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DESCRIPTION:
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PLANT NAME: H.B. Robinson #2

ENCLOSURES:
Operating Plant Change No. 2 to the FSAR. concerning the Spent Fuel Cask Handling.... as related to possible accidents.....

ACKNOWLEDGED

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Carolina Power & Light Company

May 14, 1974

50-261

File: NG-3514

Serial: NG-74-608

RECEIVED MAY 17 1974 Mail Section

Mr. Carl R. Goller
Assistant Director for Operating Reactors
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Goller:

H. B. ROBINSON UNIT NO. 2
LICENSE DPR-23
SPENT FUEL CASK HANDLING

In response to your request of March 6, 1974, Carolina Power & Light Company submits one signed and thirty-nine copies of Operating Plant Change No. 2 to the H. B. Robinson FSAR. This change addresses the areas of concern expressed in your letter on the Robinson cask handling crane system. This change also revises the description of cask handling crane safety cable system contained in the response to Question 5 of the AEC letter dated March 24, 1969, in order to provide as-built information.

Yours very truly,

E. E. Utley
Vice-President
Bulk Power Supply

JMB:mvp
Attachments

cc: Messrs. N. B. Bessac
T. E. Bowman
B. J. Furr
W. E. Graham
E. R. Hager
D. V. Menscer
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4447

CAROLINA POWER & LIGHT COMPANY
H. B. ROBINSON STEAM ELECTRIC PLANT
UNIT 2

FINAL SAFETY ANALYSIS REPORT
OPERATING PLANT CHANGE NO. 2

FILING INSTRUCTIONS

Insert the Operating Plant Change No. 2 transmittal letter in the front of Volume 1.

Pages to be Removed		New Pages to be Inserted	
Page Number	Date	Page Number	Date
Response to AEC Question 5 - March 24, 1969, Pages 2 and 3		Response to AEC Question 5 - March 24, 1969 Pages 2 and 3	May, 1974

Insert response to AEC Questions March 24, 1969, in Volume IV.

RESPONSE TO AEC QUESTIONS - MARCH 6, 1974

Question

The Regulatory Staff's review of reactor power plant safety includes consideration of postulated spent fuel shipping cask drop accidents. These events must be adequately documented and analyzed by licensees and applicants and evaluated by the staff. Possible damage that could occur to plant structures, systems, and components important to safety in the event of a cask drop caused by a failure in the crane system or handling devices must be evaluated. Our review of the FSAR for the facility(s) indicates that the probability of damage from these postulated events has not been explicitly addressed and evaluated.

We request that you provide us with analyses and other relevant information needed to determine the possible damage in the event of a cask drop caused by a system failure and whether design or procedural modifications would be appropriate to reduce the probability of occurrence. For the facility(s) having both the fuel transfer cask and fuel shipping cask, both casks should be evaluated. Areas of particular concern which should be included in your evaluation are the following:

1. Integrity of the spent fuel storage pool - If the cask(s) should drop while being handled over the storage pool, would the pool floor be damaged to the extent that makeup capability could not be assured or resultant flooding could cause critical systems to become inoperable?

2. Spent fuel integrity - Can the cask(s) be positioned near spent fuel so that a cask can drop on the spent fuel or be deflected onto the spent fuel if it should hit a pool edge?

3. Integrity of critical systems and equipment - In moving the cask(s) through the building to or from the fuel stroage pool area, does it pass over systems or equipment important to safety which could be damaged by a cask drop? This consideration must include the capability of the floors to protect equipment or systems important to safety which are located below the floor.

4. Description of the handling equipment for the spent fuel cask - Provide a description of the crane facilities currently installed in the plant, indicating design conditions to which they were designed, the tests that have been performed on the cranes in accordance with accepted code procedures and describe the factor of safety that you believe to exist in the current crane system. Particular attention should be given to control braking versus emergency holding brakes that are currently installed. Evaluate the maximum stall torque of the crane motor and the capability of the brakes to preclude this torque being transmitted to the load being lifted. Describe any other protective features that are installed that would prevent a two blocking situation from occurring should the load be raised too high. Also provide a description of all lifting devices such as slings, hooks, ropes, and the attachments to the spent fuel cask(s).

If the results of your analysis indicate that changes in the design of your fuel transfer cask or fuel shipping cask crane systems or handling devices are necessary to protect plant structures, systems, or components important to safety or to prevent spent fuel damage, please provide information on your plans to revise the design of your facility(s) or equipment as required. We will need estimates of the schedule for design, fabrication, and installation of any modifications found to be necessary.

