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VARGA,S.A. Operating Reactors Branch 1

SUBJECT: Forwards addl info re expansion of spent fuel storage capacity,in response to NRC 810127 request.

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May 11, 1981

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Office of Nuclear Reactor Regulation
ATTENTION: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
United States Nuclear Regulatory Commission
Washington, D. C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
REQUEST FOR ADDITIONAL INFORMATION CONCERNING
SPENT FUEL POOL EXPANSION

Dear Mr. Varga:

This letter is in response to your request of January 27, 1981 for additional information concerning our December 1, 1980 submittal for the expansion of the spent fuel storage capacity at H. B. Robinson, Unit No. 2. Our responses to these questions are in Attachments 1 and 2. Please contact my staff if you have further questions regarding our proposed modification.

Yours very truly,

E. E. Utley
Executive Vice President
Power Supply and
Engineering & Construction

SDF/jc (4741)
Attachments

cc: Mr. J. D. Neighbors (NRC)

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Attachment 1

AUXILIARY SYSTEMS BRANCH

H. B. ROBINSON SFP EXPANSION PRELIMINARY QUESTIONS

QUESTION

1. Section 6 of the December 1, 1980 submittal indicates that a temporary traveling bridge and hoist is to be erected on the fuel handling bridge rails. It will handle the old and new storage racks located beyond the reach of the Spent Fuel Cask Handling Crane. In this regard provide the following additional information.

   a. Describe the temporary crane, with the aid of drawings, the codes and standards to which it has been built, its load rating and the precautionary measures taken during its installation and removal which precludes it or its components from being dropped on stored spent fuel during its installation or removal.

   b. Describe and discuss, with the aid of drawings, the adequacy of the laydown area provided for the racks when the load is being transferred from the spent fuel cask handling crane to the temporary crane and the reverse.

   c. In the load handling operations involving the movement of any temporary structures, indicate and describe the load handling equipment and rigging that will be employed as well as the sequence and frequencies of these operations in order to complete the spent fuel pool modifications.

   d. Describe the lifting devices and associated attachment points interposed between the lifting devices and load. The response should include sufficient detail to enable the reviewer to conclude

that they will not fail during the installation and removal of the temporary crane and storage racks or other temporary structures.

e. With the aid of drawings describe the sequence and travel paths of all heavy load handling operations that are required in order to implement the spent fuel pit modifications.

RESPONSE TO ITEMS 1.a THRU 1.e

Carolina Power and Light Company is not currently in a position to respond to these questions as they pertain to construction details which are still in the planning stage. We anticipate providing you with this information in May, 1981.

QUESTION

f. In regard to the travel paths, provide information which will enable the reviewer to conclude that following a load drop at any point along the travel path, that even with the most potentially adverse conditions the consequences are acceptable when the following evaluation criteria are used:

i. Releases of radioactive material that may result from damage to spent fuel based on calculations involving accidental dropping of a postulated heavy load produce doses that are well within 10CFR Part 100 limits of 300 rem thyroid, 25 rem whole body (analyses should show that doses are equal to or less than 1/4 of Part 100 limits);

ii. Damage to fuel and fuel storage racks based on calculations involving accidental dropping of a postulated heavy load does not result in a configuration of the fuel such that k_{eff} is larger than 0.95;

iii. Damage to the spent fuel pool based on calculations of damage following accidental dropping of a postulated heavy load is limited so as not to result in water leakage that could uncover the fuel, (makeup water provided to overcome leakage should be from a borated source of adequate concentration if the water being lost is borated); and

iv. Damage to equipment in redundant or dual safe shutdown paths, based on calculations assuming the accidental dropping of a postulated heavy load, will be limited so as not to result in loss of required safe shutdown functions.

RESPONSE TO ITEM 1.f

The new racks will be brought into the spent fuel building using a single-failure-proof lifting rig and the single-failure-proof fuel cask crane which is described in the April 15, 1975 letter from E. E. Utley (CP&L) to Karl R. Goller (NRC) Serial NG-75-534. The racks will be placed so that they rest on the pool floor in the case of the 8 x 12 array or on a temporary platform installed in the fuel cask area for the 8 x 10 array. (See Figure 2-3 of the H. B. Robinson Unit 2 Spent Fuel Storage Expansion Report attached to CP&L letter NO-80-1759, dated December 1, 1980.) A temporary bridge crane, which travels on the fuel handling machine crane rails at the operating deck level, or other temporary lifting equipment, will place the racks in their final location. The removal of those existing racks that are to be replaced will follow the same procedure, but in reverse order. The height of lift of the racks above the fuel pool floor, while using the temporary bridge crane or other temporary lifting equipment, will be limited such that in the event of a load drop, the integrity of the fuel pool structure will not be impaired.

QUESTION

g. Currently the technical specifications limit the use of the spent fuel cask handling crane to periods when the outside ambient air temperature is greater than 33° F. Describe and discuss the

temperature limitations that will be applied to the use of the temporary crane.

RESPONSE TO ITEM 1.g

The temporary lifting equipment employed will be designed such that any temperature limitations will be below any expected ambient temperatures. We will advise you of the equipment temperature limits upon completion of the design which is expected in May, 1981.

QUESTION

2. Since the spent fuel cask handling crane is an outside crane it is necessary to remove a wall panel and roof hatch cover before heavy loads can be moved into or out of the spent fuel storage area. Assuming a load drop occurs that leads to a radiological release when the opening exists, describe and discuss the significance this has on the radiological offsite doses.

RESPONSE TO ITEM 2

The spent fuel cask handling crane is a single-failure-proof crane as described in the April 15, 1975 letter from E. E. Utley (CP&L) to Karl R. Goller (NRC), Serial No. NG-75-534. Therefore, a load drop is not a credible event.

QUESTION

3. In regard to the movement of loads into and out of the spent fuel storage area, describe and discuss the limitations imposed by the removable wall panels and roof hatch cover on the movement of heavy loads by the overhead cask crane.

RESPONSE TO ITEM 3

In regard to the movement of loads into and out of the spent fuel storage area, the limitation imposed by the removable wall panel and roof hatch cover on the movement of heavy loads by the overhead cask crane is basically the size of the openings into the building. The opening left by the removal of the roof hatch cover is 13' 5 3/4" wide and 24' 2" long, the opening created by the removal of the panel is also 13' 5 3/4" wide, but it is 26' 9" tall.

QUESTION

4. From the figures supplied in the December 1, 1980 submittal, it appears the spent fuel pool bottom in the cask loading area is approximatley 2'-5" thick. Describe and discuss the adequacy of the pool bottom to protect the gas decay tanks which are just below the fuel pool assuming that the various heavy loads (handled in the spent fuel pit modifications) are dropped over this area from their maximum drop height.

RESPONSE TO ITEM 4

As stated in the answer to Question 1f, the single-failure-proof lifting rig and fuel cask handling crane will be used to place the 8 x 10 array of racks on a temporary platform installed in the cask loading area. Therefore, a rack drop is not a credible event with this crane. In order to preclude damage from a drop from the pool floor elevation into the cask loading area, the temporary platform will be designed to protect the fuel pool bottom in the cask loading area and the gas decay tanks below this area from the effects of a load drop from the temporary bridge crane or other temporary lifting equipment.

QUESTION

5. With the aid of drawings indicate the total number of fuel assemblies stored in the spent fuel storage pit as well as their location and decay times, in relation to the travel paths of the heavy load handling operations associated with the described modifications.

RESPONSE TO ITEM 5

Figures A through G show the locations of the fuel assemblies stored in the spent fuel pool at present and after each fuel shuffle during rack installation. Fuel will be shuffled so as to keep the maximum possible distance between divers and spent fuel (approxiately 9 to 10 feet). Therefore, spent fuel will not be in or near the work area or paths where racks are being removed or installed. No loads will pass over spent fuel locations. The discharge dates for the fuel assemblies identified in Figures A through G are as follows:

Assembly Index	Discharge Date
1	3-16-73
2	5-04-74
3	10-31-75
4	10-30-76
5	1-27-78
6	4-11-79
7	8-08-80
8	10-09-81 (projected)

QUESTION

6. Section 7.4 of the December 1, 1980 submittal states that for accident conditions it can be assumed that the soluble boron is in the storage pool water during the initial conditions. However, it has not been demonstrated that the loss of pool water, containing soluble boron, could not occur in the event of a load drop accident. Describe, discuss and demonstrate that for all loads being handled over the pool that a load drop accident will not result in the loss of pool water and/or that borated makeup water is available and can be supplied at a makeup rate equal to or in excess of the loss rate until the loss of pool water is

terminated. In this regard describe how the loss of pool water will be terminated and the time required to stop the loss of pool water.

RESPONSE TO ITEM 6

Since the height of lift above the fuel pool floor of heavy loads transported by the non-single-failure proof bridge crane or other temporary lifting equipment will be strictly limited to a distance from which a drop will not cause any damage, it is not postulated that a loss of pool water will occur following a load drop accident.

