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February 4, 1997

U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Document Control Desk

Subject: Duke Power Company
Oconee Nuclear Station
Docket Numbers 50-269, -270, and -287
Response to Request for Additional Information; Bulletin 96-02, "Movement of Heavy Loads Over Spent Fuel, Over Fuel in the Reactor Core, or Over Safety-Related Equipment"

Attached is Duke Power's response to the subject request for additional information. This request focused on the hypothetical drop of a spent fuel cask, causing the cask to tip over and eject its contents onto areas of the plant not shielded by water. For the reasons described herein, this scenario is not considered credible at Oconee.

If you have any questions, or need more information, please call Scott Gewehr at (704) 382-7581.

Very truly yours,

M. S. Tuckman

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Tell

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I. INTRODUCTION:

The following is Duke Power's response to the NRC's Request for Additional Information related to Bulletin 96-02, "Movement of Heavy Loads over Spent Fuel, Over Fuel in the Reactor Core, or over Safety-Related Equipment". The Request for Additional Information (RAI) presents a hypothetical scenario in which the loaded canister/cask could drop in a tipped-over orientation such that the shield plug and/or fuel assemblies might be ejected from the cask. Duke Power has evaluated the crane design, load path, and cask loading and unloading processes and determined that this scenario is not credible at Oconee Nuclear Station. Refer to the attached Figures 1 & 2 for layout sketches of the Spent Fuel Pool, crane and associated structures.

II. CRANE DESIGN:

Oconee Nuclear Station uses two cranes for handling the loaded spent fuel cask within the Spent Fuel Building; one within the Unit 1&2 Spent Fuel Building and one in the Unit 3 Spent Fuel Building. Both of these cranes are Whiting Cranes rated at 100 tons, which were built and installed in the 1969-1970 time frame as original Oconee equipment. These cranes have two hoists rated at 100 tons and 3.5 tons, and are CMAA Service Class A cranes with infrequent use.

Each crane is installed in the north end of its respective Spent Fuel Building and only covers the north end of the Spent Fuel Pool and the Receiving Bay. The crane has a main hoist hook capacity of 100 tons. The main hoist controls are five step magnetic, contactor reversing, secondary resistor-type with time delay acceleration and a maximum speed of 9 feet per minute. The bridge controls are the same as the hoist controls and has a maximum speed of 50 feet per minute. The trolley is a single speed, four feet per minute, magnetic contactor reversing type controller. The cranes were designed in accordance with Electric Overhead Crane Institute's Specification No. 61, Class A.

The structural and mechanical components of the crane are designed to have a minimum factor of safety of 2.5 based on yield strength and rated capacity. The required designed safety factor for the main hoist wire rope is five times the load rating. The actual safety factor for the Oconee 100 Ton Cranes is 6 times the rated load.

Some of the special design features of the crane are:

- Micro speed hoist motor at approx. 0.5 fpm.
- Micro speed bridge motor at approx. 1.5 fpm.
- Single speed trolley (short distance: < 2 ft. off center).
- Eddy Current load control brake (max. current In micro speed).
- Load Holding Brake (150% of motor torque)

All hoisting speeds, when the cask is within predetermined "slow zones", is in micro speed. Bridging speeds can also be in "micro". The trolley has a limited speed (4 fpm) and motion range (<2 ft. off center), by design.

The hoist has two independent braking systems. The Magnetic Eddy Current control braking system in the electrical circuits and an AC solenoid-operated spring set Load/Drum Holding Braking system. The bridge and trolley controls are also equipped with an AC solenoid-operated brake system. The hoist's eddy current brake is a dynamic AB 707 eddy-current control brake and is for speed limiting which has a maximum current in micro speed.

Special cask lifting devices were designed, tested, and receive periodic inspection and testing in accordance with ANSI N14.6. The overhead crane and other lifting devices receive annual and quarterly inspections in accordance with the applicable ANSI Standard. Daily inspections are performed in accordance with ANSI B30.2 on the overhead crane prior to use each day in which the crane is to be used. All lifting devices receive inspection to the applicable ANSI Standard prior to each use. All inspections are current and limited wear has been found in the past. The crane is in a limited area and is seldom used for other work such that the crane sees near rated load lifts on the main hook less than ten times a year.

