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January 24, 1990

Re: Indian Point Unit No. 2
Docket No. 50-247

Document Control Desk
US Nuclear Regulatory Commission
Mail Station P1-137
Washington, DC 20555

SUBJECT: Indian Point Unit No. 2 Spent Fuel Pool Storage Capacity Increase (TAC 72962)

REFERENCE:

1. Letter to Mr. Stephen B. Bram (Con Edison) from Mr. Donald S. Brinkman (NRC), dated November 28, 1989 entitled: "Request for Additional Information Regarding Spent Fuel Pool Rerack".

2. Letter to Mr. Stephen B. Bram (Con Edison) from Donald S. Brinkman (NRC), dated December 5, 1989 entitled: "Request for Additional Information Regarding Spent Fuel Pool Rerack".

References 1 and 2 requested Consolidated Edison to provide additional information regarding storing Indian Point Unit No. 2 spent fuel. Attachment I to this letter contains the information requested in Reference 1. Attachment II to this letter contains the information requested in Reference 2.

Should you or your staff have any questions regarding this matter, please contact Mr. Charles W. Jackson, Manager, Nuclear Safety and Licensing.

Very truly yours,

Attachment

A001
1/1

cc: Mr. William Russell
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ATTACHMENT I

ADDITIONAL INFORMATION REGARDING THE INDIAN POINT 2
INCREASE IN SPENT FUEL POOL STORAGE CAPACITY
(RESPONSES TO REFERENCE 1)

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
INDIAN POINT UNIT NO. 2
DOCKET NO. 50-247
JANUARY, 1990

Question 1. Provide sufficient detail to show that your heavy load handling system is single-failure-proof in accordance with the guidelines of alternative (1) of Section 5.1.1 of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants." Note that the guidelines for design of a single-failure proof load handling system are described in detail in NUREG-0554.

Response The IP2 Technical Specifications allow movement of a rack and its associated handling tool over the spent fuel pool but prohibit movement of a rack over fuel (Technical Specification 3.8.C.1). This Technical Specification was approved by the NRC with the safety evaluation contained in the January 11, 1982 letter issuing amendment No. 75 to Facility Operating License No. DPR-26 [Mr. John Hannon, (NRC) to Mr. John D. O'Toole, (Consolidated Edison)]. Section 3.6 of the Safety Evaluation entitled "Installation of Racks and Fuel Handling" discusses rack movement over the spent fuel pool. This evaluation is applicable to and bounds the current proposed rerack for the following reasons:

1. The heaviest rack addressed in the previous evaluation is 20 tons. The heaviest new rack, including its associated handling tool, is 19.4 tons.

2. The reracking of the Indian Point Unit 2 Spent Fuel Pool will have designated travel paths to preclude the handling of any heavy load directly over spent fuel. The sequences of removing and installing spent fuel storage racks is shown in Figures 1-6 (see response to question 2).

3. Procedures to maximize the spacing between lifted loads and spent fuel will be utilized for the proposed reracking.

4. There is no equipment which is essential in the safe shutdown of the reactor or employed to mitigate the consequences of an accident located beneath, adjacent to or otherwise within the area of influence of any loads that will be handled during the reracking.

5. A minimum horizontal spacing of three empty locations (2.75') was maintained between lifted racks and the stored fuel during the previous rerack modification. In the proposed rerack, this minimum spacing is 4'.

6. A load drop during reracking would not damage the pool or pool liner beyond the capability of the makeup sources available (see response to question 3).

7. The load movement restrictions, discussed above in numbered paragraphs 2, 3, and 5, on the motion of the spent fuel crane meets the intent of Section 5.1.6 of NUREG-0612, in that in the event of a failure of the load handling system the guidelines of Section 5.1 of NUREG-0612 would not be exceeded:

a) In such an event no fuel would be damaged. The lifting rigs are designed, in accordance with NUREG-0612, such that a single failure would not cause a drop of a rack (see response to question 4). In the unlikely event of a load handling failure, a drop of a rack could only occur above the lifting rig and therefore the failure would be symmetric with respect to the center of gravity of the rack. In addition, the horizontal movement of a rack will not exceed 5 feet per minute. This means the rack drop, if it were to occur, would be vertical. Since there is no fuel under the rack and a minimum distance to any adjacent fuel of four feet is maintained, no fuel would be damaged.

b) In the unlikely event that a rack is dropped on a storage rack with sufficient impact to cause structural deformation, it has been concluded that k_{eff} would decrease. The basis for this conclusion is that the principal effect of dropping a heavy object would be to squeeze water from the rack. Both in the case of compacted fuel and voided pool water, depletion of water leads to a decrease in k_{eff}.

   Due to the confinement of the poison material, it would not be possible for a dropped heavy object to eject the poison material from the rack; the crushing effect of the heavy object could only act to compress the fuel and poison together and increase the effective density of the poison material. In addition, soluble boron is present for which credit is allowed under this condition.

c) Damage to spent fuel pool would be limited to the capability of the makeup water sources (see response to item 6 above).

d) There will be no damage to safe shutdown equipment (see response to item 4 above).

8. The handling of racks will utilize special lifting devices, as defined in NUREG-0612, with a stress design factor exceeding that required by ANSI-N14.6-1978.

9. A load test of the special lifting devices will be conducted with a test load of 150% of the rated load prior to usage for rack handling in the spent fuel pool.

