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DOCKETED USNRC JUN 29 1976 Office of the Secretary Docketing & Service Section

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. POWER AUTHORITY OF THE STATE OF NEW YORK (Indian Point Station Unit No. 3)	)	Docket No. 50-286

APPLICATION FOR AMENDMENT TO
OPERATING LICENSE

Pursuant to Sections 50.59(c) and 50.90 of the regulations of the U. S. Nuclear Regulatory Commission, Consolidated Edison Company of New York, Inc., and Power Authority of the State of New York ("the Licensees"), as holders of Facility Operating License No. DPR-64, hereby request that portions of Technical Specification 3.8 set forth in Appendix A to that license be amended.

In addition, the Licensees request the Commission to review and approve a proposed modification to the Indian Point Unit No. 3 storage facility pursuant to Section 50.59(a)(2)(ii) of the Commission's regulations.

The proposed modification is described and evaluated in Attachment A to this Application. The proposed Technical Specification changes consist of the specific revisions set forth in Attachment B to this Application, and a safety evaluation of the proposed changes is set forth in Attachment C.

This evaluation also demonstrates that the proposed changes do not involve a significant change in the types or an increase in the amounts of effluents or any change in the authorized power level.

CONSOLIDATED EDISON COMPANY
OF NEW YORK, INC.

By ______________________
William J. Cahill, Jr.
Vice President

Sworn to before me this
22nd day of June, 1976.

____
Notary Public

ANGELA ROBERTI
Notary Public, State of New York
No. 41-8593813
Qualified in Queens County
Commission Expires March 30, 1978

ATTACHMENT A

SPENT FUEL POOL PROPOSED MODIFICATIONS

Consolidated Edison Company of New York, Inc.
Power Authority of the State of New York
Indian Point Station, Unit No. 3
Docket No. 50-286

June, 1976

CONTENTS

I. Introduction

To increase the spent fuel storage capacity of Indian Point Unit No. 3 (IP 3), a modification of the fuel storage facility is planned. The proposed modification consists of replacing the present spent fuel storage racks with new racks that store the fuel in a more closely spaced lattice, thereby increasing the spent fuel storage capacity of IP 3 from 264 to 482 assemblies. The increased capacity would provide space for all spent fuel to be discharged until 1983, while allowing space for a complete core discharge.

The proposed modification is scheduled to be effected prior to March, 1978, the earliest expected time of the first refueling. This schedule will permit the modification to be performed without the additional procedures and safety consideration that would be necessary if the modification were to be implemented with irradiated fuel stored in the pool. In accordance with this schedule, Nuclear Regulatory Commission approval of the proposed modification and associated changes to IP 3 Technical Specifications is requested by October 1, 1976 to accommodate any necessary design revisions before ordering the new spent fuel racks. The proposed modification of the facility is essentially the same as the modification approved by the Commission on December 16, 1975 for Indian Point Unit No. 2.

This report describes the proposed modification in detail, including, where available, information requested by the Commission during its review of the IP 2 modification.

II. Description of Proposed Modification

A. Reason for modification

The present spent fuel storage capacity of IP 3 is 264 assemblies, or slightly more than four regions. However, it is prudent engineering practice to reserve storage space to permit an entire reactor core discharge (three regions), should this be necessary for any reason. It is expected that spent fuel reprocessing facilities will not be available to IP 3 until 1982, at the earliest. Thus, after the second refueling, scheduled for the fall of 1979, it would not be possible to discharge the entire reactor core into the present storage racks, and the plant would not be able to continue power operation if a situation were to develop requiring a full core discharge. The planned expansion of fuel storage capacity will assure full core discharge capability until 1983.

B. New Spent Fuel Rack Design

1. General Criteria

The new spent fuel racks will meet all relevant design criteria of ANSI Standard N18.2 - 1973 (Revised August, 1974) and draft ANSI Standard N210 (Revised January, 1975).

2. <u>Description of Racks</u>

The proposed new racks are similar in design to the present racks with the following exceptions:

a. The center-to-center spacing of the storage locations is reduced from the present 20.5 inches to 14.0 inches.

b. To ensure an adequate subcriticality margin with the reduced spacing, 1/8-inch thick boron-stainless steel plates, running the full length of the active fuel region of an assembly, are welded onto the sides of each storage location between storage positions.