Answer

Initial spent fuel shipments to the fuel recovery site will be made in the following shipping casks:

Cask	Approximate Load Weight Including Lifting Attachments
NLI 1PWR/2BWR (Truck)	25 tons
NLI 10PWR/24BWR (Rail)	110 tons

The existing 100 ton cask handling crane has insufficient load capacity and dimensional requirements to handle the NLI 10PWR/24 BWR rail cask. This restricts the crane to handling only the NLI 1PWR/2BWR truck cask for spent fuel shipments. The 100 ton crane will be replaced with a 125 ton capacity redundant main hoist crane similar in design to the Reactor Building cranes at the Brunswick Steam Electric plant Units 1 and 2. This will provide the capability to ship spent fuel by rail cask. Crane replacement is scheduled for November, 1974, along with support structure modifications to accommodate increased crane load capacity and rail length. Additional crane rail length is needed to provide the necessary crane travel to erect the NLI 10PWR/24BWR rail cask on the rail car and to provide sufficient hook envelope to provide coverage over the cask sit down area in the spent fuel pool. The existing 100 ton crane will be maintained for handling the 25 ton NLI 1PWR/2BWR truck cask until replacement.

1. An analysis of the consequences of dropping a fuel cask in the fuel handling building has been provided in the answer to AEC Question 5 of March 24, 1969. Additional analysis of the consequences of dropping a fuel cask is provided below.

   The answer to Question 5 refers to conditions which could result in failure of the spent fuel pit bottom by punching shear after a 100 ton cask drop resulting from failure of the main hoist of the spent fuel handling crane. Analysis showed makeup capability of the spent fuel pool is not sufficient to prevent loss of water in the pool after this type of failure. However, any resultant flooding would not affect critical systems required for recovery of a design basis accident or to provide safe shutdown of the plant. A failure of the spent fuel pit slab can cause flooding of the gas decay tank bay below the spent fuel pit. Water could pass from the gas decay tank bay to the surrounding ground level areas around the spent fuel building. To prevent such an event from occurring, the

cask handling crane has been provided with an additional auxiliary safety device consisting of safety cables and wedging devices which will prevent the cask from falling in the event of failure of the main hoist components. This system was installed as a result of the above mentioned analyses and with this system the possibility of a cask drop accident is eliminated. The crane with the auxiliary safety system was accepted by the Regulatory Staff as adequate for this plant. (See answer to AEC Question 5, of March 24, 1969, for a description of analyses and safety system.)

The auxiliary safety system and resulting conservative safety factors were based on a 100 ton fully loaded system. The conservative safety factors showed adequate safety margins when handling a 100 ton load. As stated earlier the larger rail cask will not be lifted by the present crane, only the smaller 25-ton cask will be lifted. This results in much higher safety margins (by a factor of approximately 4) and therefore eliminates the credibility of a spent fuel cask drop.

2. As stated above, safety devices, etc., installed on the crane eliminates the credibility of a cask drop which could result in damage to any part of the plant. In addition to these safety devices, the spent fuel cask will be handled on a path prescribed by procedural requirements to prevent handling the cask over the spent fuel storage racks. The prescribed path will also minimize handling time on the pool edge. A postulated cask drop at the pool edge could result in the cask being deflected into spent fuel.

3. The spent fuel cask does not pass over any critical systems or equipment within the hook envelope of the crane.

4. A discussion of the spent fuel handling crane including design conditions and safety features is provided in the answer to AEC Question 5, of March 24, 1969. Additional information pertaining to the existing 100 ton cask handling crane is given below.

   The main hoist has one electric stopping and holding brake (WHITING TYPE 12" SR) mounted on the motor shaft and one mechanical control brake which is built into the main hoist reduction gear (WHITING TYPE #25). Both brakes are capable of stopping and holding 150% of the rated load. A solenoid is energized to release the electric brake thereby releasing the brake shoes from the wheel. The brake is applied by opening the circuit to the solenoid allowing a compression spring to extend and force the brake arms to the set position. The electric brake always maintains a safe condition by automatically setting and holding the load in case of power interruption. The brake solenoid is connected across two phases of the main hoist motor which results in the brake being released when the motor is energized and being set when the motor is deenergized. The major components of the mechanical control brake are located on a brake shaft in the main hoist reduction gear case. Situated between the brake gear and pinion on the brake shaft is a ratchet wheel which is governed by a pawl actuated by a friction sleeve on the motor drive shaft. The pinion on the motor drive shaft transmits its torque to the brake gear. The rachet wheel is provided with two friction washers

and is free to idle on the brake shaft but is held stationary when engaged by the pawl. The brake gear is not keyed to the brake shaft but transmits its torque to the shaft, through a brake nut which turns on a screw that is an integral part of the shaft. The brake pinion transmits its torque to the gear on the output shaft.