QUESTION

7. Describe the overhead cranes protective devices which limit the bridge, trolley and hoist motions when passing heavy loads into or out of the spent fuel pool enclosure and thereby preventing the load or load carrying members from contacting the enclosure.

RESPONSE TO ITEM 7

When passing heavy loads into or out of the spent fuel pool enclosure the load or load carrying members are routinely kept from contacting the enclosure by placing the crane in "Restricted Path" mode. When in this mode, the following restrictions are placed on the operation of the overhead crane:

a. An operator is required to be in the cab of the crane at all times.

b. A limit switch keeps the center line of the load from moving beyond the centerline of the cask sitdown area.

c. Limit switches restrict bridge and trolley movement.

d. A special limit switch system on the reaving equalizer assembly warns the operator if unequal rope stretch or an unbalanced condition occurs in the assembly.

e. A limit switch will open the hoist motor circuit if the cable becomes slack from overhoisting.

f. An overload limit device incorporated into the design of the main hoist interrupts power to the main hoist motor if the load exceeds rated capacity.

The movement of some pieces of equipment into the building may sometimes call for operation of the crane outside of the "Restricted Path" mode. These periods will be kept to a minimum but, if necessary, plant procedures are already in place which provide for compensatory actions while outside the "Restricted Path" mode. These procedures require two qualified crane operators to be in the cab at all times when not in the "Restricted Path" mode to ensure additional surveillance to prevent loads from contacting the enclosure.

Details of the crane design and restrictions have been provided to the NRC staff in the following documents:

DATE	TITLE	SERIAL NO.
October 17, 1974	SPENT FUEL CASK HANDLING	NG-74-1246
December 26, 1974	REQUIREMENT FOR SPENT FUEL SHIPMENT	NG-74-1445
April 15, 1975	SPENT FUEL SHIPPING CRANE	NG-75-534
May 6, 1975	REQUEST FOR WAIVER OF REQUIREMENTS FOR SPENT FUEL	NG-75-663
May 19, 1975	REQUEST FOR WAIVER-SPENT FUEL SHIPMENT	NG-75-728
July 18, 1975	SPENT FUEL SHIPPING CRANE	NG-75-1080
August 9, 1978	CONTROL OF HEAVY LOADS NEAR SPENT FUEL	GD-78-2207

QUESTION

8. Describe the features of the overhead cask handling crane which precludes the possibility of "two blocking" while the lower load block passes over the fuel pool enclosure or demonstrate that the structure will withstand the impact of a dropped lower load block without failing or creating secondary missiles.

RESPONSE TO ITEM 8

The features of the overhead cask handling crane which precludes the possibility of "two blocking" have been addressed in CP&L's letter of April 15, 1975, to Mr. Karl R. Goller, of your office. Attachment 1 of this letter (Serial: NG-75-534) under section 3, Equipment Selection, paragraph j, explains in detail how "two blocking" is prevented by the use of independent limit switches.

QUESTION

9. With the aid of drawings, describe the travel path which will be followed in installing and removing the temporary crane and the storage racks. Identify all equipment essential in the safe shutdown of the reactor or employed to mitigate the consequences of a load drop which is beneath, adjacent to, or otherwise within the area of influence of the dropped load along the entire travel paths.

RESPONSE TO ITEM 9

The spent fuel cask crane that will be used in installing and removing the temporary crane, or other temporary lifting equipment, and in bringing racks into and out of the spent fuel pool is a single-failure-proof crane as described in the April 15, 1975 letter from E. E. Utley (CP&L) to Karl R. Goller (NRC), Serial NG-75-534. The temporary bridge crane or other temporary lifting equipment that will be used for manuevering the new and old fuel racks within the spent fuel pool will be restricted to a lift which will preclude the lifted load from being raised above safety related equipment. Therefore a drop of a heavy load that would damage any safety related equipment is precluded.

QUESTION

10. In regard to the adequacy of the storage racks to protect the stored fuel from dropped loads, describe, discuss and demonstrate that the

consequences are acceptable should any of the normally used handling tools and their associated loads be dropped on the storage racks from their maximum drop height.

RESPONSE TO ITEM 10

A fuel assembly drop accident analysis was performed to ensure that, in the unlikely event of dropping a fuel assembly, accidental deformation to the rack does not cause the criticality acceptance criteria to be violated, and the spent fuel pool liner will not be perforated. The accident conditions and final results are discussed in Table 4-2 (attached).

Case 1 on Table 4-2 is for a drop of a fuel assembly (with RCCA's) and the associated handling tools.

QUESTION

11. In accordance with section IV (4) of the enclosure to NRC letter dated April 14, 1978, describe and discuss the maximum uplift forces available from the load lifting devices spanning the spent fuel pools and the adverse consequences if they should be applied to the free standing unanchored fuel storage racks. Further, verify that the specific loads and load combinations are acceptable and conform with 3.8.4-II-3 of the Standard Review Plan.

RESPONSE TO ITEM 11

A fuel handling crane uplift analysis was performed which demonstrated that the rack can withstand the maximum uplift load of 3000 pounds of the fuel handling crane without violating the criticality acceptance criteria. Two accident loading conditions were postulated. The first condition assumed that the uplift load was applied to a fuel cell. The second condition assumed that the load was applied to the top grid. The crane uplift analysis conditions and results are discussed in Table 4-1 (attached).

QUESTION

12. The December 1, 1980 submittal indicates that the fire protection system water could be used in conjunction with the spent fuel pit heat exchanger, to remove heat should the component cooling water be unavailable. With the aid of P&I diagrams, indicate, describe and discuss the operations required to activate this system and the length of time required to carry out these operations. Provide pertinent system information such as the flow rate, the inlet and outlet water temperatures and where is the hot fire water discharged.

RESPONSE TO ITEM 12

As stated in Paragraph 8.4.1 of the Spent Fuel Pool Storage Expansion Report, the loss of component cooling water is considered to be an unlikely event. The component cooling water system (CCWS), as described in Section 9.3.2 of the FSAR consists of the three (3) 6000 GPM centrifugal pumps with two (2) shell and tube heat exchangers, each with a design duty of 29.4×10^6 Btu/hr. The normal full power operation and safe shutdown heat loads can be adequately handled by one pump and one heat exchanger, leaving two (2) full capacity pumps and one full capacity heat exchanger to back-up the operating units in the event of a failure of either component. A failure analysis of the Component Cooling Water System is presented in the FSAR - Table 9.3-5 and clearly demonstrates that adequate redundancy exists in the CCWS whereby the CCWS would be available at any time.

The ability to replace CCWS flow to the SFPCS heat exchanger with water from the Fire Protection System is a feature that exceeds redundancy requirements and is not a safety related service.

QUESTION

13. Figures 3.3-1 and 3.3-2 of your previous submittal on increased storage capacity (September 5, 1975) shows an emergency cooling pump in parallel with the normal spent fuel pit cooling pump. From this is it correct to infer that the additional pump mentioned in Section 8 of the December 1,

1980 submittal will be the third pump operating in parallel in the spent fuel pool cooling system loop?

Clarify and provide the pertinent pump characteristics for all pumps, the materials of fabrication as well as the codes and standards to which they conform.

Describe and discuss the feasibility and increased heat removal capability if two pumps are operated in parallel during the peak heat loads encountered during a full core off load.

RESPONSE TO ITEM 13

The spent fuel pool recirculation pump is an Ingersoll-Rand Model 6x13LP. The spare pump, presently scheduled to be operable in late Spring, 1981 is identical. Design characteristics are as follows:

Type-Horizontal Centrifugal
Minimum Developed Head (Ft. H_2O) - 125
Motor Horsepower - 100
Design Pressure, psig - 150
Design Temperature, °F - 200
Material - Stainless Steel
Flowrate, GPM - 2300

The following are manufacturing design codes and standards:

A) Standards of the Hydraulic Institute.
B) ASA B16.5
C) NEMA Standard Publication MG1-1963.
D) Standards of the American Society for Testing and Materials.
E) ASME Code Sections III, VIII, and IX.
F) Westinghouse Specifications PS-292722 and EDSK 498B932.

The third pump, A Model GE 20K manufactured by the Chempump Division of the Crane Company, was a standard material purchase and was not manufactured to any quality assurance requirement. This pump is not permanently piped to the pool cooling loop and upon loss of the main recirculation pump is flanged into the system. Its present function as a backup will not be necessary when the spare Ingersoll-Rand pump is put into service. The capability, however, for its use will still exist.

During the evalution of the thermal hydraulics of the Spent Fuel Pool Cooling System (SFPCS), several performance calculations were made increasing either shell side or tube side mass flow or both. These calculations demonstrated that, as expected,the overall heat transfer coefficient does increase as does the frictional pressure drop with an increasing Reynolds number. As discussed in Section 8.3 of the Spent Fuel Pool Storage Expansion Report, the decay heat load associated with the full core off-load can be adequately handled with the present SFPCS arrangement by scheduling fuel assembly transfer to the spent fuel pool on a regulated basis, therefore it is not necessary to operate two pumps in parallel.