The conceptual design of the new racks is shown in Figure B-1. The racks rest on the stainless steel liner plate at the bottom of the storage pool, and support the fuel assemblies above the pool floor by means of shelves within each storage position. Each rack is seismically restrained at the bottom by two 4.5-inch diameter stainless steel guide pins and at the top by removable plates which connect the rack to the adjacent racks. The sides of racks adjacent to the storage pool walls have kicker plates at the top to provide additional seismic stability.

3. Nuclear Criticality Design

The present Indian Point Unit No. 3 spent fuel storage racks maintain subcriticality by providing a center-to-center spacing of 20.5 inches between assemblies. In the proposed new spent fuel storage racks, the center-to-center spacing will be reduced to 14.0 inches. The increase in reactivity caused by the reduction in spacing will be offset by using fixed neutron absorber plates consisting of equivalent 304 stainless steel with a natural boron content of 1.0 to 1.2 percent by weight. All the fuel storage locations, except the outermost which are adjacent to the pool liner, will have a neutron absorber plate welded to each side. The outermost storage locations will have neutron absorber plates only on those sides facing other storage locations. The neutron absorber plates will run the full length of the active fuel region. Nuclear criticality analyses were carried out to ensure that subcriticality will be maintained by an adequate margin even under conservative assumptions. The results demonstrate that the nuclear design of the proposed racks meets the current Technical Specification limit (Reference 1) and satisfies the ANSI standard (Reference 2).

The conservative assumptions used for the design case calculations are:

a) Fresh, unirradiated 3.5 w/o U-235 enriched fuel (present Technical Specifications limit is 3.4 w/o).

b) Water temperature of 68° F

c) Minimum boron content of the boron stainless steel (1.0 w/o).

d) Minimum dimensions allowed in the fabrication of the boron stainless steel plates (1/8" x 7" x 145").

e) Center-to-center spacing of 13.875 inches which includes fabrication tolerance (14.0 inches is the nominal design specification).

f) No axial or radial neutron leakage (infinite medium calculation).

g) No soluble boron.

The criticality analysis was performed using a two-dimensional discrete ordinate transport theory computer code, DOT (Reference 3). This code employs three broad group cross-sections, two fast and one thermal, which were obtained using GAM II (Reference 4) and THERMOS (Reference 5), respectively. The calculated k_∞ for the above design case is 0.874.

A separate and independent calculation performed by Westinghouse resulted in a k_∞ of 0.87, agreeing with the DOT result. The Westinghouse analysis used two-dimensional diffusion theory (Reference 6) and blackness theory for the neutron absorber plates. Sensitivity studies were performed to ascertain the effects of variations in basic parameters for the criticality calculations.

Variation of k_∞ with assembly spacing

A study was performed to determine the effect of variations of assembly spacing on k_∞ . The results of this study, which was performed using diffusion theory, are tabulated as follows:

Center-to-center Spacing (Inches)	K_∞ (at 1.0 w/o Boron)
13.875	0.87
13.275	0.88
12.000	0.92

The 13.875 inch spacing is representative of the design 14-inch center-to-center spacing with allowance made for fabrication tolerances. The 13.275 inch spacing is the minimum center-to-center spacing possible between two assemblies based on allowance for rack fabrication tolerances and assembly movement within the storage locations. Realistically, if an assembly moves towards one neighboring storage location, it must lean away from some other neighbor. Neglecting this realism for conservatism, an infinite array with a center-to-center spacing of 13.275 inches produces a k_∞ of 0.88, as cited above.

Variation of k_∞ with boron content of neutron absorber plates

A parametric study employing transport theory was performed to determine this variation. The results are tabulated as follows:

Natural Boron Content (Weight Percent)	k_∞ (at 13.875" Spacing and 68° F)
1.0	0.874
0.9	0.878
0.75	0.885
No neutron absorber plates	0.950

The boron stainless steel will be produced with a natural boron content of 1.0 to 1.2 percent by weight. A strict quality assurance program will ensure that any 5 gram sample contains at least 1.0 weight percent of natural boron.

