel storage racks through the top and stored vertically.

9.1.1.3 Safety Evaluation. Units 1 and 2 of the STP are each provided with separate and independent fuel handling facilities.

Flood protection of each FHB is discussed in Section 3.4.1. Flooding of the new fuel storage pit from fluid sources inside either FHB is not considered credible since all fluid systems components are located well below the elevation of the new fuel storage pit access hatch. A floor drain is provided in the new fuel storage pit to minimize collection of water.

The applicable design codes and the ability of the FHB to withstand various external loads and forces are discussed in Section 3.8.4. Details of the seismic design and testing are presented in Section 3.7. Missile protection of the FHBs is discussed in Section 3.5. Failure of nonseismic systems or structures will not decrease the degree of subcriticality provided in the new fuel storage pit.

In accordance with ANSI N18.2, the design of the normally dry new fuel storage racks is such that the effective multiplication factor will not exceed 0.98 with fuel of the highest anticipated enrichment in place, assuming optimum moderation (under dry or fogged conditions). For the unborated flooded condition, assuming new fuel of the highest anticipated enrichment in place, the effective multiplication factor does not exceed 0.95. Credit may be taken for the inherent neutron - absorbing effect of the materials of Construction. 2 Q10.7

The new fuel assemblies are stored dry, the 21-in. spacing ensuring a safe geometric array. Under these conditions, a criticality accident during refueling and storage is not considered credible. Consideration of criticality safety analysis is discussed in Section 4.3.

Design of the facility in accordance with RG 1.13 ensures adequate safety under both normal and postulated accident conditions. The new fuel storage racks also meet the requirements of General Design Criterion (GDC) 62. 44

9.1.2 Spent Fuel Storage

9.1.2.1 Design Bases. The spent fuel pool is a stainless steel-lined reinforced concrete pool and is an integral part of each FHB. ~~The pool is designed to accommodate 724 spent fuel assemblies. Space for 324 spent fuel assemblies is provided in nine 6x6 modules having 16-inch center-to-center spacing (Figure 9.1.2-1a). These modules are firmly bolted to anchors in the~~ 23

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floor of the spent fuel pit. The (All) spent fuel racks are classified as seismic Category I, as defined by RG 1.29, and as ANS SC 3.

One hundred ninety six (196) Another 400 storage spaces are provided (in the FHB spent fuel pool) in four 7x7, four 6x7, and one 6x6 modules. These modules have 14-inch center-to-center spacings (Figure 9.1.2-1b) and are "free standing" in that they rest on vertical shear pins attached to adapter plates that are bolted to the spent fuel pit floor. Spaces between storage cells are blocked to prevent improper insertion of fuel. 6

(new paragraph.) Both the 16 in. and 14-in. (and 16-in. (described below)) spacings provide sufficient separation between fuel assemblies to maintain a subcritical array. All rack surfaces that come into contact with fuel assemblies are made of annealed austenitic stainless steel. These materials are resistant to corrosion during normal and emergency water quality conditions. 23

The racks are designed to withstand normal operating loads as well as to remain functional with the occurrence of an SSE. The racks are designed with adequate energy absorption capabilities to withstand the impact of a dropped spent fuel assembly from the maximum lift height of the spent fuel pit bridge hoist. The racks are designed to withstand a maximum uplift force equal to the uplift force of the bridge hoist. The racks also meet the requirements of ASME Code, Section III, Appendix XVII.

Shielding for the spent fuel pool is adequate to protect plant personnel from exposure to radiation in excess of published guideline values as stated in Section 12.1. A depth of at least (approximately) 10 ft of water over the top of the spent fuel assemblies will limit direct radiation to 2.5 mR/hr (surface dose rate).

The FHB Ventilation Exhaust System is designed to limit the offsite dose in the event of a significant release of radioactivity from the fuel, as discussed in Sections 12.3.3, 15.7.4 and 9.4.2.

The FHB is designed to prevent missiles from contacting the fuel. A more detailed discussion on missile protection is given in Section 3.5.

(In addition, space is provided for storage of fuel during refueling inside the Reactor Containment Building for 64 fuel assemblies in four 4x4 modules having 16 inch center-to-center spacing (Figure 9.1.2-1a). These modules are firmly bolted in the floor.)