10. In accordance with Section IV(4) of the enclosure to the NRC letter dated April 14, 1978 "OT Position for Review and Acceptance of Spent Fuel Storage and Handling Applications", the specific loads and load combinations conform with 3.8.4-II-3 of the Standard Review Plan.

Question 2. Provide an outline of the procedure to be used for (1) moving the spent fuel assemblies (SFAs) already in the pool, (2) removal of the old spent fuel storage racks, (3) installation of the new racks and (4) replacement of SFAs in new racks. Indicate approximate minimum distances between stored spent fuel and racks during movement.

Response The removal and installation of the racks involves a carefully planned sequence of fuel assembly relocation followed by old rack removal and new rack placement. Figures 1 through 6 show the sequence of rack regions occupied by fuel, racks removed and racks installed in the pool. Old racks are indicated by numerals 1 through 12. New racks are designated by alphanumeric identifications used in the Licensing Report. The dimension "x" (with subscripts where necessary) indicates the shortest distance between the fuel and the new racks at each reracking stage. These figures provide proposed fuel shuffles which meet the objective of maintaining a minimum distance of four feet between stored fuel and a rack being installed. The final reshuffling plan may differ somewhat from Figures 1 through 6, but the objective of maintaining the minimum distance of four feet will be met.

Outlines of the procedures to be used for the reracking are presented below:

1. Moving the spent fuel assemblies (SFAs) already in pool:
   - o Prior to start and during fuel moves:
     - Monitor radiation levels
     - Maintain minimum water level in pool
     - Pool water clarity required
   - o Checkout of required fuel handling equipment is performed using dummy fuel assembly
   - o Detailed listing of the relocation movements including description of components, initial and final locations is developed.
   - o A diagram of the initial component configuration prior to movement is provided
   - o A diagram of the expected final component configuration following completion of the relocation movements as described within the procedure is provided.
   - o Independent verification is required to be performed for all spent fuel relocations implemented by this procedure. This includes the "from" and "to" spent fuel pool locations of a particular component's movement.

2. Removal of the old spent fuel storage racks:
   - o Install old rack lift rig in rack to be removed.
   - o Verify lift fixture is in place by using underwater camera.
   - o Carefully lift module approximately 6" off spent fuel pool floor liner and hold it for 10 minutes.
   - o Raise the module an additional 18" (approximately).

- o Move module to south side of pool for completion of lift.
- o Lift racks until they are 12" submerged in water.
- o Begin hydrolasing operations.
- o Health physics to monitor modules as they are being lifted out of water.
- o Locate all "hot spots" and re-hydrolase, if necessary.
- o When module is dry, move to cask decon area for bagging.
- o Bag racks, and crate for shipping.

3) Installation of the new racks:
   - o Using new module lifting fixture, lift module located in the cask decontamination area.
   - o Using appropriate calculations from pool elevation deviations, survey and adjust module support legs to their proper height.
   - o Bring module up to spent fuel pool.
   - o Lower module into pool on south side until it is about 6" above spent fuel pool floor liner and protrusions.
   - o Move rack to designated position.
   - o Verify module location with remote tools or camera.
   - o Module can be rechecked for levelness and readjusted, if required, using remote tools.

4) Replacement of SFAs in new rack:

   - o The SFAs will be placed into the new racks as required by the fuel shuffles shown in Figures 1-6 in accordance with the fuel movement procedure outlined in item 1 above.