Variation of k_∞ with water temperature

The temperature effect on reactivity has been analyzed using transport theory and the results are tabulated as follows:

Water Temperature (°F)	k_∞ (at 13.875" Spacing and 1.0 w/o Boron)
68	0.874
120	0.872
150	0.869
200	0.864

moderator temperature coefficient.

Uncertainties and tolerances in enrichment, rack material, and rack fabrication were all considered in the reactivitity calculation of the design case. A computational uncertainty of 0.1% $\Delta\rho$ and a standard deviation of 0.85% $\Delta\rho$ were reported by Westinghouse for the k_∞ calculations obtained using two-dimensional diffusion theory and blackness theory. These values are based upon the Westinghouse analysis of critical experiments involving poisoned as well as unpoisoned cases. Total calculational uncertainty based upon the arithmetical sum of these component uncertainties is equal to 0.95% $\Delta\rho$.

4. <u>Structural Design</u>

<u>Criteria and Codes</u>

The racks are designed to withstand the combined loadings of the dead weight of the rack structure, the weight of the spent fuel assemblies, and seismic loads. The racks are designed as a seismic Class I structure. All design is in accordance with the AISC Specification for Design, Fabrication and Erection of Structural Steel for Buildings, 1970. Stresses are within AISC working stress allowable for normal loading conditions (deadload plus weight of spent fuel assemblies) and within 0.9 Fy for the faulted condition (dead load plus weight of spent fuel assemblies plus safe shutdown earthquake).

The new racks will be constructed of type 304 stainless steel conforming to ASTM A 240 or A 276. The minimum yield strength for 304 stainless steel as specified above is 30,000 PSI. The modulus of elasticity at 70° F is 28.3×10^6 PSI.

The ratios of allowable load to yield strength by AISC code for carbon steels are applied to the yield strength of the stainless steel to obtain the allowable loads.

Seismic Design of Racks

The seismic design of each spent fuel rack is based on limiting stresses in the structural elements of the rack to 0.9Fy under the combined loading of the dead weight of the rack, the weight of the spent assemblies and the Safe Shutdown Earthquake. The weight of the fuel assemblies stored in the rack is conservatively calculated assuming that control rods are inserted in each assembly. The racks sit on the bottom of the Spent Fuel Storage Pool which is a 3' thick reinforced concrete mat poured directly on bedrock. The seismic acceleration applied to the racks therefore is the same as the site ground acceleration, and the ground response spectrum curves shown on Figures A.1-1 and A.1.2 of the Indian Point Unit No. 3 FSAR are used in the vertical and horizontal directions, respectively. The vertical and horizontal earthquake forces are assumed to act simultaneously. The seismic forces on the storage racks were determined by URS/John A. Blume and Associates Of special concern was the effect of water pressure on the racks since the racks will be fully submerged under approximately 25 feet of water.

Based on a review of the literature, Blume advised that there is an added mass effect due to the water pressure acting on the rack structure. This effect is significant (in proportion to the weight of the structure) in the horizontal direction, and is relatively insignificant in the vertical direction. Blume also noted that the effects of the water will increase the effective damping of the rack structure. Whereas 1% damping would normally be applicable for a welded steel structure, the damping would increase to 2% on the same structure underwater. Therefore, to determine lateral forces on the rack, the 2% damping curve was used considering the total weight of the rack structure, the fuel assemblies and the added mass effect of the water. Vertical forces were determined using the actual weight of the rack structure and the fuel assemblies ignoring the insignificant added mass effects of the water. The 1% damping curve was used in the vertical direction. The added mass effect was computed by Blume on the information given in References 7,8 and 9. The increased damping effect is based on Reference 8. To obtain natural periods, the rack structure was analyzed as a single degree of freedom system for both directions. The racks are basically considered as a cantilever structure supported laterally at the base by friction and by two 4.5-inch diameter guide pins.