9.1.2.2 Facilities Description. The FHB abuts the south side of the RCB and is adjacent to the west side of the MEAB of each unit. The locations of the two FHBs are shown in the station plot plan on Figure 1.2-3. For general arrangement of the spent fuel storage facilities, refer to Figures 1.2-37 (9) through 1.2-40 (8).

The spent fuel storage facilities are designed for the underwater storage of spent fuel assemblies and control rods after their removal from the reactor vessel. The spent fuel is transferred to the FHB and handled and stored in the spent fuel pool underwater. The fuel is stored to permit some decay, then transferred offsite. For a detailed discussion of spent fuel handling, see Section 9.1.4. 6 7 6

The spent fuel pool is located in the northwest quadrant of each FHB. The floor of the pool is at El. 21 ft 11 in., with normal water level at El. 66 ft 6 in. The top of a fuel assembly in a storage rack is El. 39 ft. (does not extend above the top of the storage rack which is El. 39 ft. 3 in.) (Initially,) The storage of 724 (196) spent fuel assemblies is accommodated in the pool. The fuel assemblies are loaded into the spent fuel racks through the top and are stored vertically. 6 7 6

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9.1.2.3 Safety Evaluation. Units 1 and 2 of the STP are each provided with separate and independent fuel handling facilities.

Flood protection of each FHB is discussed in Section 3.4.1.

A detailed discussion of missile protection is provided in Section 3.5.

The applicable design codes and the various external loads and forces considered in the design of the FHB are discussed in Section 3.8.4. Details of the seismic design and testing are presented in Section 3.7.

Design of this storage facility in accordance with GDC 62 and RG 1.13 ensures a safe condition under normal and postulated accident conditions. The center-to-center distance between adjacent spent fuel assemblies is sufficient to ensure K_{eff} = 0.95 ($\leq$) even if unborated water is used to fill the spent fuel pool. The design of the spent fuel storage rack is such that it is impossible to insert the spent fuel assemblies in other than prescribed locations, thereby preventing any possibility of accidental criticality. Consideration of criticality safety analysis is discussed in Section 4.3.

The spent fuel pool is designed to maintain leaktight integrity. To ensure such integrity, the pool is lined with stainless steel plate, and plate welds are backed with channels to detect and locate leakage. Leakage entering these channels is directed to the Liquid Waste Processing System (LWPS) via the FHB sump. Should a leak be detected, either by a low-level alarm (setpoint: 6 in. below normal water level) or by the fuel pool liner channel leak detection method, the operator would initiate makeup to the spent fuel pool. Makeup capability is provided by permanently installed connections to: (1) the Demineralized Water System (DWS), (2) the Reactor Makeup Water System (RMWS), and (3) the refueling water storage tank (RWST) in the Emergency Core Cooling System (ECCS).

A complete loss of spent fuel pool cooling is not considered a credible event since the components involved are designed to SC 3 seismic Category I requirements and could be powered from redundant Engineered Safety Features (ESF) power supplies. Further, the systems providing cooling are redundant. Therefore, no single failure would result in a complete loss of fuel pool cooling. For a more detailed discussion of spent fuel pool cooling, refer to Section 9.1.3. 3

9.1.3 Spent Fuel Pool Cooling and Cleanup System

The Spent Fuel Pool Cooling and Cleanup System (SFPCCS) is designed to remove the decay heat generated by spent fuel assemblies stored in the spent fuel pool and/or the in-Containment storage area. A second function of the system is to maintain visual clarity and purity of the spent fuel cooling water and the refueling water.

9.1.3.1 Design Bases. The SFPCCS design heat loads are given in Table 9.1-1. System capabilities to withstand natural phenomena and piping rupture are addressed in Chapter 3. The spent fuel pool cooling portions of the SFPCCS are designed to seismic Category I requirements, and are located in the FHB, a seimic Category I building. The spent fuel pool water purification portions of the SFPCCS are not required for safety functions and are not designed to seismic Category I requirements. 44 2 Q10.8 (8) 44

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the maximum allowable temperatures specified by Table 9.1-1.

9.1.3.1.1 Spent Fuel Cooling: The SFPCCS is designed to remove the amount of decay heat produced by the number of spent fuel assemblies that are stored following refueling. The system design incorporates two trains of equipment. Each train is capable of removing 100 percent of the normal maximum design heat load and 50 percent of the abnormal maximum design heat load. ~~When the spent fuel assemblies resulting from seven refuelings are stored,~~ the system can maintain the spent fuel cooling water temperature at or below ~~125°F.~~ This temperature is based on the heat exchangers (HXs) being supplied with component cooling water at the design flow and temperature. The flow through the spent fuel storage areas provides sufficient mixing to maintain uniform water conditions. 44

the maximum allowable temperature specified by Table 9.1-1.