QUESTION

14. Section 8.4.1 of the December 1, 1980 submittal states that there are two alternative means of cooling the spent fuel pool. The only alternate cooling system discussed utilizies the fire protection system water. With the aid of a P&I diagram describe and discuss the second alternate cooling system. The discussion is to include the capacity of this cooling system as well as the length of time required to carry out the steps necessary to get the system fully operational.

RESPONSE TO ITEM 14

Paragraph 8.4.1 was intended to describe the redundancy designed into the active components of the Spent Fuel Pool Cooling System (SFPCS). The system has two (2) full capacity pumps, each of which provides 100 percent of the

circulation required to remove heat at the design heat loads of the pool. Additional redundancy is neither required nor provided.

The Fire Protection System is considered a non-essential back-up source to component cooling water to the SFPCS heat exchanger in the unlikely event of loss of component cooling. As stated in the response to question 12, adequate redundancy exists in the Component Cooling Water System to preclude complete loss of component cooling water to the SFPCS heat exchanger.

QUESTION

15. Position 6 of Regultory Guide 1.13 states "Drains, permanently connected systems and other features that by maloperation or failure could cause loss of coolant that would uncover fuel should not be installed or included in the design." Section 9.3-3 of the FSAR indicates that a permanently installed drainage line exists which permits essentially all water to be removed.

    Provide the following additional information:

    a. Describe how the existing design meets Regulatory Guide 1.13. The additional information is to include the possibility of valve 797 inadvertently being open and a line break permitting all water to be removed by siphoning or operation of the spent fuel cooling loop pump.

    b. Describe the pool water level, temperature, and radiation monitoring and alarm systems.

    c. Describe and discuss the merits of modifying the existing system, in order to bring it more clearly in compliance with Regulatory Guide 1.13, by replacing the permanently installed drain line with a removable section which would only be installed when the pool water level is to be lowered below its normal operating limits.

RESPONSE TO ITEM 15

a. The intent of Regulatory Guide 1.13 is met in the design in that the pool cannot be gravity drained below a level of 6 feet above the fuel assemblies due to the configuration of the drain piping (see enclosed figures). The drain inlet is approximately 3 inches above the bottom of the spent fuel pool. A locked closed valve, operable by means of a reach rod, is located at the drain pipe inlet. On the opposite side of the pool wall a normally closed valve is located upstream on the recirculation pump suction connection. No single failure will result in system integrity degradation to the extent that fuel assemblies will be uncovered. Should valve 797 be inadvertently left open and a break occur downstream, the pool would not drain due to the locked closed valve (Valve 793) at the pool drain inlet. A break upstream of Valve 797 (downstream of Valve 793) is unlikely because less than 12 inches of exposed piping is located in the spent fuel pool approximately 37 feet below the waterline and in an area of the pool where no routine activity occurs during the fuel movement. Additionally, the position of Valves 793(locked closed valve at pool bottom) and 797 (normally closed valve in recirculation pump cubicle) are verified in Plant Operating Procedure 41B, "Initial Valve Lineup for Placing Cooling Loop in Operation." Utilizing these valves is not a normal operation and would be accomplished by means of a PNSC approved procedure. Therefore valve 797 being inadvertently left open and a line break occurring resulting in drainage of the pool below the fuel assembly storage level via siphoning or the recirculation pump is not considered a credible event.

b. The spent fuel pool is instrumented with level, temperature, and area radiation monitoring with alarms in the Control Room as follows:

Indication	Instrument No.	Setpoint
Level	LA 651	Hi-2" above normal Lo-7" below normal
Temperature	TIA 651	125°F
Area Radiation	R-5	2.5 MR/HR
Ventilation Exhaust Gas	R-21	4240 CPM (plus background)

c. The installation of a removable section of piping in the drain line would not achieve any measurable safety margin. As previously stated, the drain line is not used in normal operation and as discussed in (a) above, it meets the single failure criteria. The present design of the piping geometry and isolation valves coupled with procedural and administrative controls clearly meet the design intent of Regulatory Guide 1.13.

(R#12A)

Attachment 2

RADIOLOGICAL ASSESSMENT BRANCH QUESTIONS

QUESTION

471.1 Describe your provisions for administratively tracking and evaluating radiation exposure during performance of this task. Include a general discussion of how individual exposure is tracked; and how exposure goals are set and tracked for the same work group involved in varying tasks (such as quality control), and for any particular task involving several work groups (such as removal of braces and struts), to assure that individual, group and task exposure are ALARA.

RESPONSE TO ITEM 471.1

Administrative tracking and evaluation of radiation exposure during the performance of this task will be accomplished under the auspices of the H. B. Robinson Health Physics Procedures HP-7, "Special Radiation Work Permits", HP-9, "Personnel Dosimetry Program", HP-13, "Pocket Dosimeter Quality Control", HP-15, "ALARA Procedure", and HP-32, "Personnel Whole-Body counting." Special consideration will be given to multibadging for extremity dose tracking per individual and group-task.

The potential source of radiation exposure, in this case, will be external exposure from existing spent fuel elements. Divers will be wearing "dry-suits" which will eliminate the possibility of any radioisotope in the solution from coming in contact with the skin (except in the case of a rip or tear in the suit). In order to evaluate the radiological consequences of external exposure from the spent fuel elements, dose rate measurements will be performed in the Spent Fuel Pool to determine the dose rate profile. Based on these measurements, a "radiation zone" will be defined (within proximity of an array of spent fuel elements) such that occupancy within the zone will not be allowed.

Exposure goals will be set and tracked according to both the individual's prior exposure history and a realistic dose scenario for each work group task based on prior dose rate measurements. Each individual will be evaluated according to his task and work group tasks (both dose and person-dose considerations) to maintain ALARA. The concept of a "radiation zone" will also help in the same respect to maintain ALARA. Specific procedures for maintaining ALARA and tracking individual and work group task exposures are currently under consideration.

QUESTION

471.2 Identify by position which individuals are responsible for monitoring group and task exposures during the course of work (e.g., work group foreman or supervisors), and describe how this information is coordinated and utilized to achieve ALARA exposure.

RESPONSE TO ITEM 471.2

Monitoring of individual and group-task exposure will be performed under the direct supervision of the Radiation Control & Testing (RC&T) Foremen. the Foremen will assign RC&T technicians to cover specific jobs as necessary. Project radiological engineering, supervision, and evaluation will be performed by the Environmental and Radiation Control (E&RC) subunit. As part of the E&RC subunit, the ALARA specialist will provide direct consultation concerning ALARA considerations. Administrative control of radiation exposure (documentation, filing, etc.) will be coordinated by RC&T personnel. More specific procedures for documentation and coordination of extremity and group-task exposures are currently under consideration.

QUESTION

471.3 Describe the use of mockups, specialized training, and special tools in preparation for this task as aspects of your efforts to achieve ALARA exposure (e.g., mock-ups of pool support installation, new rack installation, rack decontamination, etc.).

RESONE TO ITEM 471.3

Carolina Power & Light Company is not currently in a position to respond to these questions as they pertain to construction details which are still in the planning stage. We anticipate providing you with this information in May, 1981.

QUESTION

471.4 Describe how the radiation protection aspects of the tasks will be controlled. Include a discussion of all features to be employed, such as general employee/contract employee radiation protection training, RWPs, direct radiation protection technician surveillance, radiological engineering review of work procedures and documents, work practice on mockups, pre-work radiological reviews and briefings, experience at other facilities, etc.

RESPONSE TO ITEM 471.4

In addition to controls and procedures already discussed, the E&RC subunit will perform the following tasks with respect to this project:

1) Provide general employee/contract employee radiation protection training prior to admittance.

2) Inform all RC&T Foremen of radiological engineering review and work procedures (including special RWPs) as well as documentation, etc.

3) Contact other nuclear facilities in regard to this project.

Thus, all preparatory radiological engineering functions will be controlled by the E&RC subunit.

QUESTION

471.5 Describe how divers will be protected from unnecessary exposure from spent fuel elements and how their exposures will be maintained ALARA. Include a general description of the personnel monitoring of divers, as well as description of their work functions.

RESPONSE TO ITEM 471.5

Divers will be protected from unnecessary exposure from spent fuel elements via the concept of the "radiation zone" as described in question 471.1. Preliminary dose rate measurements in the spent fuel pool will be performed in order to define this zone. The dose rate within the vicinity of the spent fuel will be measured as a function of height and distance with sealed and submerged TLDs. Divers will be performing the reracking task at some period of time (T) after the latest fuel cycle. Current dose rate measurements will be performed on existing spent fuel elements from the last fuel cycle. Therefore, in order to provide a good estimate of future dose rates, the measured doses will have to be corrected for decay back to the same decay time (T) as will be experienced by the divers. This will apply to an arrangement of the same geometry and initial activity. As mentioned before, divers will be multibadged to include head and extremities, as well as the whole-body. Pocket-chamber dosimeters will provide a quick reference for cumulative dose assessment.