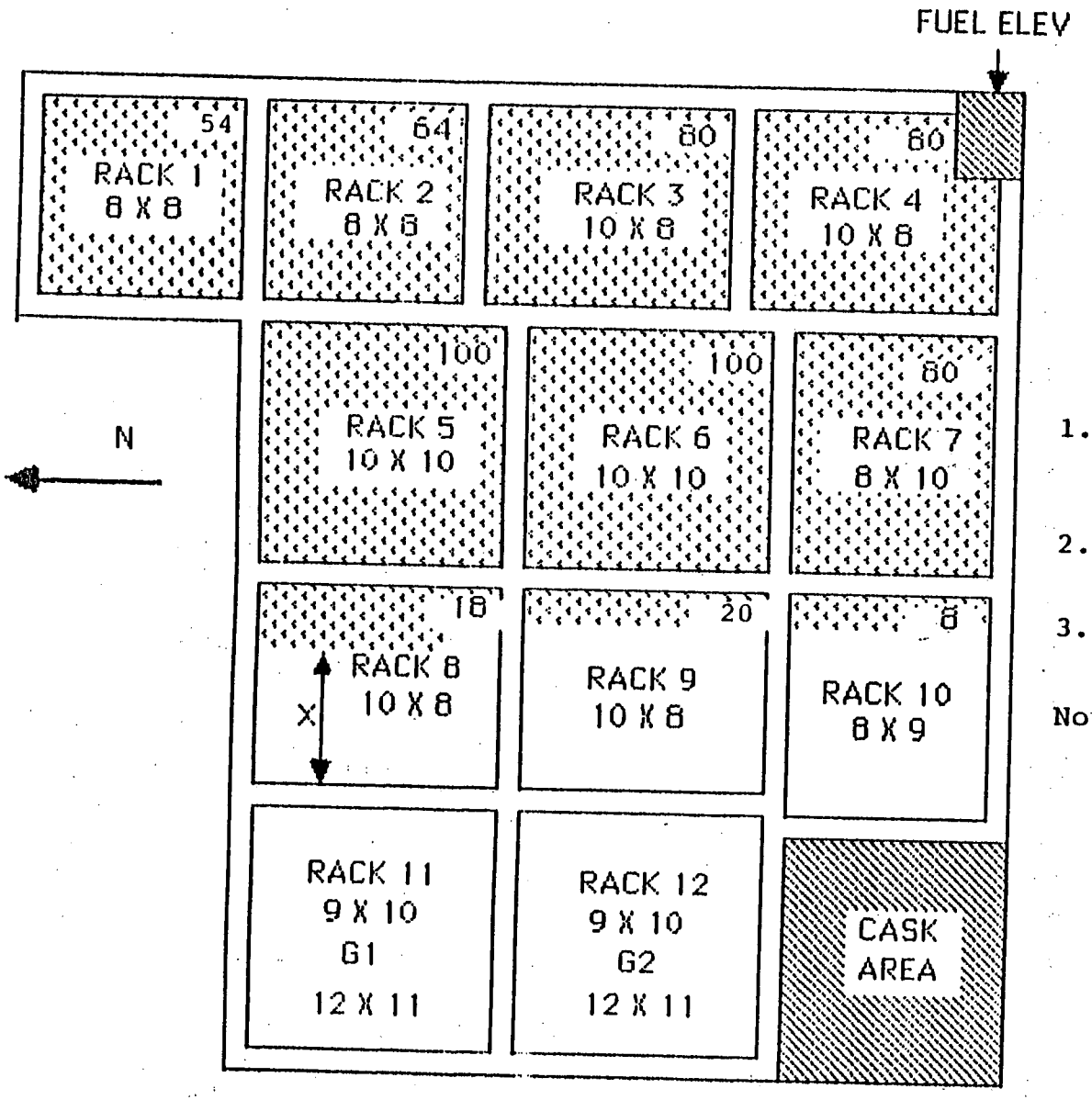

FIGURE 1

INDIAN POINT UNIT II

INSTALLATION AND REMOVAL SEQUENCE AND PROPOSED FUEL SHUFFLE STEPS:

1. Shuffle all fuel assemblies to locate them as shown in this Figure.

2. Remove Racks 11 and 12 for disposal.

3. Install Racks G1 and G2.

Note: 5' < x '