The fundamental mode period in the horizontal direction is less than 0.15 seconds. Higher mode periods are 1/3 of the fundamental period and less. The stiffness of the fuel assembly is neglected but the weight of the assembly is considered to be uniformly distributed in the cell. In the vertical direction, the fuel cells and the perimeter frames are very rigid. The horizontal diaphragms are the only flexible parts. Conservatively considering only the bottom diaphragm and applying the entire weight of the rack to it, the fundamental period obtained is 0.18 second. Based on the above, it was conservatively assumed that the acceleration response of the rack structure as a whole is equal to the peak of the response spectrum - i.e. 0.35g horizontally (peak of 2% curve) and 0.30g vertically (peak of 1% curve).

The static working stress analysis of the racks assumed each row of cells to be behaving as a Vierendeel Truss. While the rack is actually a 14' - 2" deep truss with a top, middle and bottom chord, only the lower half of the rack was used in determining the vertical load capacity of the structure. The bottom chord of the truss is comprised of the horizontal channels at the base of the rack and the top chord is the horizontal channels at the midheight of the rack. Using the STRESS computer program (Ref. 10), forces and moments in the truss due to the weight of the rack and fuel assemblies were determined. Stresses were limited to less than 18,000 psi for non-compact shapes and 20,000 psi for compact shapes.

The vertical seismic load will increase the moments, forces and stresses by 30%.

The horizontal component of the earthquake transmitted to the top of the structure is carried by the tubing (which acts as a diaphragm) to the diagonal bracing down to the base of the structure. The total horizontal shear can be resisted at the base by friction and by the two 4.5-inch guide pins. Combined stresses in members due to simultaneous vertical dead, live and seismic forces and horizontal seismic forces are limited to 0.9Fy.

Overturning forces on the racks consist of the horizontal seismic force applied at the center of gravity and a 0.3g vertical force upward. The 0.3g force is multiplied by the actual, dry weight of the rack. The stabilizing force is taken as the buoyant weight of the rack and fuel assemblies.

As a result, there is a net overturning force on the rack. Stability is achieved by tying the tops of each rack to one another, using removable plates. The sides of the racks adjacent to the storage pool walls have kicker plates at the top to brace the racks against the wall after the tops have displaced laterally by more than 0.125 inches. The spent fuel assemblies will be confined in individual cells which comply with the fuel manufacturer's recommended arrangement, and the maximum seismic loads imparted to the fuel assemblies by the new racks will be no greater than calculated for the original racks. Therefore, the new storage racks will provide the same protection against damage to the fuel due to the design basis earthquake as intended by the original design.

Seismic Analysis of Pool

As noted in the previous section, the bottom of the Spent Fuel Storage Pool is a 3-foot thick reinforced concrete mat poured directly on bedrock.

The total weight of a completely filled rack structure is approximately 92 kips. Adding 28 kips due to a vertical downward seismic force, a total load of 120 kips is generally distributed over an area 8' -5" x 8'-5" (70 square feet).

The shims provided to level each rack are of sufficient size and number to prevent local crushing of the concrete immediately beneath the exterior frame of the rack where the shims are located. The resulting compressive force carried through the mat into the bedrock is less than 2 kips / square foot.

The impact of the top of the racks against the 4'-6" thick pool walls was found to produce stresses less than 3.5 KSI in the wall reinforcing steel, which has a minimum yield strength of 60 KSI.

5. Cooling Analysis

With the proposed increased spent fuel storage capacity, the maximum total decay heat load in the storage pool will be slightly increased. Therefore, the spent fuel heat loads and the cooling system capability have been re-evaluated.

Maximum Heat Load

The maximum spent fuel heat loads have been calculated for conservatively selected normal and abnormal cases, and are presented in Figures B-2 and B-3. The normal case corresponds to the discharge of one region at approximately 15-month intervals until all storage locations are occupied. The abnormal case refers to the discharge of a full core with four regions of spent fuel already present in the pool, at which time all locations will then be occupied. The heat loads were calculated using NRC Branch Technical Position APCSB 9-2 (Ref. 11). The calculations assume 15 months of 100% power operation (3025 Mw(t)) per cycle, and include actinide decay heat. For the normal case it was conservatively assumed that the individual region discharge takes place one hundred hours after reactor shutdown, the minimum time permitted by the Technical Specifications. For the abnormal case, it was conservatively assumed that the full core discharge takes place at the end of the cycle when all three regions can contribute decay heat, with all fuel being moved into the pool four hundred hours after reactor shutdown. Proposed changes to the IP 3 Technical Specifications will require observance of the four hundred-hour waiting period.