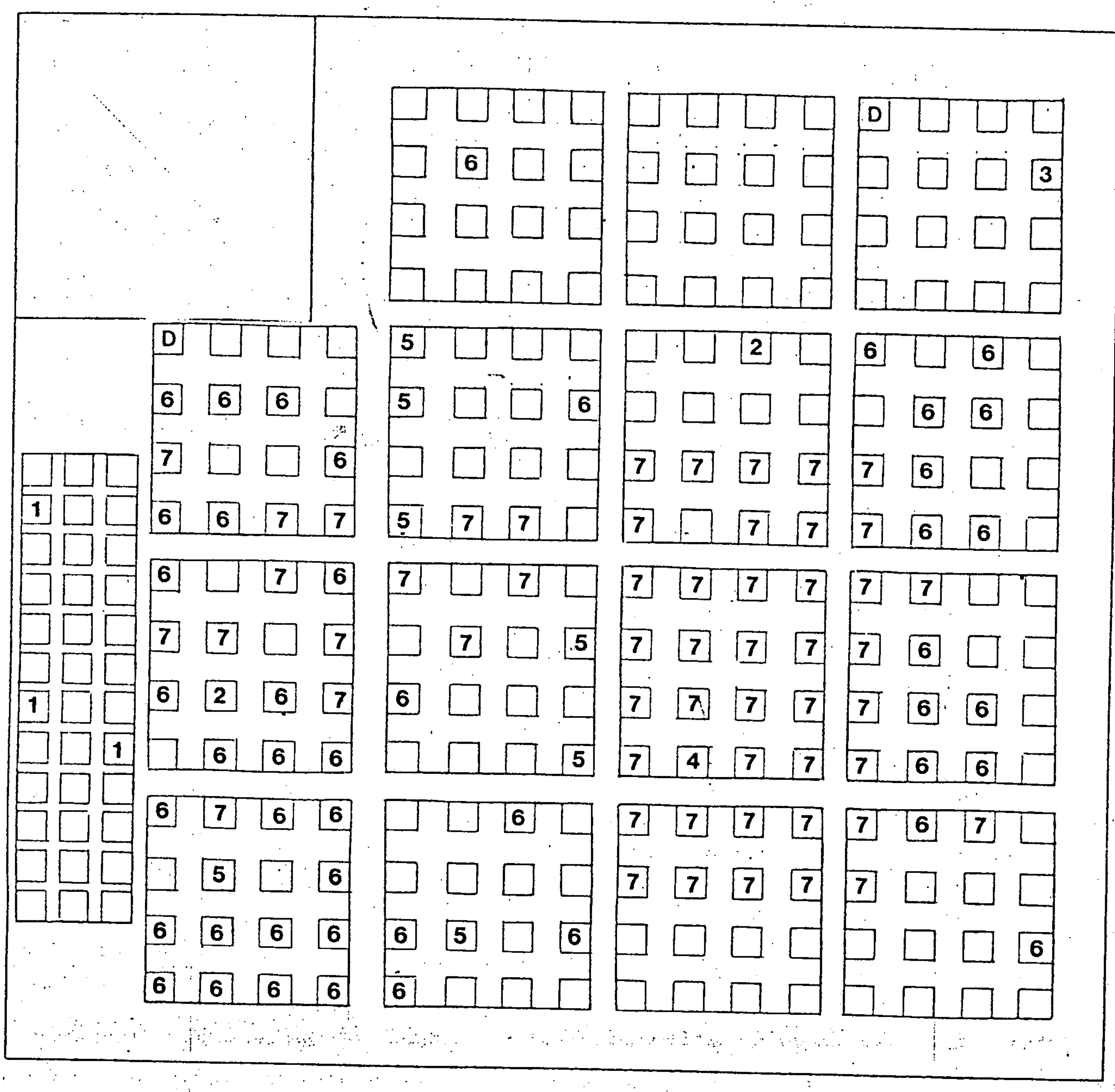
QUESTION

471.6 Provide person-hour, dose rate and person-rem estimates for the proposed methods of rack disposal listed in Section 10.7 of the application.

RESPONSE TO ITEM 471.6

The proposed methods of rack disposal listed in Section 10.7 of the application are estimated to involve no greater than approximately 500 person-hours and 2 person-rem exposure. Dose rate measurements are currently being performed on empty spent fuel racks in the spent fuel pool. These measurements will provide more precise data for the establishment of good ALARA practice during all phases of rack disposal. Measurements will be performed in the same manner as described in the response to Question 471.5.

(R#13A)



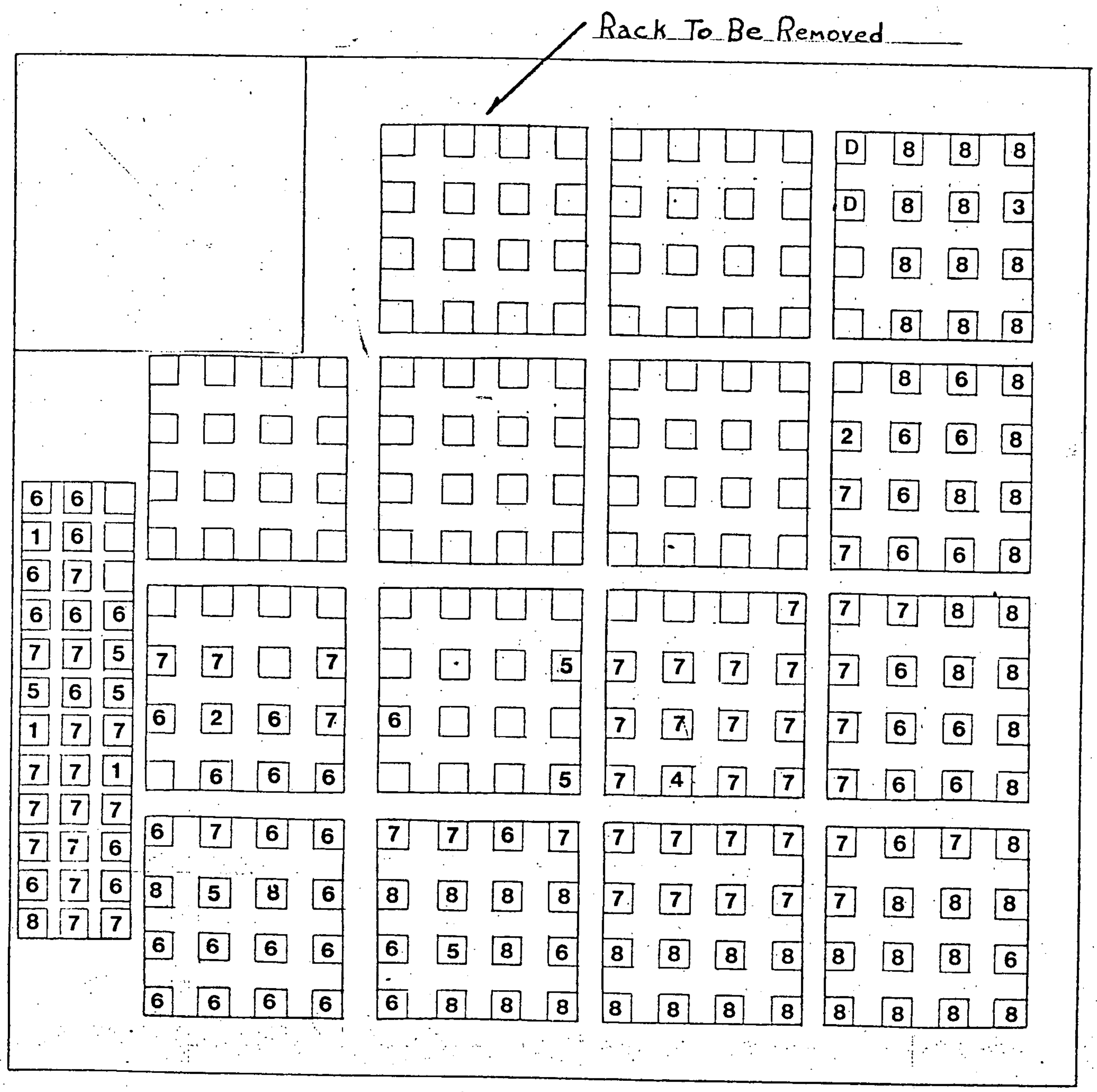
H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