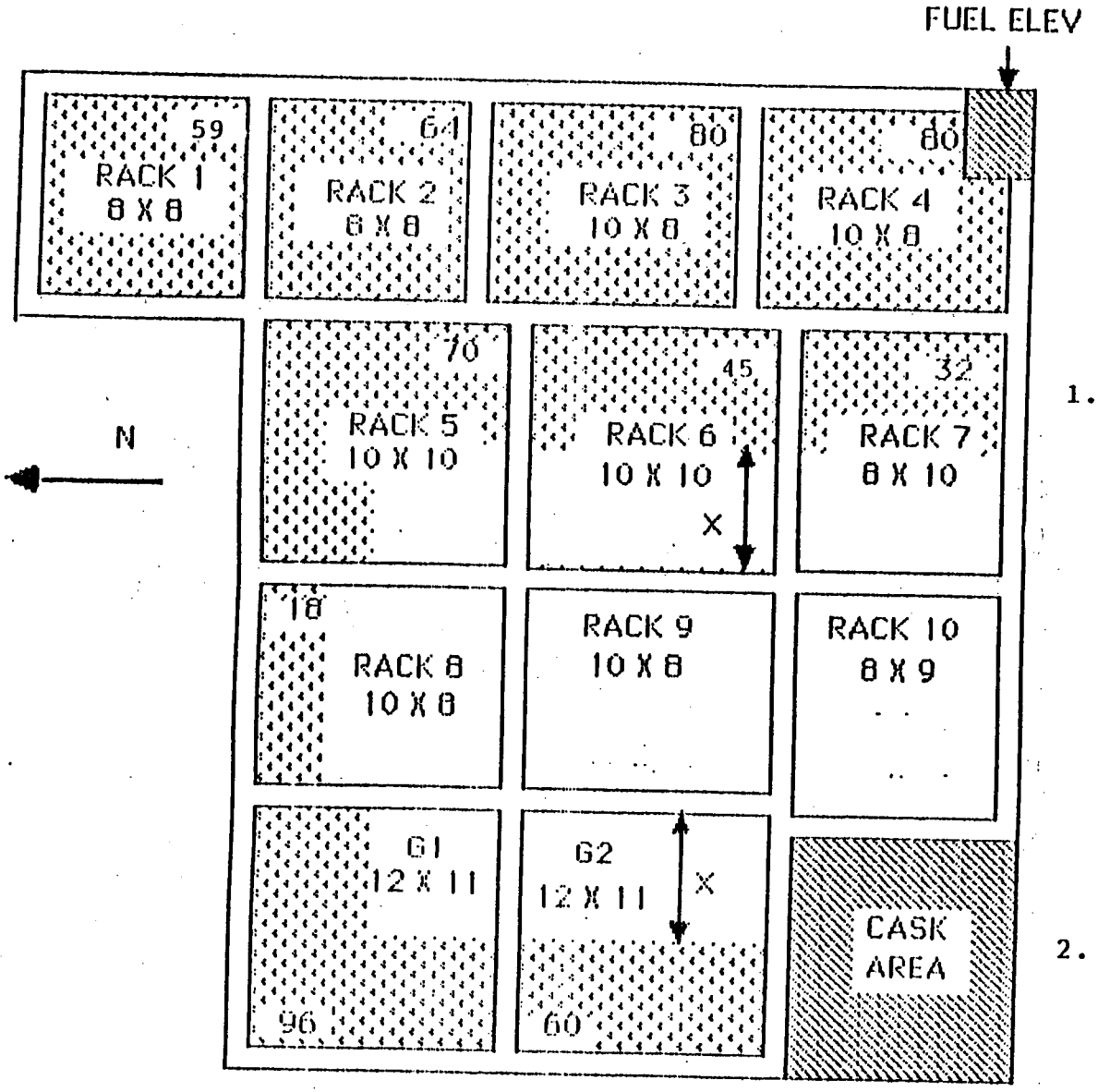

FIGURE 2

INDIAN POINT UNIT II

INSTALLATION AND REMOVAL SEQUENCE AND PROPOSED FUEL SHUFFLE STEPS:

1. Shuffle fuel to obtain the configuration shown in this Figure. The following net movements from racks are involved.

Rack ID	Assemblies Added (+) or Removed (-)
1	+5
5	-30
6	-55
7	-48
9	-20
10	- 8
G1	+96
G2	+60

2. Remove Racks 9 and 10.

Note: 4'<x

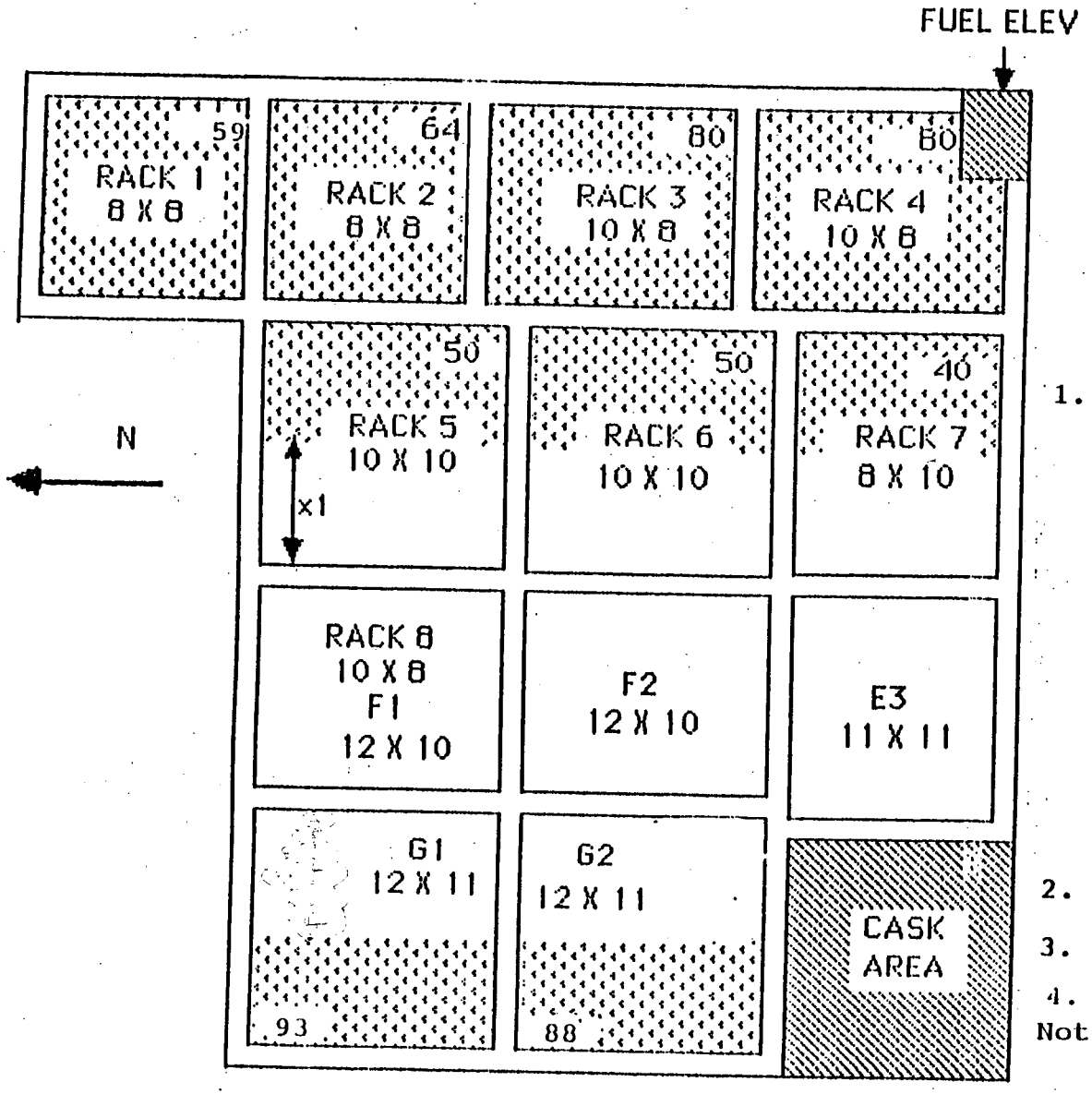

FIGURE 3

INDIAN POINT UNIT II

INSTALLATION AND REMOVAL SEQUENCE AND PROPOSED FUEL SHUFFLE STEPS:

1. Shuffle and move fuel to obtain the storage configuration shown in this Figure. The following net movements from racks are involved.