The starting of the hoisting cycle causes the brake nut to advance along the screw in the direction of the ratchet wheel until the friction washers are engaged, at which point the entire assembly operates as if it were simply a shaft with a gear and pinion keyed to it.

When the motor is reversed to lower, the pawl actuated by the motor drive shaft promptly engages the ratchet wheel and holds it stationary. The continued turning of the brake gear backs the brake nut off the screw, thereby loosening the entire assembly and allowing the load to lower. Should the load begin to drop faster than the speed for which the motor controller is set, the brake immediately tightens up and retards the load to the controller speed. At the same time that the lowering load is tightening the brake, the torque of the motor is being used to keep the brake loose, resulting in an alternate tightening and loosening that occurs in rapid succession. Hence, the load is lowered smoothly, without exceeding the speed for which the controller is set.

The electrical and mechanical brakes are not designed to prevent transmitting the maximum motor stall torque to the load being lifted. This is assuming that the stall condition caused by an excessive load or a hang-up of the load. To avoid this condition administrative and operational procedures as well as qualified operators will be employed which will prohibit operation of the crane under conditions which will result in a stall from excessive load. No loading exceeding the 100 ton design capacity of the crane will be lifted and on all lifts the load will be visually monitored by the operator and other qualified personnel to detect any hang-ups. Since the maximum hoist speed is only 5.5 feet per minute, visual monitoring for detection of hang-ups is both adequate and reliable. Prior to handling any spent fuel cask the crane and lifting devices will have received a load test of not less than 125% of rated capacity.

A two blocking situation which would result from raising the load too high is prevented by a paddle type limit switch which opens the hoist motor circuit as the hook reaches the upper limit of travel. The operation of the limit switch does not prevent lowering the hook. Operational procedures prohibit using this upper limit switch as a routine operational limit.

The lifting devices used with the NLI 1PWR/2BWR truck cask from the hook to the point of attachment consists of the following:

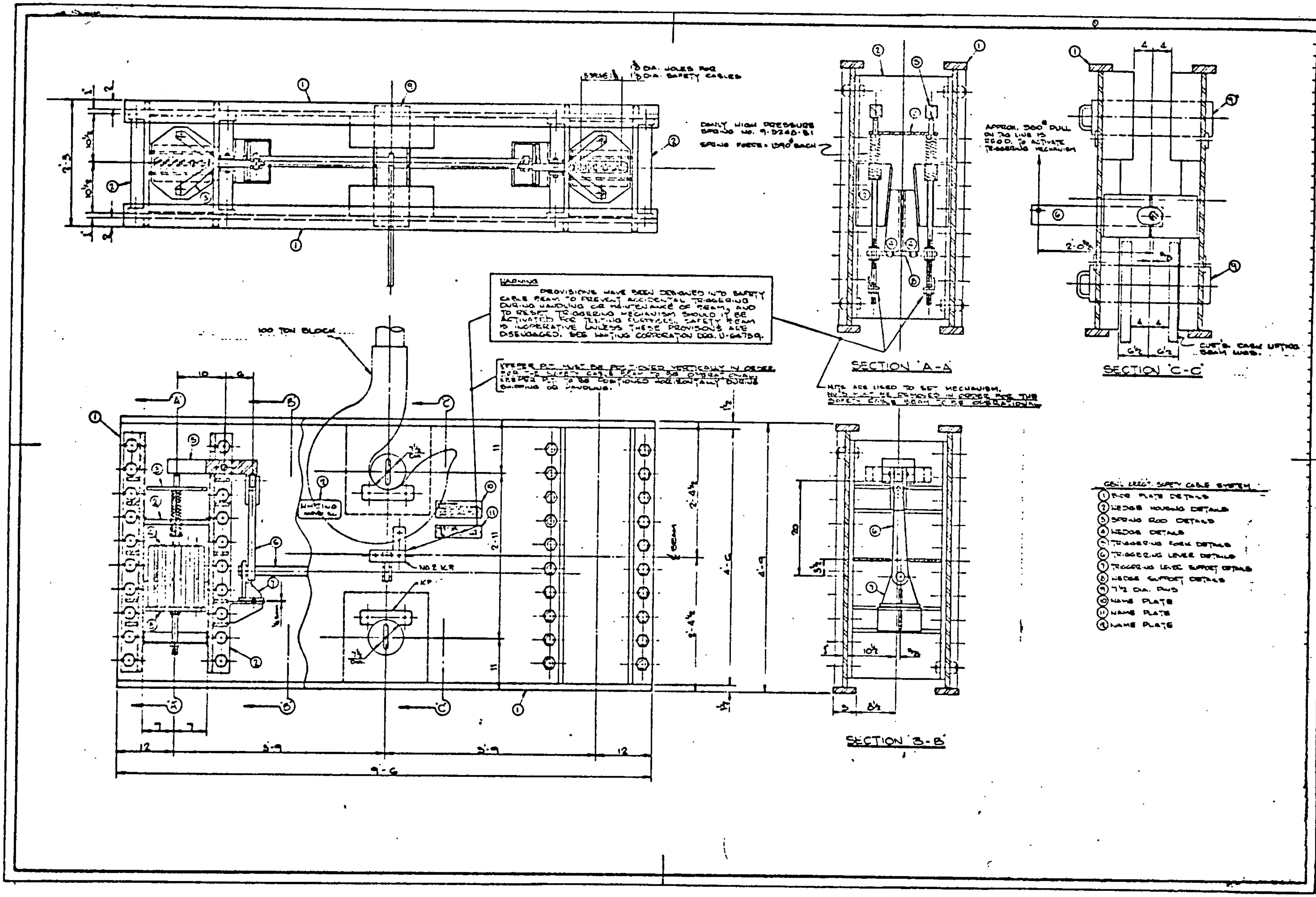
a. Main hook - The hook is a single-type solid, forged steel of rugged construction with a standard depress-type safety latch. The hook has a swivel in the load block and operates on a thrust bearing with hardened races.

b. Safety cable beam - Figure 1 shows the safety beam. Figure 2 shows how the safety cable beam is used for handling the spent fuel shipping cask. A discussion of the function of the safety cable beam is provided in the answer to AEC Question 5, of March 24, 1969.

c. Lift rig adapter - The lift rig adapter will be fabricated in accordance with National Lead Industries Drawing 40426D and is used to adapt the safety cable beam to the cask lifting yoke. The adapter will be of all steel construction and will have a minimum of three (3) times the maximum load based on material yield strength. The shop test load will be two (2) times the maximum operating load.

d. Cask lifting yoke - The yoke will be of all steel construction and will have a design load rating of three (3) times the maximum load based on material yield strength. The shop test load will be two (2) times the maximum operating load.

e. Cask trunnions - The cask trunnions are described in the "Safety Analysis Report NLI 1/2 Spent Fuel Shipping Cask" Docket No. 70-1318.



WARNING
PROVISIONS HAVE BEEN DESIGNED INTO SAFETY CABLE BEAM TO PREVENT ACCIDENTAL TRIGGERING DURING HANDLING OR MAINTENANCE OF BEAM, AND TO RESET TRIGGERING MECHANISM SHOULD IT BE ACTIVATED FOR TESTING PURPOSES. SAFETY BEAM IS INOPERATIVE UNLESS THESE PROVISIONS ARE DISENGAGED. SEE HAHTING CORPORATION DWG. U-64759.
100 TON BLOCK
SECTION 'A-A'
SECTION 'B-B'
SECTION 'C-C'
NUTS ARE USED TO SET MECHANISM.
DANLY HIGH PRESSURE SPRING NO. 9-3240-81
SPRING FORCE = 1390# EACH
APPROX. 500# PULL ON TRIG LINE IS REQD. TO ACTIVATE TRIGGERING MECHANISM
SAFETY CABLE SYSTEM
1 BASE PLATE DETAILS
2 WEDGE HOUSING DETAILS
3 SPRING ROD DETAILS
4 WEDGE DETAILS
5 TRIGGERING FORK DETAILS
6 TRIGGERING LEVER DETAILS
7 TRIGGERING LEVER SUPPORT DETAILS
8 WEDGE SUPPORT DETAILS
9 7½ DIA. PINS
10 NAME PLATE
11 NAME PLATE
12 NAME PLATE
9-6