Cooling System Capability

The heat removal capability of the spent fuel cooling system has been calculated as a function of the spent fuel pool water temperature, and is presented in Figure B-4. The analysis is based on the FSAR values of 88.2° F for the component cooling water temperature and 1.4 million pounds per hour for the component cooling water flow rate through the spent fuel heat exchanger. With maximum heat loads, the maximum pool water temperature will be 127°F and 147°F for the normal and abnormal cases, respectively. To assure adequate cooling of each fuel assembly, natural flow paths were considered in the rack design. Sufficient downcomer area exists between storage locations and at the top of the racks between lead-in funnels, and ample inlet area has been provided at the bottom of each storage location to permit adequate flow to each fuel assembly.

Pool Heat Up Analysis

Pool temperature as a function of time in the absence of external cooling is presented in Figures B-5 and B-6 for the normal and abnormal cases described. These times are calculated for the same conservative assumptions as before. Figures B-5 and B-6 show that the pool water temperature would rise to 180°F in seven hours for the normal case, and in three hours for the core discharge case.

At the present time, the Unit No. 3 FSAR describes alternate connections to hook up a temporary pump in the event the fuel pool cooling pump should fail. It is our intention to permanently install a standby pump of sufficient capacity to maintain the maximum pool water temperature within 150°F for either heat load case. This standby pump can be activated within one hour following failure of the normal pump.

6. References

1. Docket No. 50-286, Technical Specifications

Final Facility Description and Safety Analyses Report, Consolidated Edison Company of New York, Inc., Indian Point Nuclear Generating Unit No. 3.

2. ANSI N210, "Design Objectives for Light Water Reactor Spent Fuel Storage Facilities at Nuclear Power Stations", (Revised January 1975).

3. K-1694, "A User's Manual for DOT (a Two-Dimensional Discrete Ordinate Transport Code With Anisotropic Scattering", F.R. Mynatt, (1967).

4. GA-4265, "GAMII, A B3 Code for the Calculation of Fast Neutron Spectra and Associated Multigroup Constants", G.D. Joanou and J.S. Dudek, (1963).

5. BNL-5826, "A Thermalization Transport Theory Code for Reactor Lattice Calculations", H. Honeck, (1962).

6. WAPD-TM-678, "PDQ-7 Reference Manual", W.R. Cadwell, (January 1967).

7. Stetson, T.E. and Mavis, "Virtual Mass and Acceleration in Fluids" Trans. ASCE, Volume 122, 1957

8. Clough, Ray W., "Effects of Earthquakes on Underwater Structures" Proceedings II WCEE, Tokyo and Kyoto, Japan, July 1960.

9. Chandrasckaran, A.R. et al, "Virtual Mass of Submerged Structures" Proc. ASCE, Volume 98, No. HY5, May 1972

10. "STRESS" - A structural program by S.J. Fenjes, R.D. Logcher, S.P. Mauch, And R.F. Reinschmidt, M.I.T.

11. ANS standard (proposed) N18.6, Decay Energy Release Rates Following Shutdown of Uranium-Fueled Thermal Reactors (Revised October, 1973).

III. Safety Considerations

In addition to evaluating the proposed modification with respect to criticality and cooling considerations, postulated accidents involving spent fuel have been reviewed.

The Indian Point Unit No. 3 FSAR Section 14.2.1 describes an analysis of four fuel-handling accidents:

a) a fuel assembly becomes stuck inside reactor vessel.

b) a fuel assembly or control rod cluster is dropped onto the floor of the reactor cavity or spent fuel pit.

c) a fuel assembly becomes stuck in the penetration valve.

d) a fuel assembly becomes stuck in the transfer carriage or the carriage becomes stuck.