Rack ID	No. of Assemblies Added (+) or Removed (-)
5	-20
6	+5
7	+8
8	-18
G1	-3
G2	+28

2. Remove Rack 8 for disposal.

3. Install Rack F1

4. Install Racks F2 and E3.

Note: 4' < x1

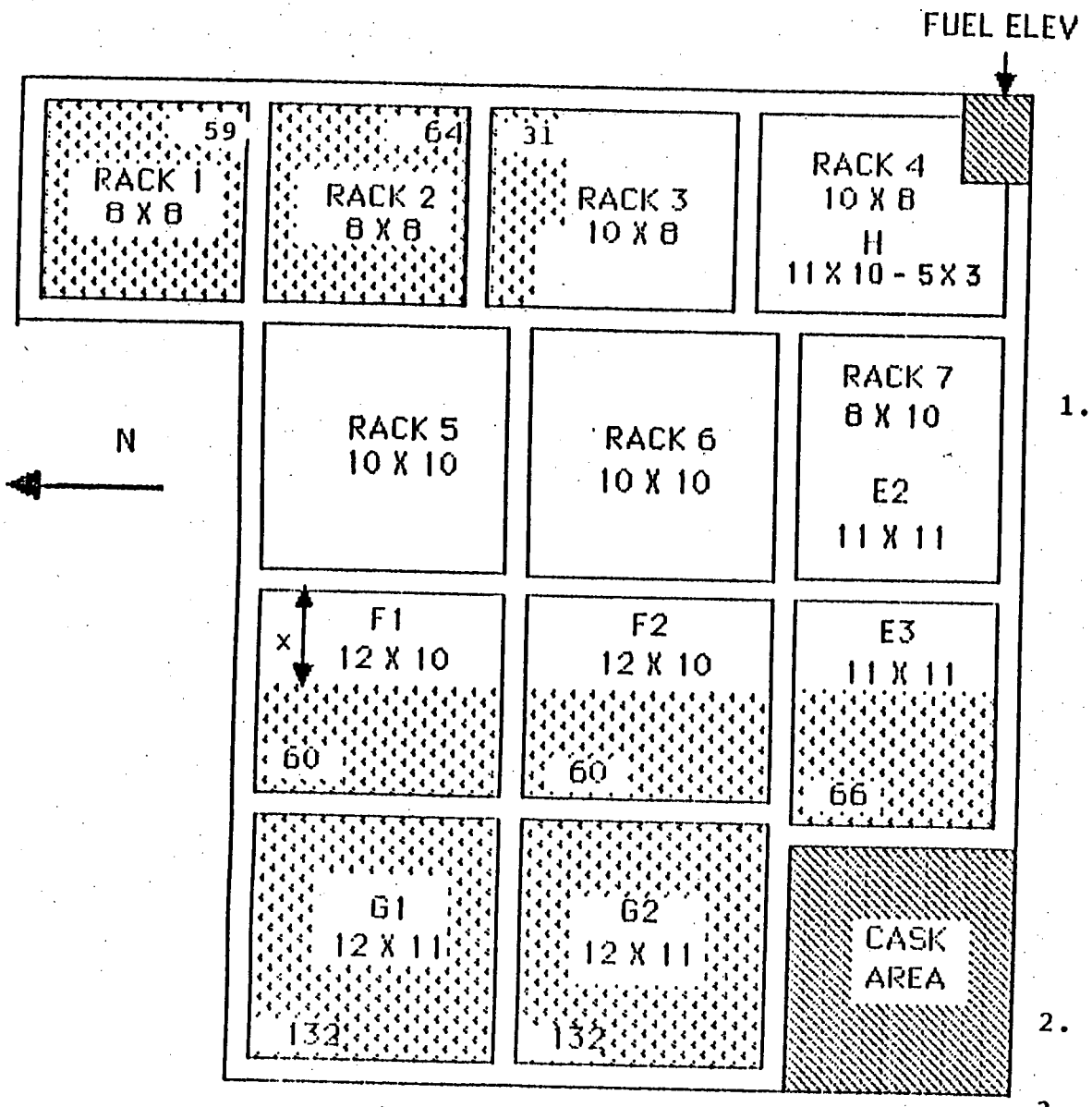

FIGURE 4

INDIAN POINT UNIT II

INSTALLATION AND REMOVAL SEQUENCE AND PROPOSED FUEL SHUFFLE STEPS:

1. Shuffle fuel to obtain the storage configuration shown in this Figure. The following net movements from racks are involved.

Rack ID	No. of Assemblies Added (+) or Removed (-)
3	-49
4	-80
5	-50
6	-50
7	-40
F1	+60
F2	+60
E3	+66
G1	+39
G2	+44