FIGURE 1

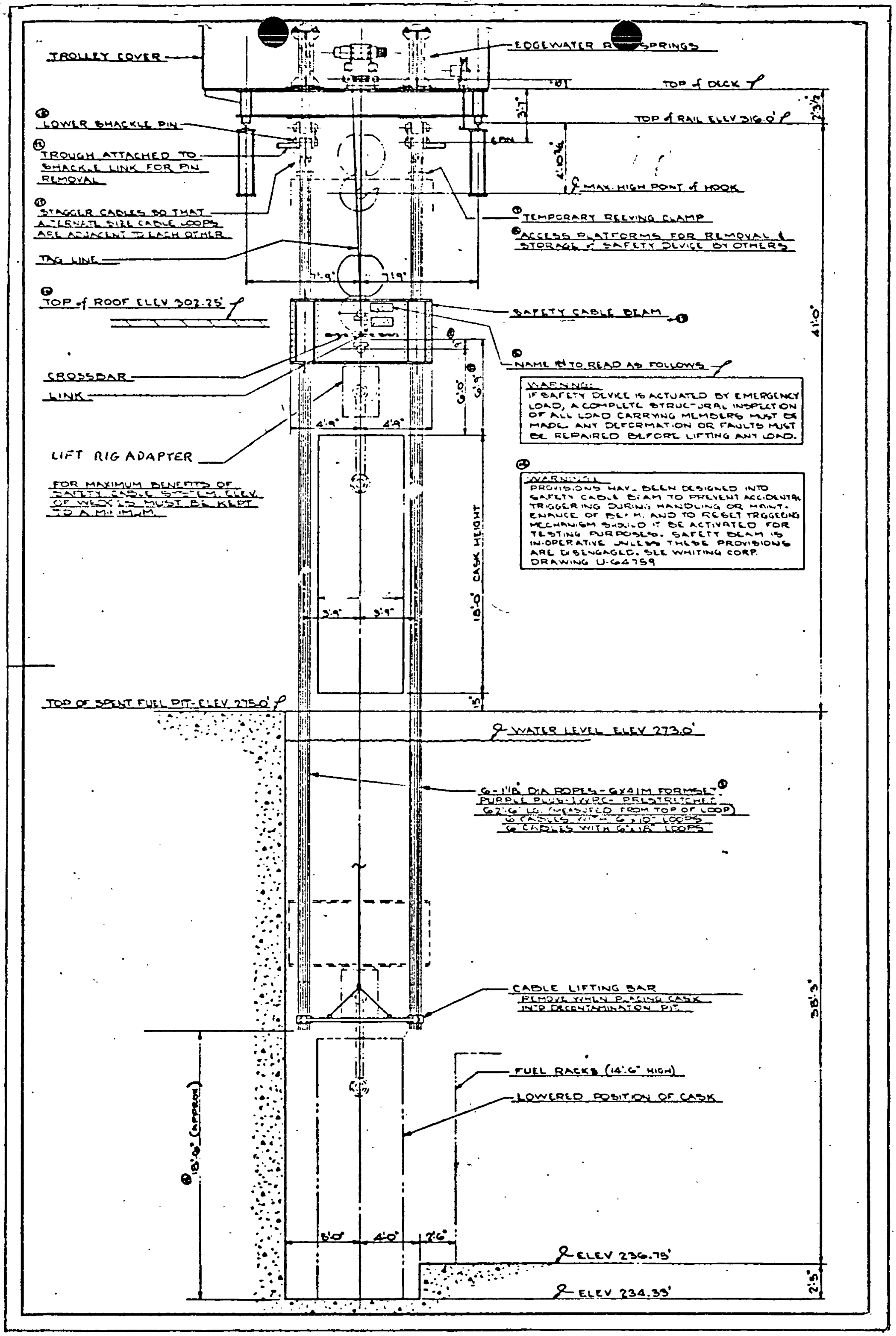

TROLLEY COVER
EDGEWATER R SPRINGS
TOP ℄ DECK
TOP ℄ RAIL ELEV 316.0'
LOWER SHACKLE PIN
TROUGH ATTACHED TO SHACKLE LINK FOR PIN REMOVAL
STAGGER CABLES SO THAT ALTERNATE SIZE CABLE LOOPS ARE ADJACENT TO EACH OTHER
TAG LINE
℄ MAX. HIGH POINT ℄ HOOK
TEMPORARY REEVING CLAMP
ACCESS PLATFORMS FOR REMOVAL & STORAGE OF SAFETY DEVICE BY OTHERS
TOP ℄ ROOF ELEV 302.25'
SAFETY CABLE BEAM
NAME PLATE TO READ AS FOLLOWS
WARNING: IF SAFETY DEVICE IS ACTUATED BY EMERGENCY LOAD, A COMPLETE STRUCTURAL INSPECTION OF ALL LOAD CARRYING MEMBERS MUST BE MADE. ANY DEFORMATION OR FAULTS MUST BE REPAIRED BEFORE LIFTING ANY LOAD.
CROSSBAR
LINK
LIFT RIG ADAPTER
FOR MAXIMUM BENEFITS OF SAFETY CABLE SYSTEM ELEV OF WEDGES MUST BE KEPT TO A MINIMUM
WARNING: PROVISIONS HAVE BEEN DESIGNED INTO SAFETY CABLE BEAM TO PREVENT ACCIDENTAL TRIGGERING DURING HANDLING OR MAINTENANCE OF BEAM AND TO RESET TRIGGERING MECHANISM SHOULD IT BE ACTIVATED FOR TESTING PURPOSES. SAFETY BEAM IS INOPERATIVE UNLESS THESE PROVISIONS ARE DISENGAGED. SEE WHITING CORP. DRAWING U-64759
18'-0" CASK HEIGHT
TOP OF SPENT FUEL PIT-ELEV 275.0'
℄ WATER LEVEL ELEV 273.0'
6-1⅛" DIA ROPES-6X41M FORMSET PURPLE PLUS-IWRC-PRESTRETCHED 62'-6" LG. (MEASURED FROM TOP OF LOOP) 6 CABLES WITH 6'-10" LOOPS 6 CABLES WITH 6'-18" LOOPS
CABLE LIFTING BAR REMOVE WHEN PLACING CASK INTO DECONTAMINATION PIT
FUEL RACKS (14'-6" HIGH)
LOWERED POSITION OF CASK
18'-0" (APPROX)
℄ ELEV 236.75'
℄ ELEV 234.33'
41'-0"
38'-3"
2'-5"

FIGURE 2

1. Design of the hoist cables incorporate a safety factor of five based on the rated load and efficiency of lifting tackle.

2. All parts subjected to dynamic strains such as gears, shafts, drums and blocks and other integral parts have a safety factor of five.

3. Electrical and mechanical load brakes were designed for 1 1/2 times the rated load.

4. The crane is capable of raising, lowering and transporting occasional loads of 125 percent of rated load without damage or distortion to any crane part.