Carolina Power & Light Company

SPENT FUEL POOL STORAGE EXPANSION

Existing Spent Fuel Arrangement

FIGURE A



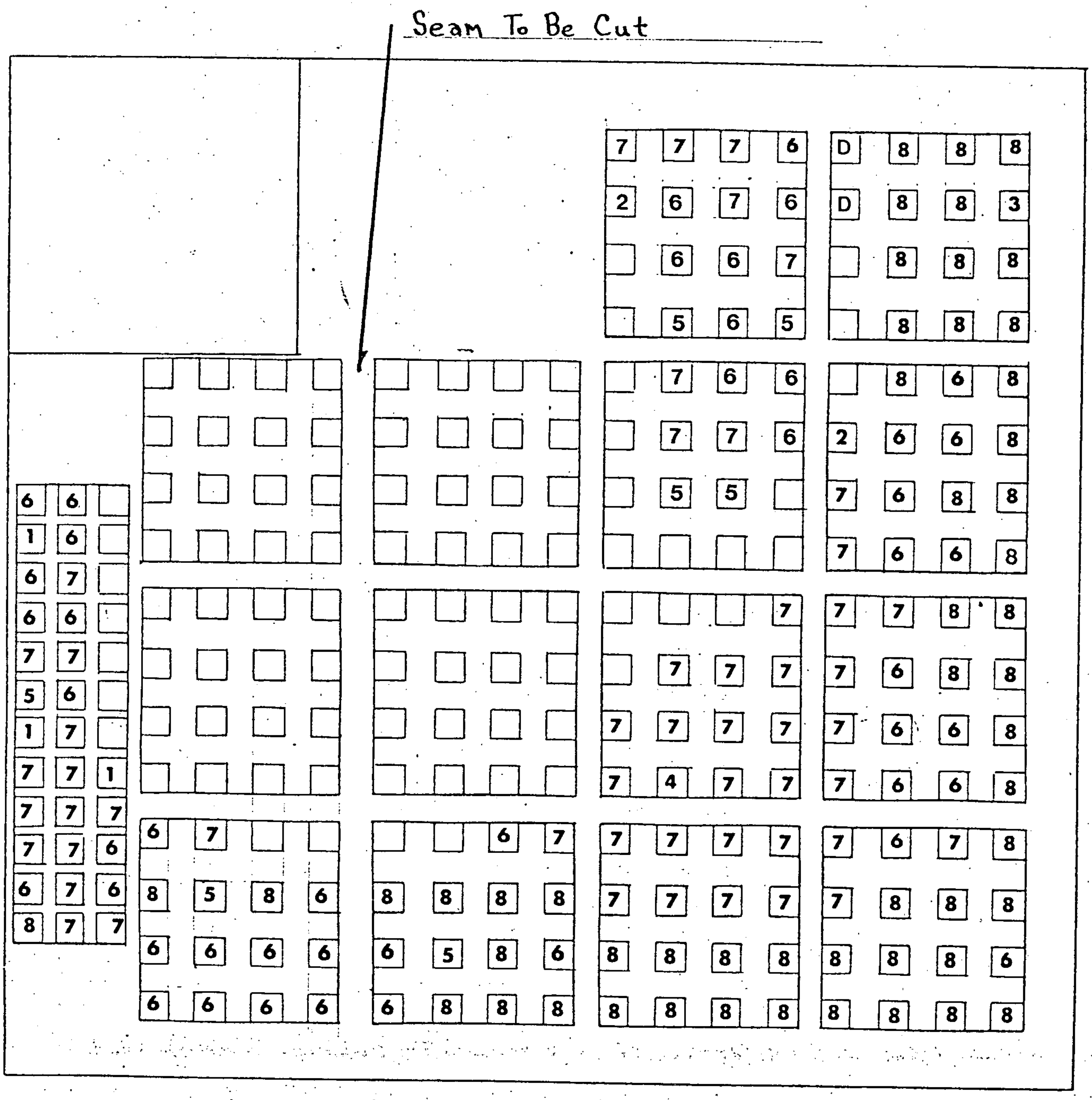
H. B. ROBINSON STEAM
ELECTRIC PLANT, UNIT NO. 2

Carolina
Power & Light Company

SPENT FUEL POOL
STORAGE EXPANSION

Shuffle No. One Arrangement
(To Remove NW Rack)