2. Remove Racks 4 and 7 for disposal.

3. Install Racks E2 and H.

Note: 4' < x

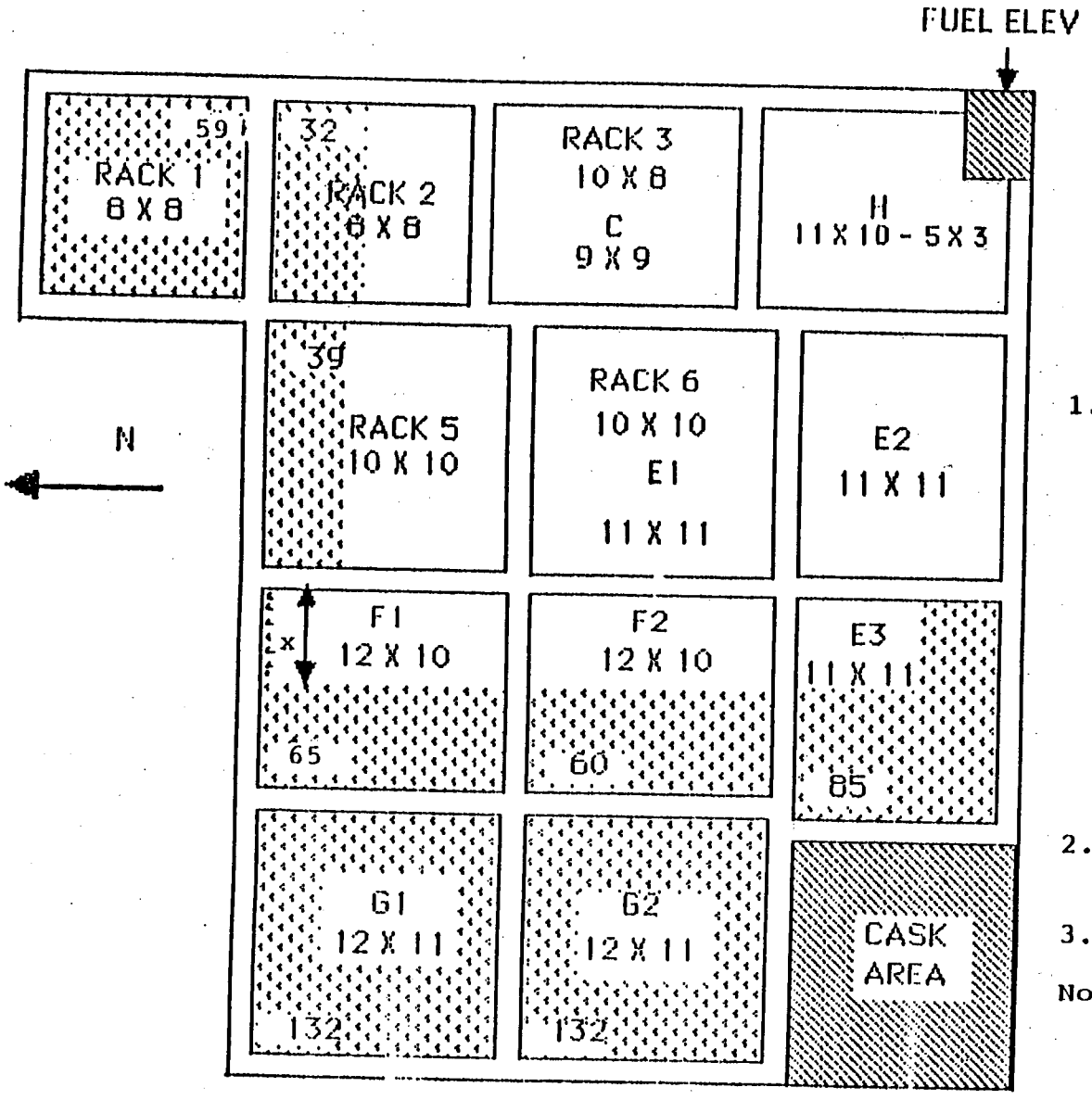

FIGURE 5

INDIAN POINT UNIT II

INSTALLATION AND REMOVAL SEQUENCE AND PROPOSED FUEL SHUFFLE STEPS:

1. Shuffle fuel to arrange them in the configuration shown in this Figure. Required assembly movements tabulated below.

Rack ID	No. of Assemblies Added (+) or Removed (-)
2	-32
3	-31
5	+39
E3	+19
F1	+5