5. Motor controllers, with at least five uniformly proportional steps for control in each direction were provided for all crane motions. This will provide a smooth uniform acceleration which would eliminate sudden jerking of the cask.

6. A depress type safety latch was provided on the hook to prevent disengagement of the lifting mechanism.

7. Three switches, clearly marked for operation, operate the crane, trolley and bridge and no interference between the motion of the crane, trolley and bridge are expected.

In addition to the safety features mentioned above which will preclude dropping the spent fuel cask, another safety feature is provided and is described below:

Spent fuel cask lifting crane is equipped with an auxiliary safety device consisting of 12 safety cables which are attached to the crane trolley and which pass through two (2) wedging devices attached to the cask lifting beam. In the event of a failure of the main hoisting device, the wedging devices are automatically engaged. The cask is thus supported by the safety cables and prevented from dropping.

The 12 safety cables are 1 1/8 inch OD steel rope with breaking strength of 61.9 tons per rope. The 100 ton fuel cask will result in a maximum load of 25 tons per rope assuming a free fall of 3 inches which is necessary to actuate and engage the wedging devices. This results in a safety factor of 2.48 for the safety ropes.

The crane structure has also been checked by the manufacturer and the load of 300 tons caused by the cask free falling 3 inches is within the safety factors for various parts of the crane structure.

This safety equipment is similar to that installed for the Consumer's Power Company except that it is designed for the 100 ton cask instead of the 75 ton cask.

Because of the numerous safety features and conservative safety factors which have been included in the design of the crane, we do not consider the cable break accident or any other accident which could result in the free fall of the spent fuel cask to be credible. Although the break failure accident is also unlikely, in the event it should occur, the spent fuel pit will retain its structural integrity.