III. CASK LOAD PATH:

The fuel cask loading operations are performed in the Spent Fuel Pool. The cask loading area is not separated from the spent fuel storage area by any physical barriers. The overhead 100 ton crane used for cask handling operates over the spent fuel pool at only one end, and has access only to the cask loading pit (elev. 800') and cask loading platform (elev. 825'). The crane bridge and trolley hard stops prevent travel over any area where spent fuel is stored in the fuel racks. The movements of the cask stay within the "Safe Load Path" for the Spent Fuel Pool. The load path also does not pass over any safety related equipment, however the lift of the Transfer Cask/DSC is treated as a "Critical Lift". As a "Critical Lift", procedures require a pre-lift briefing, a qualified crane operator, two qualified spotters and a designated individual who has authority to shut down the lifting operation.

The Cask Decontamination Pit is immediately adjacent to (West of) the north end of the Spent Fuel Pool, between the Spent Fuel Pool and the Fuel Receiving Bay. The cask load path for the lift from the Spent Fuel Pool to the Cask Decontamination Pit is very short (~16-17 ft.). The cask is lifted out of the Spent Fuel Pool water, over the side of the spent fuel pool deck (~6-7 feet wide; elev. 844') and taken directly over the Decontamination Pit using the 100 ton crane bridge and trolley motors. This entire transfer/movement takes approximately 10 minutes, after the cask has been drip dried over the spent fuel pool. During these movements, all crane travel is performed in only one direction at a time as a normal practice. After raising the transfer cask over the pool, the hoist comes to a stop and the hoist brakes are automatically applied prior to moving the bridge or trolley. After moving the bridge or trolley, they come to a stop and the bridge or trolley brakes are again applied automatically prior to lowering the hoist.

IV. CASK LOADING / UNLOADING PROCESSES:

All Canister/Cask movements at Oconee Nuclear Station with the overhead 100 ton crane are performed using Duke Power procedures MP/0/A/1500/007, "Independent Spent Fuel Storage Installation Phase I and II DSC Loading and Storage", MP/0/A/1500/015, "Independent Spent Fuel Storage Installation Phase I and II DSC Retrieval and Relocation", MP/0/A/1500/16, "Independent Spent Fuel Storage Installation Phase III DSC Loading and Storage", and MP/0/A/1500/17, "Independent Spent Fuel Storage Installation Phase III DSC Retrieval and Relocation".

The Dry Storage Canister, inside the Transfer Cask, is positioned in the cask loading area at the lowest elevation in the pool (Spent Fuel Pool depression area for cask loading; elev. 800'). Fuel is loaded into the canister using the fuel storage manipulator crane. The shield plug for the canister is then installed into the canister. The shield plug for the canister is a close tolerance fit and must be precisely leveled and aligned closely in the vertical direction to allow either insertion into, or retrieval from, the canister without it binding itself.

The transfer cask is then engaged by the lift adapter and lifting yoke attached to the overhead 100 ton crane and raised to an elevation slightly above the loading platform. The crane then traverses over the platform (elev. 825'). At this time, the top end of the transfer cask is slightly above the surface of the pool water level (nominally @ elev. 840'). The transfer cask is centered over the loading platform and lowered to rest. The lifting yoke is disengaged from, and temporarily stored on, the transfer cask while the lift adapter is being removed and stored.

Excess pool water is removed from the cavity formed above the shield plug in the canister, and four bolted shield plug restraints are installed. The crane hook is engaged directly to the yoke, while the yoke is engaged with the transfer cask, and the transfer cask is raised slightly above (on the order of one foot) the Spent Fuel Pool walkway elevation (deck level @ elev. 844'). The crane then traverses over to and is centered above the Cask Decontamination Pit. The transfer cask is lowered to rest on the bottom of the pit and the yoke is disengaged and removed. The bottom of the Decontamination Pit (elev. 816.75') consists of four feet of concrete which is over the back part of the Fuel Receiving Bay (elev. 796.5').

All remaining canister draining, welding, vacuum drying, and helium back-filling is performed in the Cask Decontamination Pit, followed by installation of the transfer cask top cover. All transfer cask travel in the Cask Decontamination Pit required to perform those activities are in the vertical direction only.