2. Remove Racks 6 and 3 for disposal.

3. Install Racks E1 and C.

Note: 4' < x

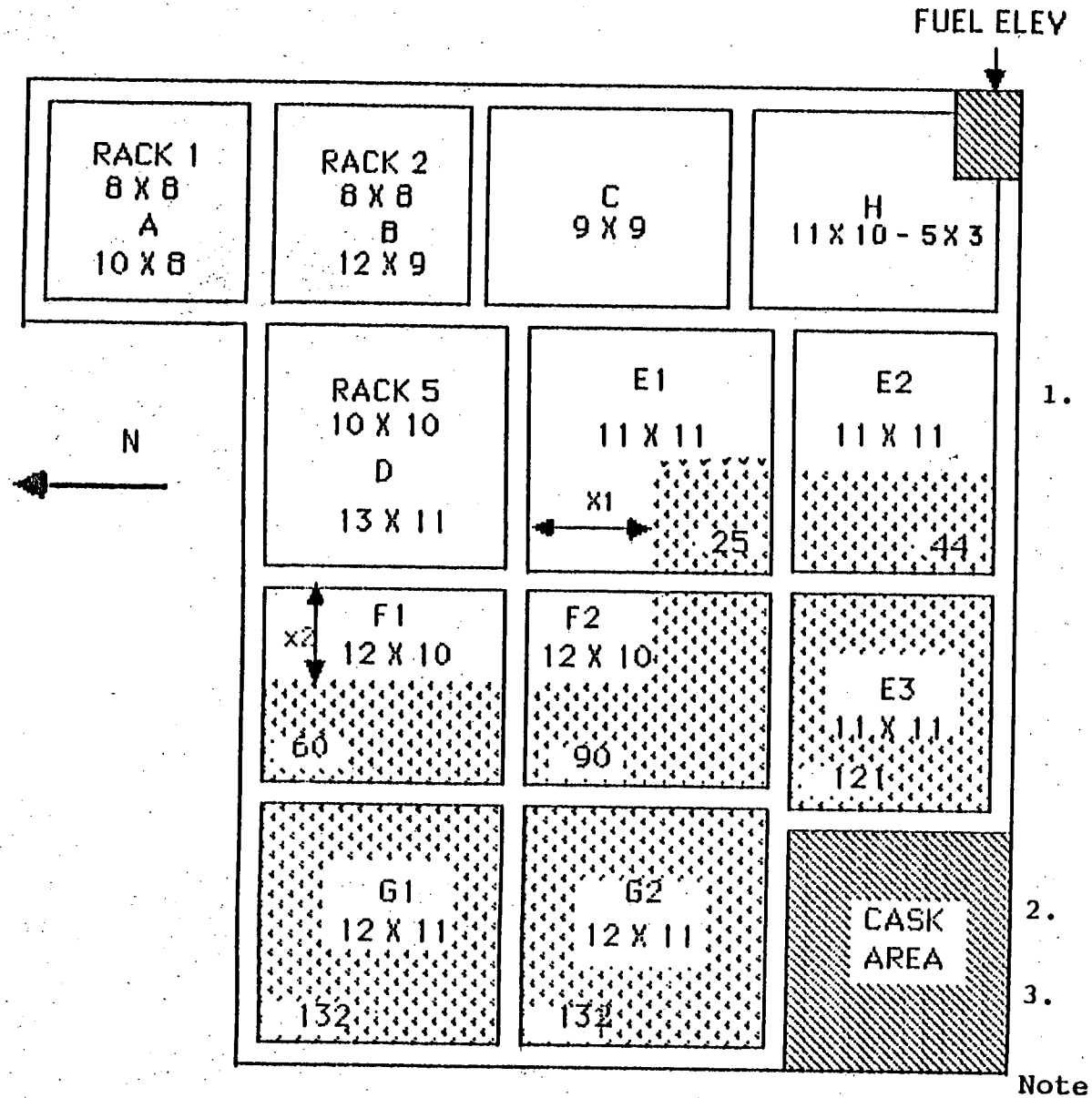

FIGURE 6

INDIAN POINT UNIT II

INSTALLATION AND REMOVAL SEQUENCE AND PROPOSED FUEL SHUFFLE STEPS:

1. Shuffle fuel to arrange them in the configuration shown in this Figure. Required assembly movements tabulated below.

Rack ID	No. of Assemblies Added (+) or Removed (-)
1	-59
2	-32
5	-39
E1	+25
E2	+44
F2	+30
E3	+36
F1	-5

2. Remove Racks 5 and 2 and Rack 1 for disposal.

3. Install Racks D, B and A.

Note: 4' < x1
4' < x2

Question 3. Provide an analysis to show the effect of a SFA drop and of a rack drop on the spent fuel pool floor if rack movement is not accomplished by use of a single failure proof crane.

Response The drop of a heavy object onto the spent fuel pool liner was analyzed and submitted to the AEC as part of the original Final Safety Analysis Report dated January, 1970. This analysis was in response to Question 9.6 and was accepted by the AEC in the November 16, 1970 Safety Evaluation Report. The heavy object analyzed was a spent fuel cask, a much heavier object than is carried over the pool during normal operation or during a reracking. The Updated Final Safety Analysis Report contains this analysis in Section 14.2. This analysis bounds the case of a fuel assembly drop and a rack drop onto the spent fuel pool floor.

Question 4. Show, in detail, how your intend to qualify special lifting in accordance with the criteria of ANSI 14.6-1978. Discuss the term "redundant" (on page 1-8 of your 6/20/89 submittal) in your use of such devices.

Response The lifting device utilized for carrying the racks over the spent fuel pool employs a remotely engageable rig which is qualified to meet the following stress criteria:

(a) The combined shear or maximum tensile stress at any load carrying point for three times the weight of the heaviest rack module is less than the material yield strength; and

(b) The maximum stress in the lifting device is less than the material ultimate strength if the dead load is assumed to be five times the weight of the heaviest rack.

A finite element model of the lift rig was made to demonstrate compliance with the above criteria.

The term "redundant" on page 1-8 of the Licensing Report indicates the redundancy in the lift points in the lifting device. Only three lift points are needed for a kinematically stable lift. However, the lift rig contains an extra lift point (a total of four) to incorporate a redundancy in the lift mechanism.

Question 5. You state that the spent fuel pool makeup rate required to maintain the pool level would be 62 gpm (Section 5.1.4) while the FSAR (Section 9.3.3.2.3, Rev. 4) states 73 gpm is required. Both values are apparently for the full core discharge heat load case. Explain the apparent discrepancy.

Response The two cases did not include identical assumptions in the calculation of the makeup modes. The earlier analysis (73 gpm) assumed no benefit due to subcooling of the makeup water, while the subsequent analysis (62 gpm) was based on a value of 100°F for the makeup water (not 212°F). Recalculating the previous case for 100°F, the two results would be in closer agreement (60 vs. 62 gpm), however, the results will not be identical due to difference in the total heat loads. The difference in the total heat loads for the earlier analysis and the current analysis consists of an increased rated capacity of Indian Point Unit 2 [2758 MWt (earlier) vs. 3071.4 (current)] and the increased number of fuel assemblies stored [980 (earlier) vs. 1376 (current)].