If it is necessary to remove a complete core from the reactor ~~while the spent fuel assemblies from the previous seven refuelings still remain in the spent fuel pool,~~ the system can maintain the spent fuel cooling water ~~at or~~ below ~~158°F.~~ Makeup water requirements will be provided by either reactor makeup water, demineralized water, or refueling water storage tank (RWST) water. The makeup flowpath from the reactor makeup water storage tank (RMWST) is seismic Category I. The flowpaths from the DWS and from the RWST are non-seismic Category I. The SFPCCS is provided with redundant seismic Category I makeup sources (i.e., from the RWST and the RMWST). 44 44

9.1.3.1.2 Dewatering Protection: A depth of approximately 10 ft of water over the top of the stored spent fuel assemblies is required to limit direct radiation to 2.5 mR/hr (10CFR20 limit for unrestricted access for plant personnel). System piping is arranged so that failure of any pipeline cannot drain the spent fuel pool or the in-Containment temporary storage area below a depth of approximately 23 ft of water over the top of the stored spent fuel assemblies. Additionally, means are provided to detect component or system leakage. Refer to Section 9.3.3 for the detailed description of leak detection via the floor drains. In addition, the water level instrumentation provides a means of leakage detection. 44 44

9.1.3.1.3 Water Purification: The system's demineralizers and filters are designed to provide adequate purification to permit unrestricted access for plant personnel to spent fuel storage areas and to maintain optical clarity of the spent fuel cooling water and the refueling water. The optical clarity of the spent fuel pool surface is maintained by use of the system's skimmer pump, skimmer/strainer assemblies, and skimmer filter. The optical clarity of the refueling cavity water is maintained by the reactor cavity filtration system. The monitoring limits for the spent fuel pool water purity are provided in Table 9.1-4 and the monitoring frequency is provided in Table 9.3-4. 44 40 Q 281.03N

9.1.3.2 System Description. The SFPCCS, shown on Figures 9.1.3-1 and 9.1.3-2 (piping and instrumentation diagrams), consists of two cooling trains, two purification trains, a surface skimmer loop and a reactor cavity filtration system. 44 36

The SFPCCS removes decay heat produced by spent fuel after it is removed from the reactor. Spent fuel is removed from the reactor core during the refueling sequence and placed in the spent fuel pool, where it is stored until it is shipped offsite for reprocessing or permanent storage. If, for some reason, it is desirable or necessary to delay the transfer of the spent fuel to the spent fuel pool, the in-Containment storage area can be used for temporary

storage of up to one-third of a core. The system normally handles the heat
load from one core region freshly discharged from the reactor. Heat is trans-
ferred from the SFPCCS through the HXs to the Component Cooling Water System
(CCWS).

When the SFPCCS is in operation, water drawn from the spent fuel pool (and/or
from the in-Containment storage area) by the spent fuel pool pumps is pumped
through the tube side of the HXs, and then is returned to the spent fuel pool
(and/or the in-Containment storage area). Each suction connection, which is 44
provided with a strainer, is located at an elevation 4 ft below the normal
water level (approximately 23 ft above the top of the fuel assemblies). The 44
return line ~~terminates at an elevation 6 ft above the top of the fuel assem-
blies and~~ contains an antisiphon hole near the surface of the water to prevent
gravity drainage.

To maintain spent fuel cooling water purity, a bypass circuit composed of a
mixed-bed demineralizer and a filter is connected to each cooling train.
While the heat removal operation is in process, a portion of the spent fuel
cooling water is diverted upstream of each HX and passed through the puri- 44
fication circuit, returning downstream of the HXs. The demineralizers remove
ionic corrosion impurities and fission products. Filters are provided to
remove any additional particulates and to prevent any resin fines from enter-
ing the system from the demineralizer discharge. Transfer canal water may be
circulated through the same purification circuits by removing the gate between
the canal and the spent fuel pool. These purification loops are sufficient
for removing fission products and other contaminants which may be introduced
into the spent fuel cooling water.