After these activities are complete, the overhead crane is used to raise the cask out of the Decontamination Pit and lower into the Fuel Receiving Bay and onto the transport trailer for transport to the ISFSI site.

For the unloading process, the order is essentially in reverse. The canister's top cover plates are removed when the cask is back in the Decontamination Pit. The four bolted shield plug restraints are installed after the top cover plates are removed, and then the cask is placed into the Spent Fuel Pool (using the same cask load path), first onto the cask platform and then into the cask depression pit. Therefore, the same load path would apply for the unloading process, as for the loading process, while the canister's top cover plate is removed.

All crane operators and inspectors used for cask handling operations are qualified to the Duke Power ETQS Program. All cask handling operations are performed as specified by written Duke Power Company procedures.

V. POSTULATED CASK DROP AND TIPOVER:

In order for a cask/canister drop to occur, a failure of the hook, cable, or hoist would have to occur. It is likely that a failure of any of these components would occur upon demand of the component; i. e., as the load is taken up or lowered. As described previously, cask/canister transfer is accomplished with travel in one direction at a time. Therefore, a gross failure of the crane during transition between vertical and horizontal movements would result in the cask falling into either the spent fuel pool or the cask decontamination pit.

If the cask/canister were to be dropped as it is being transferred between the Spent Fuel Pool and the Decontamination Pit, there are two different scenarios involving a cask tip over event that deserve discussion. First, the cask/canister could be partially over the Spent Fuel Pool and partially over the SFP Walkway. This would tend to rotate a dropped cask toward the Spent Fuel Pool and thus submerge the contents of the cask/canister under water. The water would tend to shield any radiation, thus allowing local recovery efforts to take place. With the presence of the borated water and the typical burnup of spent fuel assemblies, criticality is not a likely concern. The second scenario would be when the cask is partially over the SFP Walkway and partially over the Cask Decontamination Pit. This would tend to rotate a dropped cask toward the Fuel Receiving Bay. The horizontal distance where this is possible is only about 39.5 inches (3 ft. 3.5 in.) out of the 16-17 feet of overall horizontal travel, since otherwise the cask would either be sufficiently over the SFP Walkway so as to not induce any rotation, or the cask would be completely over the rectangular opening of the Cask Decontamination Pit. The worst case would be if the bottom edge of the cask just barely overlapped the edge of the Decontamination Pit/SFP Wallkway interface such that the cask was as far over the Decontamination Pit toward the Fuel Receiving Bay as possible while still overlapping the edge of the SFP Walkway. In this situation, the dropped cask would rotate toward the Fuel Receiving Bay and impact the far side of the Decontamination Pit at, or near, the cask's geometric longitudinal center. This would result in the cask's center of gravity staying within the bounds of the Decontamination Pit. (See Figure 3.) It is likely that there would be some plastic deformation of the cask, and some damage to the concrete edges of the Decontamination Pit during both the initial drop impact and upon the subsequent impact on the side of the cask with the other edge of the Decontamination Pit. This would act to absorb some of the kinetic energy of the cask and would tend to reduce the likelihood of further travel outside of the Decontamination Pit.

It is highly unlikely that the shield plug would eject from the canister given its tight tolerance fit. Any rotation of the shield plug as it tries to exit the canister would tend to bind the shield plug in place. With the four shield plug retainers in place, it is also very unlikely that all of these would fail at exactly the same time. Given that some of the retainers fail before others, an angular rotation of the shield plug will be induced thus binding the shield plug before it exits the canister. Even without the shield plug retainers in place, it is highly unlikely that the shield plug would exit a tipped over canister at a perfect right angle. Thus, unless the canister were inverted, the shield plug will tend to bind within the canister.

VI. <u>CONCLUSIONS:</u>

Oconee takes extreme caution in performing this transfer and treats it as a "Critical Lift". Oconee also keeps the preventative maintenance and inspections on their regular interval even though the crane is infrequently used. The crane is installed indoors in a dry, clean environment. The load path of the cask is within the specified "safe load path" for the Spent Fuel Pool. Also, the length of the path from the center of the spent fuel pool cask platform to the center of the cask decontamination pit is very short (~16-17 ft.). Given the robust design of Oconee's overhead 100 ton crane, the rigorous maintenance and inspections that are routinely performed, and the short and infrequent use of this crane, it is concluded that an actual cask drop/tipover scenario, as described by the NRC's RAI, is not credible.