FIGURE
B



H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

Carolina Power & Light Company

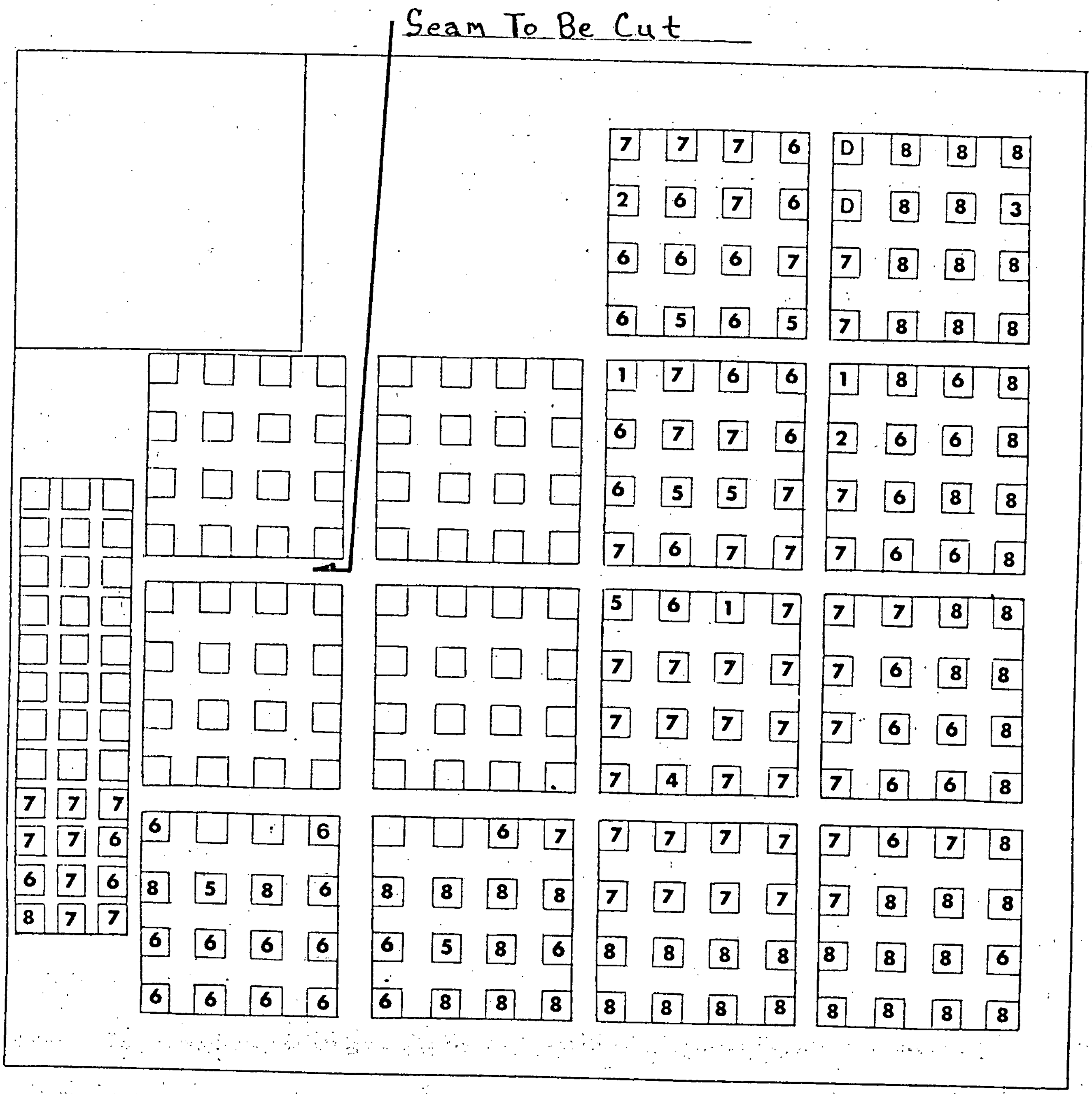
SPENT FUEL POOL STORAGE EXPANSION

Shuffle No. 2 Arrangement

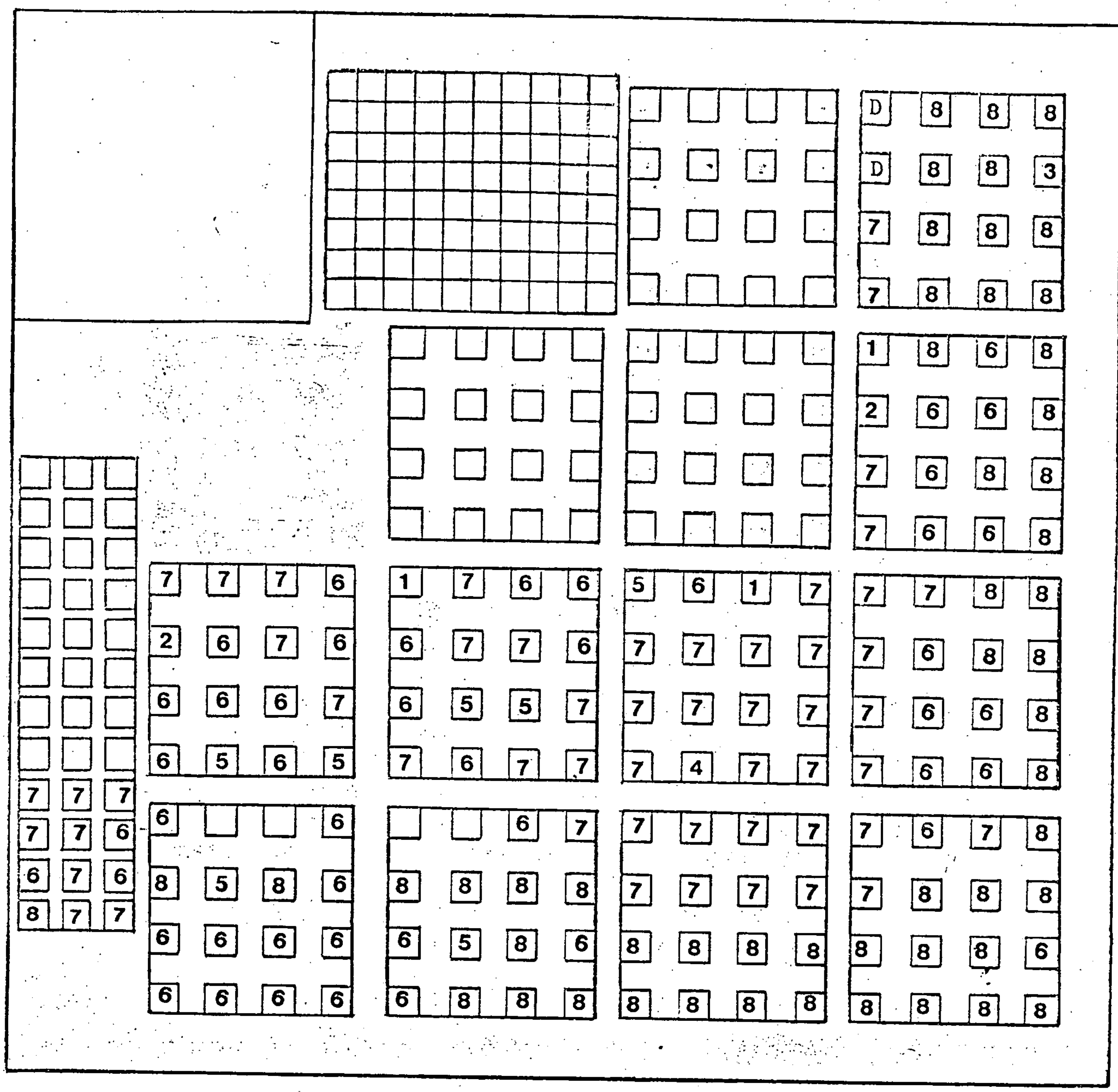
(To Cut Seam)

FIGURE

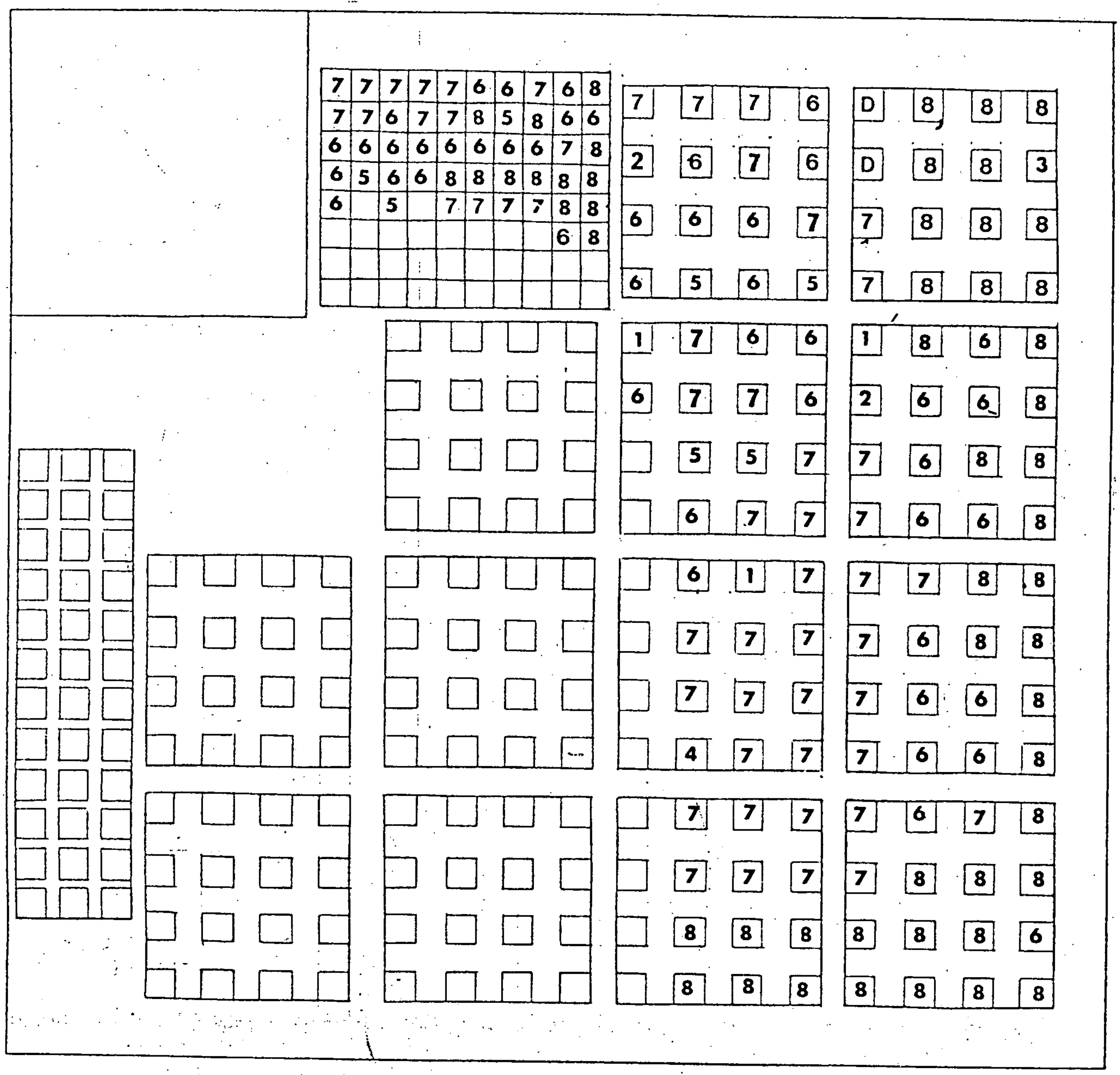
C



H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 Carolina Power & Light Company SPENT FUEL POOL STORAGE EXPANSION	Shuffle No. 3 Arrangement (To Cut Seam)	FIGURE D



H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 Carolina Power & Light Company SPENT FUEL POOL STORAGE EXPANSION	Shuffle No. 4 (New Rack Placed)	FIGURE E