Accidents (a), (c) and (d) are not relevant to the design of the spent fuel racks. Accident (b), the accidental dropping of a fuel assembly into the spent fuel pit, is no different with the proposed spent fuel racks from that reported in Section 14.2.1 of the FSAR.

The Indian Point Unit No. 3 Safety Evaluation Report Section 15.3 considered the case of a fuel assembly dropped into the pool with the assumption that all fuel rods of that assembly were damaged. This document reported that the calculated doses resulting from the release of fission product gases were within the guideline values of 10CFR Part 100. The new proposed spent fuel racks in the pool do not affect the analysis of the dropped fuel assembly. The calculation remains valid and the conclusions remain applicable. Possible fuel assembly damage due to cask drop accidents was not evaluated in the FSAR or the Safety Evaluation Report. However, the IP 3 Technical Specifications prohibit movement of spent fuel casks over spent fuel and require that all irradiated fuel stored in the spent fuel pool be in a subcritical condition for at least ninety days before a cask may be moved over any region of the pool. The latter restriction assures that, even in the event of an unlikely sideways cask drop resulting in damage to the maximum possible number of assemblies, the exposure limits of 10CFR Part 100 the pool, the ninety-day holdup time will still maintain the maximum exposure within the 10CFR Part 100 limits.

IV. Environmental Consideration

A. Cost of modification and costs of alternatives

The total cost associated with this modification is estimated to be $2.7 million. Two alternatives to increasing the storage capacity of the IP 3 spent fuel pool may be considered for cost comparison purposes, although it is not known that these alternatives would be available. The alternatives are summarized in the table below. For comparison, the table contains the estimated costs of the proposed modification as well as the suggested alternatives, in terms of cost per kilogram of fuel storage provided, i.e., $/KgU.

Alternative	Cost. $/KgU.
Increase capacity of IP 3 Spent Fuel Pool	27.
Ship spent fuel to and store at a commercial storage facility	
1. Independent storage facility (15-year committment)	75 - 85
2. Reprocessor's storage facility (10-year committment)	90 - 130

As the table indicates, increasing the spent fuel storage capacity of the IP-3 spent fuel pool is less costly than any of the other storage arrangements considered. The cost of storing spent fuel at a commercial storage facility is much higher because of the cost of construction ...

new storage compared with the cost of installing new racks in the existing Indian Point Unit No. 3 spent fuel storage pool. It is important to note that the above dollar figures do not include the cost of transporting spent fuel to off-site storage facilities. Generally accepted rates for the cost of shipping spent fuel from a nuclear power plant to an off-site storage facility are in excess of $10/KgU.

B. Radiological Effects

Radionuclide concentrations in the spent fuel pool were computed assuming normal reactor coolant activity (corresponding to 0.20% failed fuel), based on information contained in Table 9.2.5 of the Indian Point Unit No. 3 FSAR. Computations assumed normal cleanup of the primary water prior to refueling, uniform mixture of refueling water and reactor coolant, and that refueling operations begin 100 hours after shutdown. These concentrations are not expected to change significantly as a result of the proposed expansion. Expected doses resulting from fuel-handling operations were computed using these radionuclide concentrations and treating the fuel pool as a uniformly distributed gamma ray source. Such a model provides conservative estimates of dose rates above the fuel-handling pool. Dose rates at the surface of the pool have been computed to be a maximum of 3.0 mR/hr. using the above assumptions. It is expected that 3 to 6 man shifts per day would be required in the fuel storage building during normal fuel-handling operations. Thus, the maximum integrated exposure received by personnel during the expected three-week refueling period would be 1.5 to 3.0 Rem. Most of the man-rem exposure would be received during refueling approximately equal to the annual exposures during years when refueling is performed, with total exposures much lower in other years.