FIGURE 1:
SPENT FUEL POOL + RECEIVING BAY
ELEVATION VIEW
(TYPICAL)

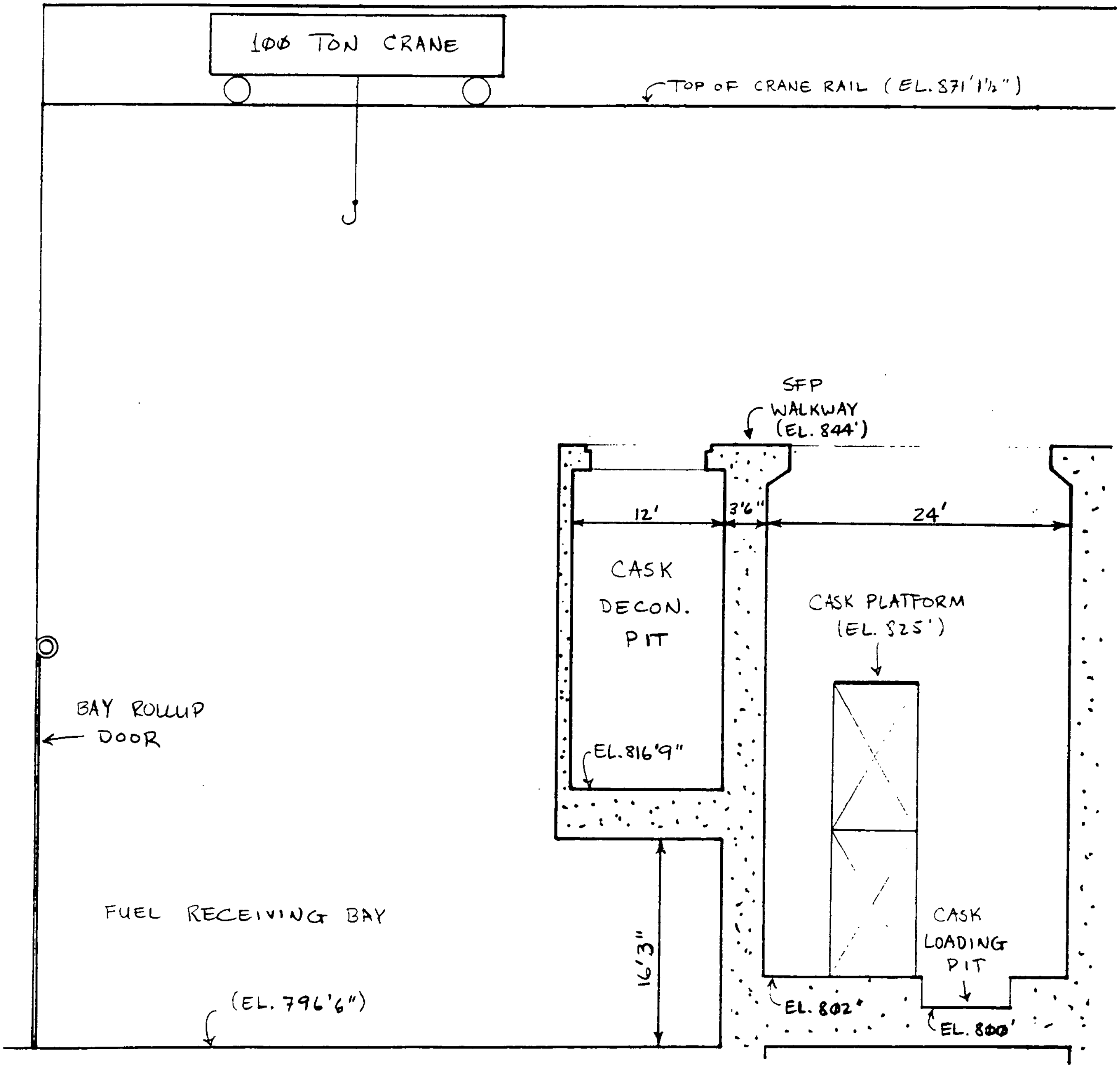

FIGURE 2:

SPENT FUEL POOL + RECEIVING BAY PLAN VIEW (TYPICAL)

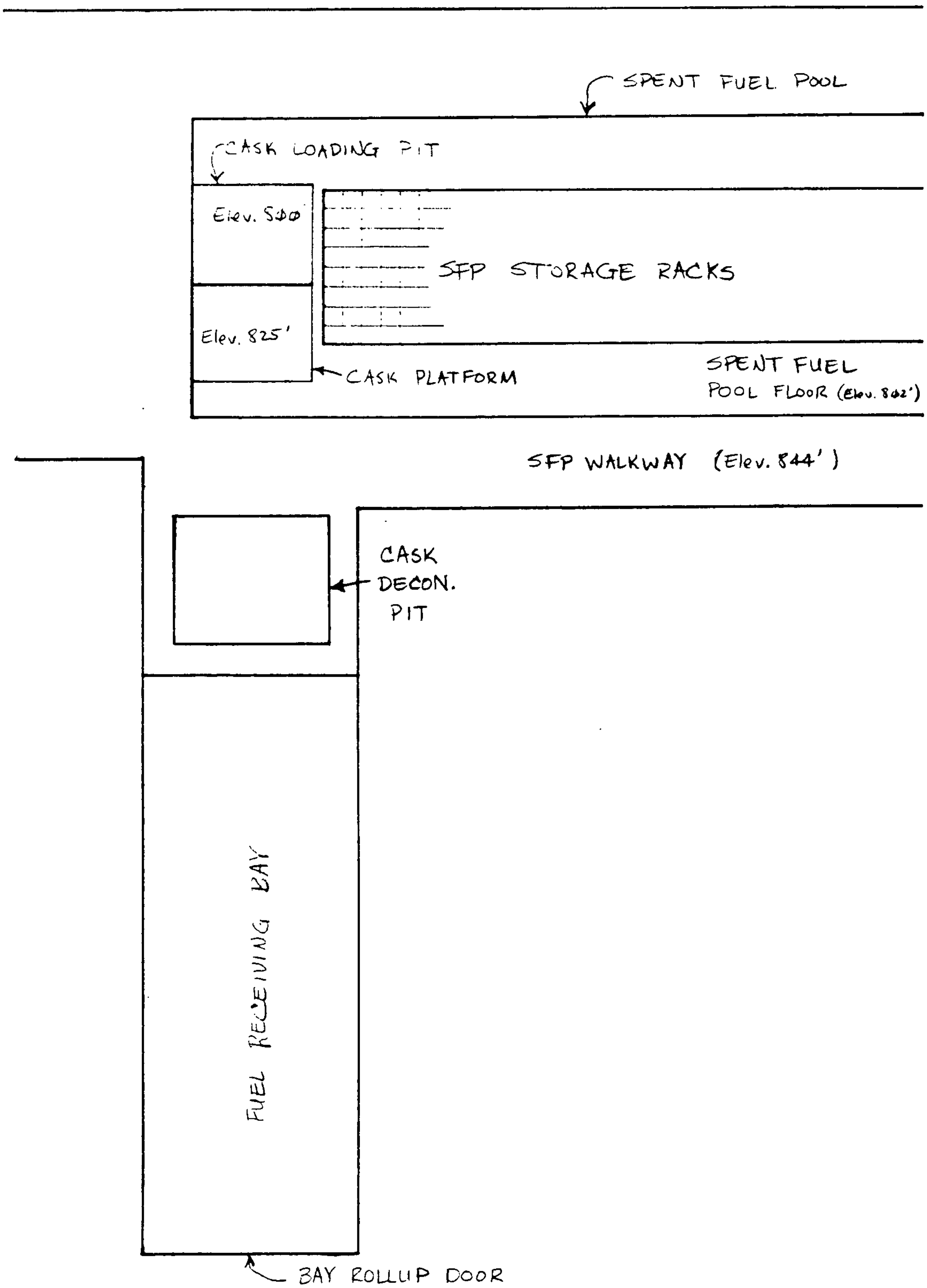

FIGURE 3:

SPENT FUEL POOL + RECEIVING BAY

ELEVATION VIEW

(TYPICAL)

CASK DROP SCENARIO