One purification loop may be isolated from the heat removal portion of the
SFPCCS. By so doing, the isolated equipment may be used in conjunction with
either the reactor coolant drain tank pumps or the refueling water purifica-
tion pump to clean and purify the refueling water while spent fuel cooling and
spent fuel cooling water cleanup operations proceed. Connections are provided
such that the refueling water may be pumped from either the RWST or the refu-
eling cavity through the demineralizer and filter, and discharged to either
the refueling cavity or the RWST. Samples are periodically taken to determine
the need for purification of the water as well as the purification efficiency. 44

To further assist in maintaining spent fuel cooling water clarity, the spent
fuel pool and fuel transfer canal surfaces are cleaned by a skimmer loop.
Water is removed from the surfaces via three skimmer/strainer assemblies, two 18
located in the spent fuel pool and one located in the fuel transfer canal. A
skimmer pump pumps the water through a filter and returns it to the pool sur-
face at three locations remote from the skimmer/strainer assemblies.

The spent fuel pool is initially filled with water that is at the same boron
concentration as that in the RWST. Borated water may be supplied from the
RWST via the SFPCCS return header, or by running a temporary line from the
boric acid blending tee, located in the Chemical and Volume Control System 44
(CVCS), directly into the pool. Demineralized water can also be added for
makeup purposes (i.e., to replace evaporative losses) through a connection in
the SFPCCS return header.

The water in the spent fuel pool may be separated from the water in the trans-
fer canal by a gate. The gate is installed so that the transfer canal may be

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This crane is designed to maintain its structural integrity under the dynamic loading of the SSE. The crane will retain its load under such dynamic loadings.

This crane's main hoist is also provided with a redundant reeving system. 40
With this redundancy, the crane can withstand a single failure without dropping its load and therefore meets the intent of RG 1.104. A more detailed description of compliance of the 15/2-ton FHB crane with RG 1.104 is given in Table 9.1-3. 40

4. New Fuel Handling Area Crane

The 5-ton new fuel handling area overhead crane is used for movement of new fuel assemblies within the new fuel handling area. Dropping of new fuel assemblies due to SSE-induced dynamic loading of the crane will not result in an offsite radiological hazard. The crane travels over no safety-related equipment. 40

9.1.4.3.2 <u>Seismic Considerations</u>: The safety classifications for all fuel handling and storage equipment are listed in Table 3.2.B-2. SC 1, 2, and 3 equipment is designed to withstand the effects of an SSE without loss of capability to perform its safety function. Further, the combined normal and SSE stresses are limited to the allowable stresses as defined by ASME Code, Section III, Appendix XVII-2110. SC 1 and 2 equipment is designed to withstand the forces of an Operating Basis Earthquake (OBE), with the combined normal and OBE stresses being limited to the allowable stresses, as defined by ASME Code, Section III, Appendix XVII. For SC 3 equipment, consideration is given to the OBE only insofar as failure of the SC 3 equipment might adversely affect SC 1 or 2 equipment.

For NNS equipment, design for the SSE is considered if failure might adversely affect an SC 1, 2, or 3 component. Design for OBE is considered if failure of the NNS component might adversely affect an SC 1 or 2 component.