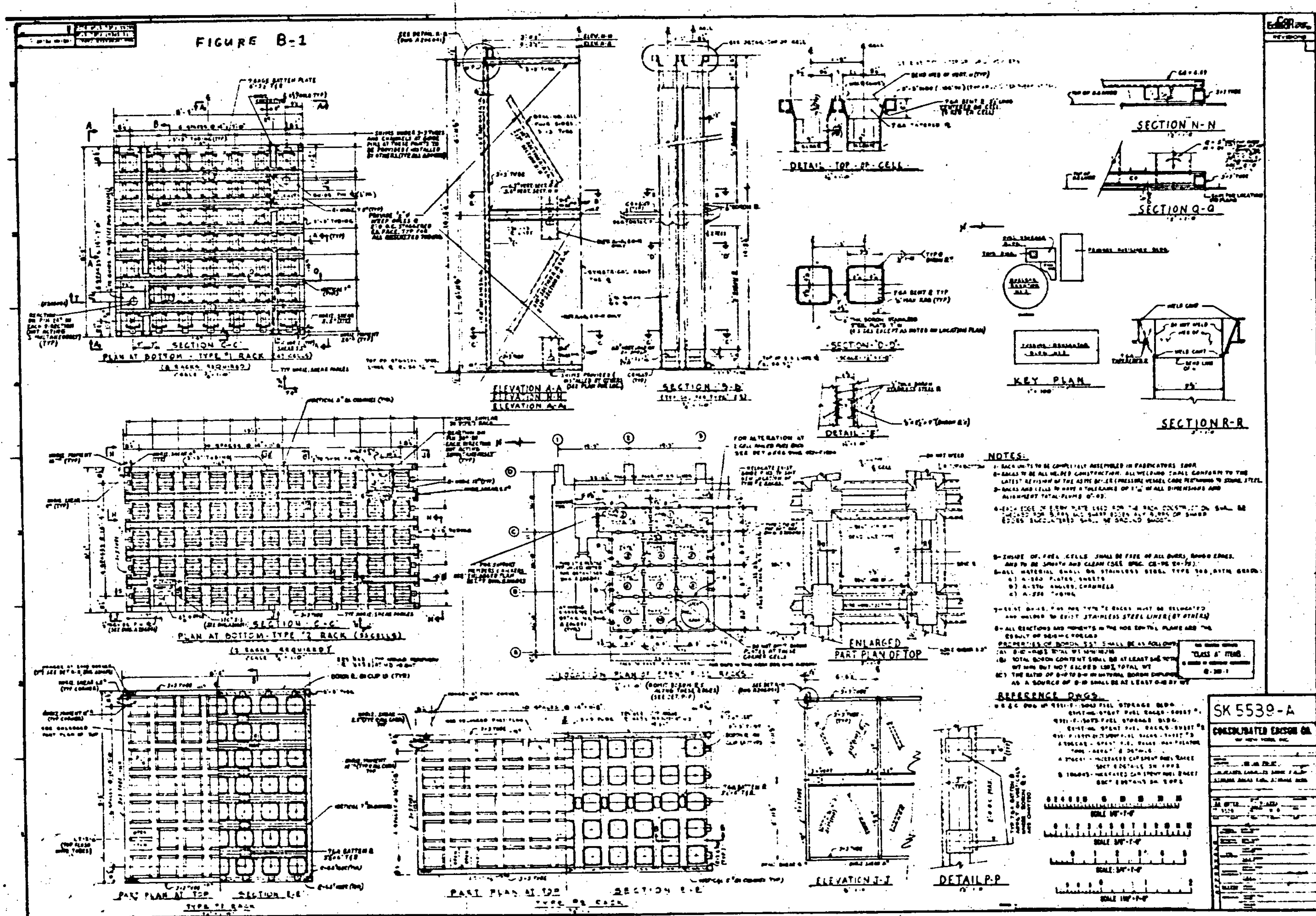


FIGURE B-1
SECTION C-C
PLAN AT BOTTOM - TYPE 1 RACK
ELEVATION A-A
ELEVATION B-B
SECTION B-B
DETAIL TOP OF CELL
SECTION N-N
SECTION Q-Q
SECTION D-D
KEY PLAN
SECTION R-R
DETAIL E
NOTES:
PLAN AT BOTTOM - TYPE 2 RACK
ENLARGED PART PLAN OF TOP
REFERENCE DWGS.
SK 5539-A
CONSOLIDATED EDISON CO.
PART PLAN AT TOP
SECTION E-E
ELEVATION T-T
DETAIL P-P