The use of 212°F (73 gpm) for the makeup water was deemed overly conservative since the safety analysis for one of the makeup sources is done at a maximum of 100°F and the other sources are not expected to exceed 100°F. In either case (62 gpm or 73 gpm), the minimum makeup source design capacity (100 gpm) is well beyond the required amount.

Question 6. Explain, in detail, the design and use of the "remotely engageable lift rig" discussed in section 2.2 of your submittal. Is this device related to the redundant special lifting devices discussed in Section 1.2 (page 1-8) of your submittal?

Response Yes, the devices mentioned in Sections 1.2 and 2.2 are the same.

The lift device consists of a box frame with four lift rods. The rods have special bayonet shapes at the bottom end. This special end shape allows the rig to be placed on top of the rack such that the bayonet clears the hole in the rack baseplate. The lift rod has a provision on its top such that it can be rotated (turned) using a long handling tool. Turning the rod by 90° locks the bayonet underneath the baseplate. The rig frame can now be lifted using suitable crane hoists. This remotely engageable feature of the lift rods enables either lifting a module from the pool floor or placing modules on the pool floor by performing all rod engaging and disengaging operations from the fuel handling bridge.

This lifting device proposed for use in connection with the IP2 reracking employs the same design concept as the one used in Millstone Unit I reracking in early 1989.

Question 7. Provide an outline of your plans and procedures for the reracking process. Include a discussion of the training to qualify operators so as to assure load handling safety during reracking.

Response The reracking procedure will contain datasheets for floor elevation, rack leveling, free path gage test and verticality checks. The work will be controlled by an installation traveler, and will be monitored by QC/QA personnel using as-built rack drawings.

A general outline of the work plan, not necessarily in chronological order, is as follows:

- Mobilize
- New rack receipt inspection
- New rack off-loading and temporary storage
- New rack upending and cleaning
- Dry drag test new racks
- Old rack removal
- Decontaminate old racks
- Ship old racks to disposal site
- Underwater vacuum cleaning
- Diving in contaminated water (if required)
- Underwater welding (if required)
- Transport new racks to fuel building
- Perform necessary fuel shuffles
- Install new racks
- Wet drag test new racks
- Demobilize

The removal of old racks and installation of new racks will be carried out using written procedures which will be reviewed and approved in accordance with the Indian Point Unit 2 review process before use. A list of activities that will be covered by procedures is provided below, along with brief explanatory notes, where necessary, for clarification.

(i) Receipt Inspection.

Includes receipt inspection of transit damage, dummy gage test, and dimensional overchecks.

(ii) Horizontal Lift and Upending of Racks.

(iii) Vertical lift and Preliminary Leveling of Racks.

(iv) Purpose and Scope of Removal of Existing Racks and Installation of New Racks.

(v) New Racks Installation

This procedure will contain the following information:

- Materials and equipment
- Safe rigging practices
- NUREG 0612 requirements

- o Load travel path well defined
  Note: The path specified will preclude movement of racks over fuel assemblies at any time.
- o Sketches of lifting fixtures
- o Sketches of remote tooling
- o QA hold points
- o Fuel shuffles

(vi) New Rack Leveling

(vii) Underwater Diving (if necessary)

(viii) Vacuum Box Testing for Leak Detection

(ix) Underwater Vacuum Cleaning

(x) Site Free Path Gauge Test

(xi) Cell Rework

Also see response to question 2.

The training to qualify operators will include crane operator skills, qualifications, safety and conduct and basic rigging principles. The Crane Operator and Rigging course outline includes:

- o Crane Operator qualifications/conduct
- o Communications
- o O.S.H.A. A.N.S.I standards
- o Safety factors and precautions
- o Riggings methods, precautions and procedures
- o Rigging hardware
- o Scaffolding

Discussions, videotaped presentations and hands on field exercises serve as the basic methodology of this course. Performance demonstrations and a written examination are administrated at the conclusion of the course. The operators will be trained, qualified and conduct themselves in accordance with Chapter 2-3 of ANSI B30.2-1976 "Overhead and Gantry Cranes." The reracking will be controlled by personnel who have been trained in the IP2 rerack procedures. The training outlined above will assure load handling safety during the proposed reracking.

ATTACHMENT II

ADDITIONAL INFORMATION REGARDING THE INDIAN POINT 2
INCREASE IN SPENT FUEL POOL STORAGE CAPACITY
(RESPONSE TO REFERENCE 2)

CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.
INDIAN POINT UNIT NO. 2
DOCKET NO. 50-247
JANUARY, 1990

Question

During the installation of new racks, consider the potential of rack drop on another rack or on the pool floor. Provide information to assure that (1) the existing fuel assemblies will not be damaged and (2) that there will be sufficient coolant in the pool in case of extensive leakage through the pool floor due to rack drop accident.

Response

The information requested is provided below:

1) See responses to question 1, item 7a, and question 2 in Attachment I.

2) See response to question 3 in Attachment I. The referenced Section 14.2 of the Indian Point Updated Final Safety Analysis report provides assurance of sufficient coolant in the pool in the unlikely event of damage to the pool due to the dropping of a heavy object.