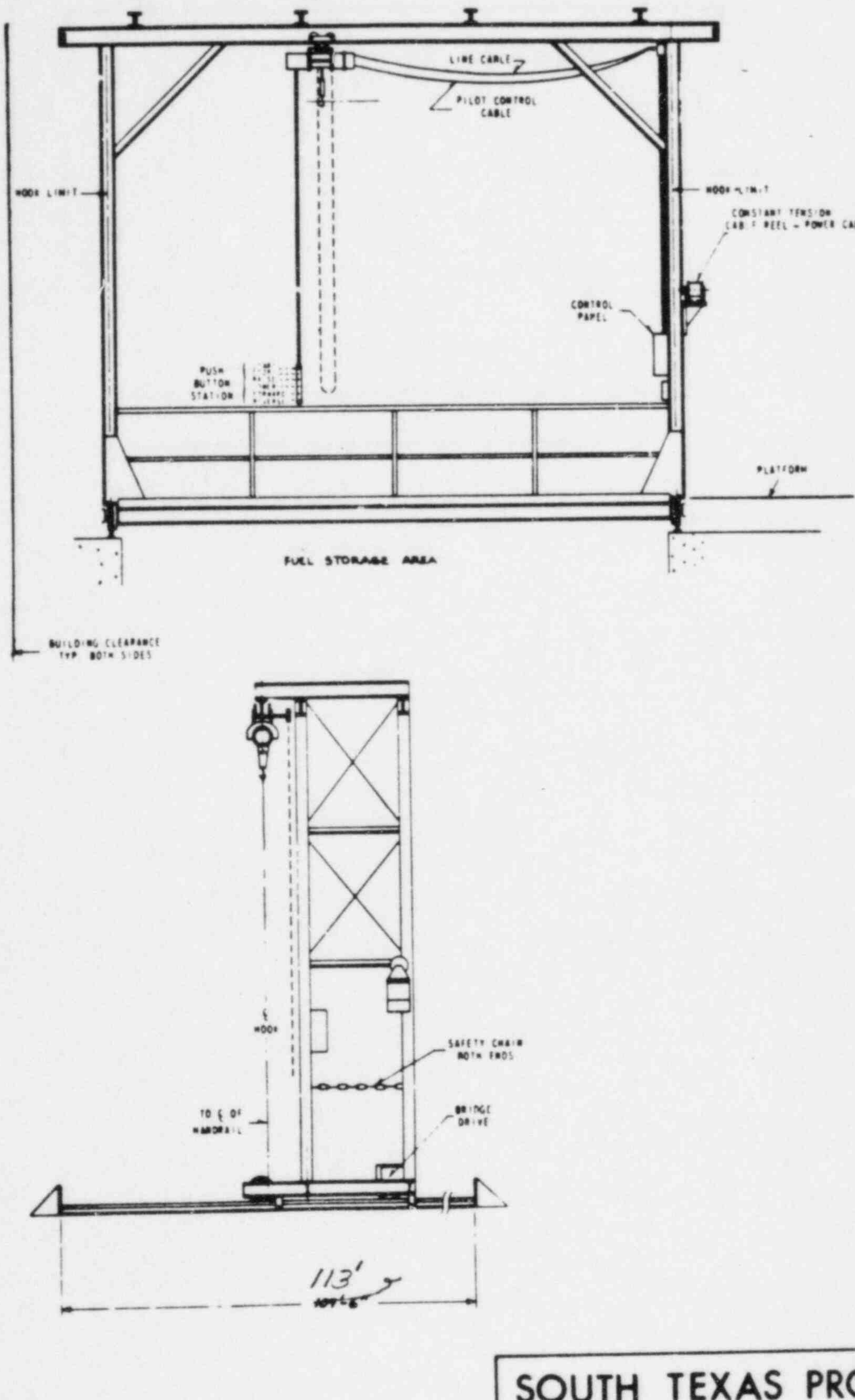
9.1.4.3.3 <u>Containment Pressure Boundary Integrity</u>: The fuel transfer tube, which connects the refueling canal (inside the RCB) and the spent fuel pit (outside the Containment), is closed on the refueling canal side by a blind flange at all times except during refueling operations. Further discussion on the fuel transfer tube can be found in Section 3.8.2.1.3.3. 40

9.1.4.3.4 <u>Radiation Shielding</u>: During all phases of spent fuel transfer, the gamma dose rate at the surface of the water is 2.5 mR/hr or less. This is accomplished by maintaining ~~a minimum of~~ approximately 10 ft of water above the top of the fuel assembly during all handling operations.

The two machines used to lift spent fuel assemblies are the refueling machine and the fuel handling machine. The refueling machine contains positive stops (STET) that prevent the top of a fuel assembly from being raised to within ~~a minimum of~~ approximately 10 ft of the normal water level in the refueling cavity. The hoist on the fuel handling machine moves spent fuel assemblies with a long-handled tool. Hoist travel and tool length likewise limit the maximum lift of a fuel assembly to within ~~a minimum of~~ approximately 10 ft of the normal water level in the spent fuel pit.

9.1.4.4 Tests and Inspections. As part of normal plant operations, the fuel handling equipment is inspected for operability before each refueling operation. During the operational testing of this equipment, procedures are followed that will verify the correct performance of the FHS interlocks. 40

9.1.4.5 Instrumentation Requirements. A description of the instrumentation and controls is provided in Section 9.1.4.3 for the refueling machine, the fuel handling machine, the FTS, and the SFCHS.



**SOUTH TEXAS PROJECT
UNITS 1 & 2**

Fuel Handling Machine
Figure 9.1.4-2