H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2

Carolina Power & Light Company

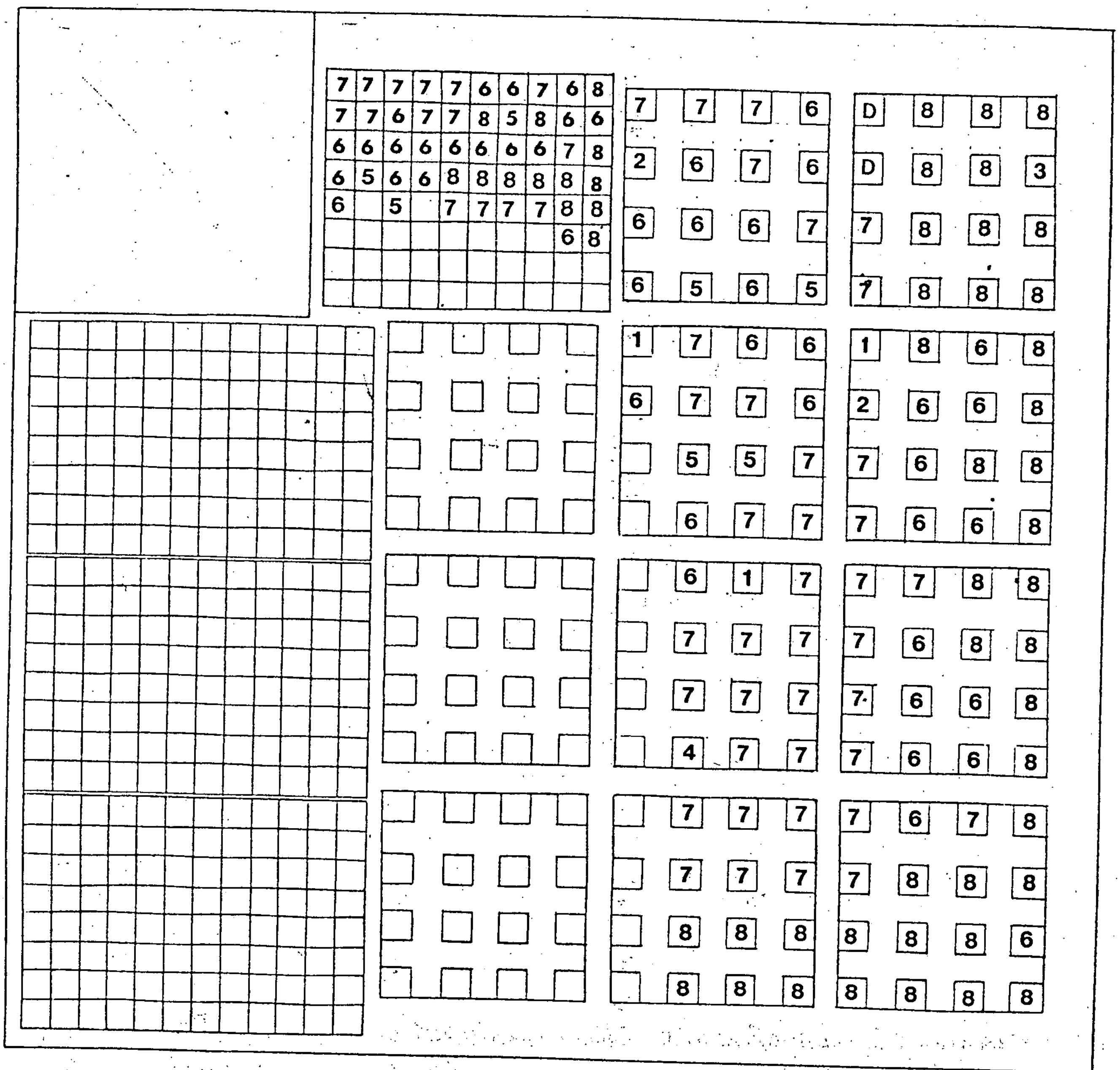
SPENT FUEL POOL STORAGE EXPANSION

Shuffle No. 5 Arrangement

(To Finish Removing Racks)

FIGURE

F



H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 Carolina Power & Light Company SPENT FUEL POOL STORAGE EXPANSION	Shuffle No. 5 Arrangement (New Racks Placed)	FIGURE G

TABLE 4-1

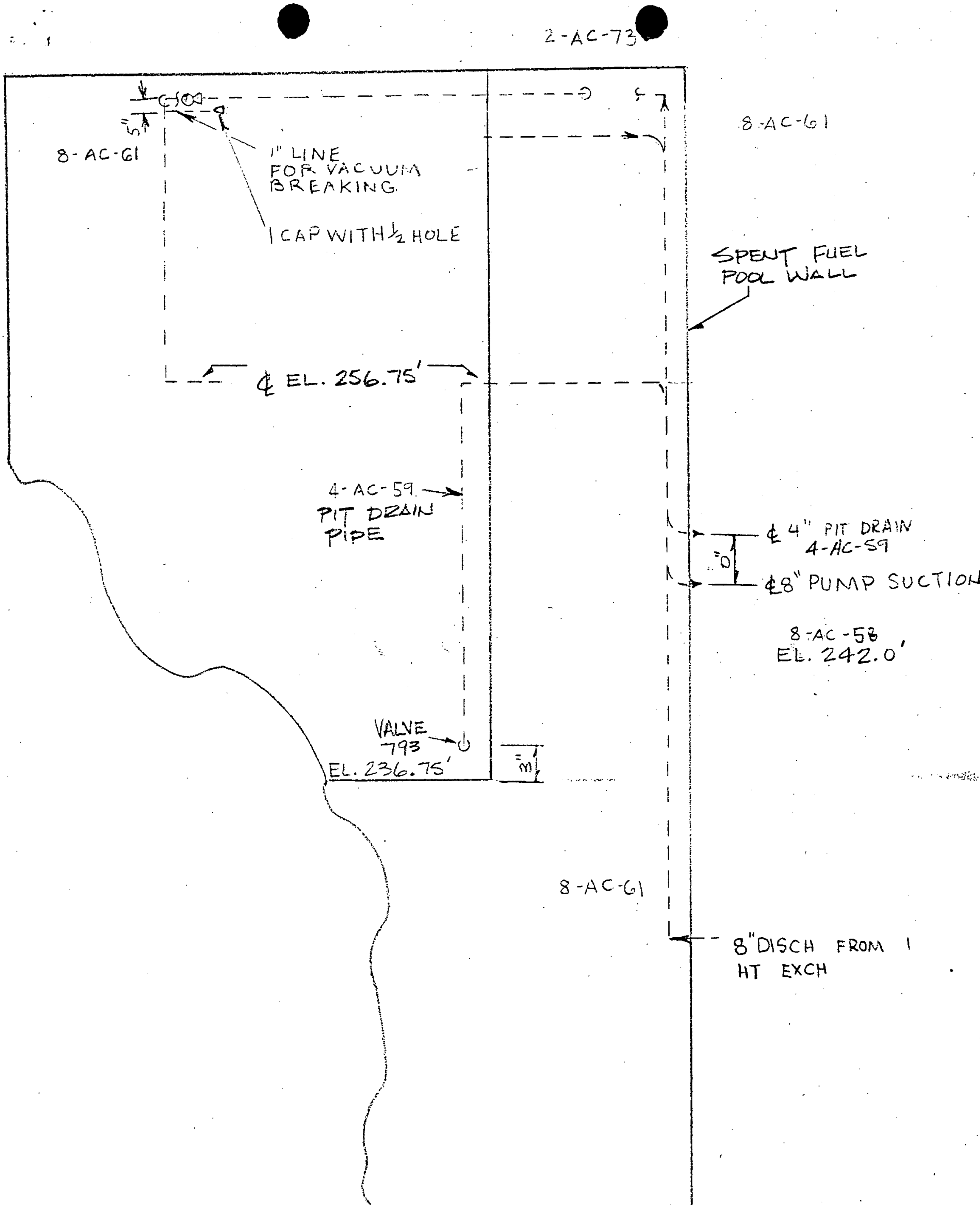
CRANE UPLIFT ANALYSIS CASE SUMMARY

Number	Case Description	Effect on Reactivity
1.	An uplift load of 3,000 pounds is applied to a fuel cell.	The uplift load will not cause separation of a cell from the rack module, therefore system reactivity is unchanged. K_{eff} <0.95.
2.	An uplift load of 3,000 pounds is applied to the top grid structure of the rack module.	The deadweight of an empty rack module sufficiently exceeds the applied uplift load such that tipping of the module will not occur for any full or partial arrangement of fuel storage. System reactivity is therefore unchanged. K_{eff} <0.95.

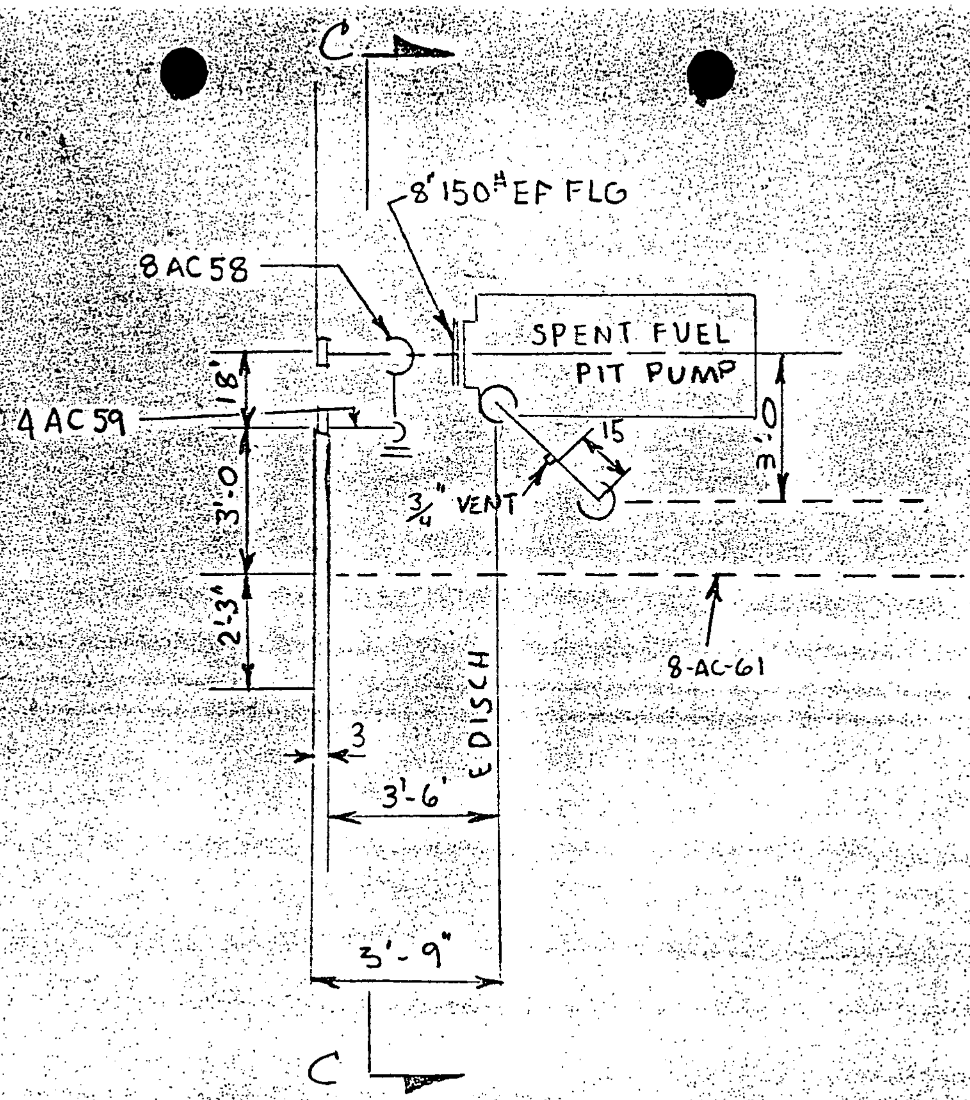
TABLE 4-2

FUEL ASSEMBLY DROP ACCIDENT ANALYSIS CASE SUMMARY

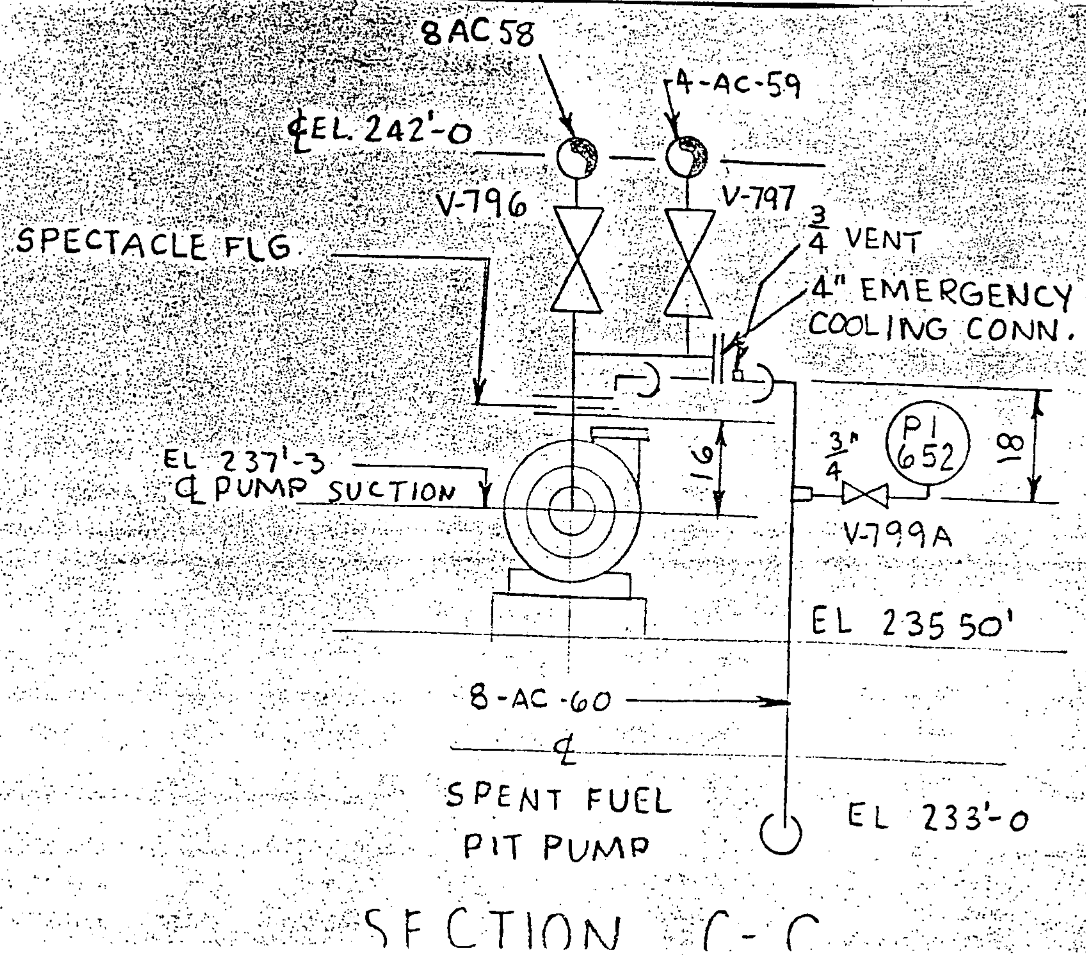
Number	Case Description	Effect on Reactivity
1.	A fuel assembly (with RCCA's) drops 30 inches vertically and impacts the top of a fully loaded rack module. The dropped assembly comes to rest horizontally on top of the rack module.	The dropped assembly has more than eighteen inches of water separating it form the active height of the stored fuel which precludes interaction. Since the analysis assumes an infinite vertical length of fuel (no neutron leakage in the vertical dimension) system reactivity remains unchanged. K_{eff} <0.95.
2.	A fuel assembly (with RCCA's) drops from 30 inches above the rack module and strikes a storage cell wall at an oblique analge.	Localized storage cell damage will occur. Conservatively assuming complete removal of one neutron absorber plate, criticality calculations show that K_{eff} for this case remains less than 0.95.
3.	A fuel assembly (with RCCA's) drops from 30 inches above the rack module, enters an empty storage location, and falls to the bottom of the storage position.	Structural analysis for this case assumes gross failure of rack module base plate welds such that pool floor liner is impacted. Compressive stress in the liner plate is within allowable limits so that liner perforation does not occur. Concurrent fuel displacement by approximately six inches below neutron absorber plates for a square array of six fuel assemblies results in a calculated K_{eff} less than 0.95.



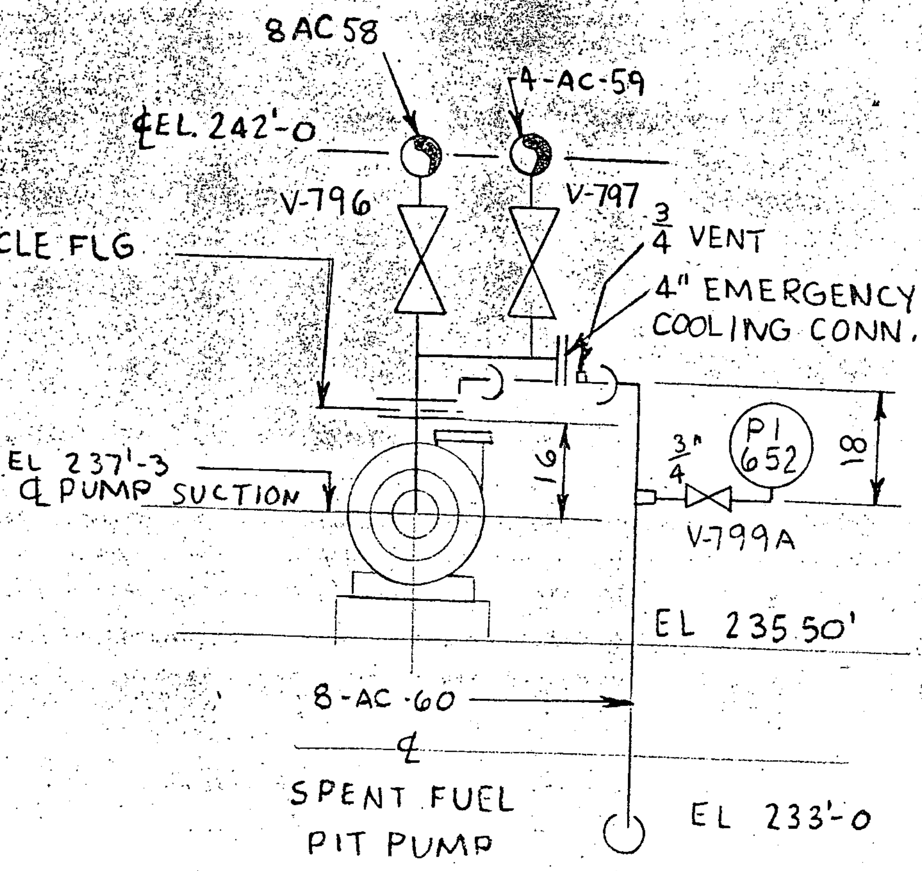
SECTIONAL VIEW OF POOL



PLAN VIEW



SECTION C-C


8 AC 58
4-AC-59
℄ EL. 242'-0
V-796
V-797
SPECTACLE FLG
3/4 VENT
4" EMERGENCY COOLING CONN.
EL 237'-3
℄ PUMP SUCTION
16
3/4"
PI 652
8
V-799A
EL 235.50'
8-AC-60
℄ SPENT FUEL PIT PUMP
EL 233'-0

SECTION C-C