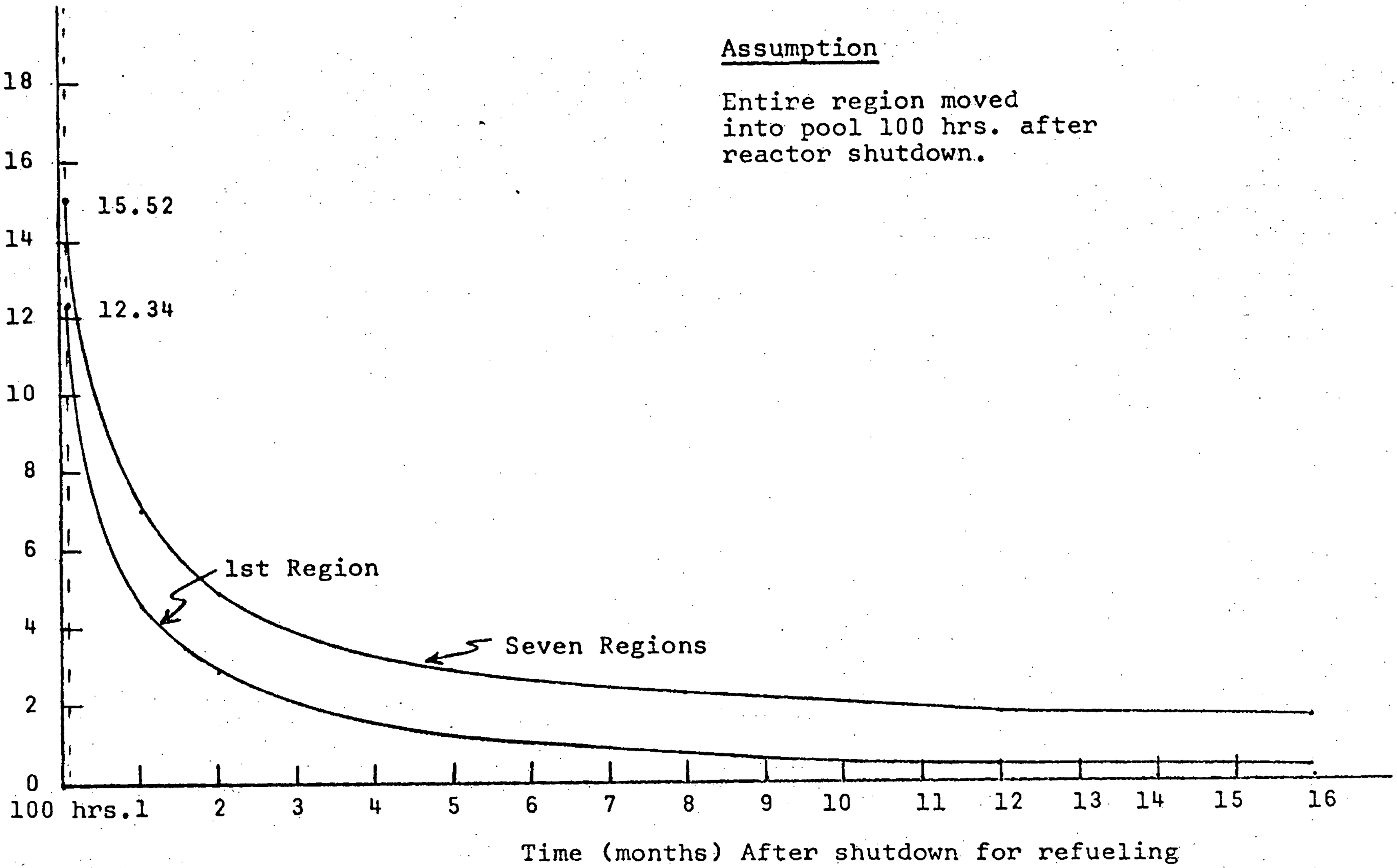


Fig. B-2 Fuel Pool Heat Load For Normal Fuel Storage

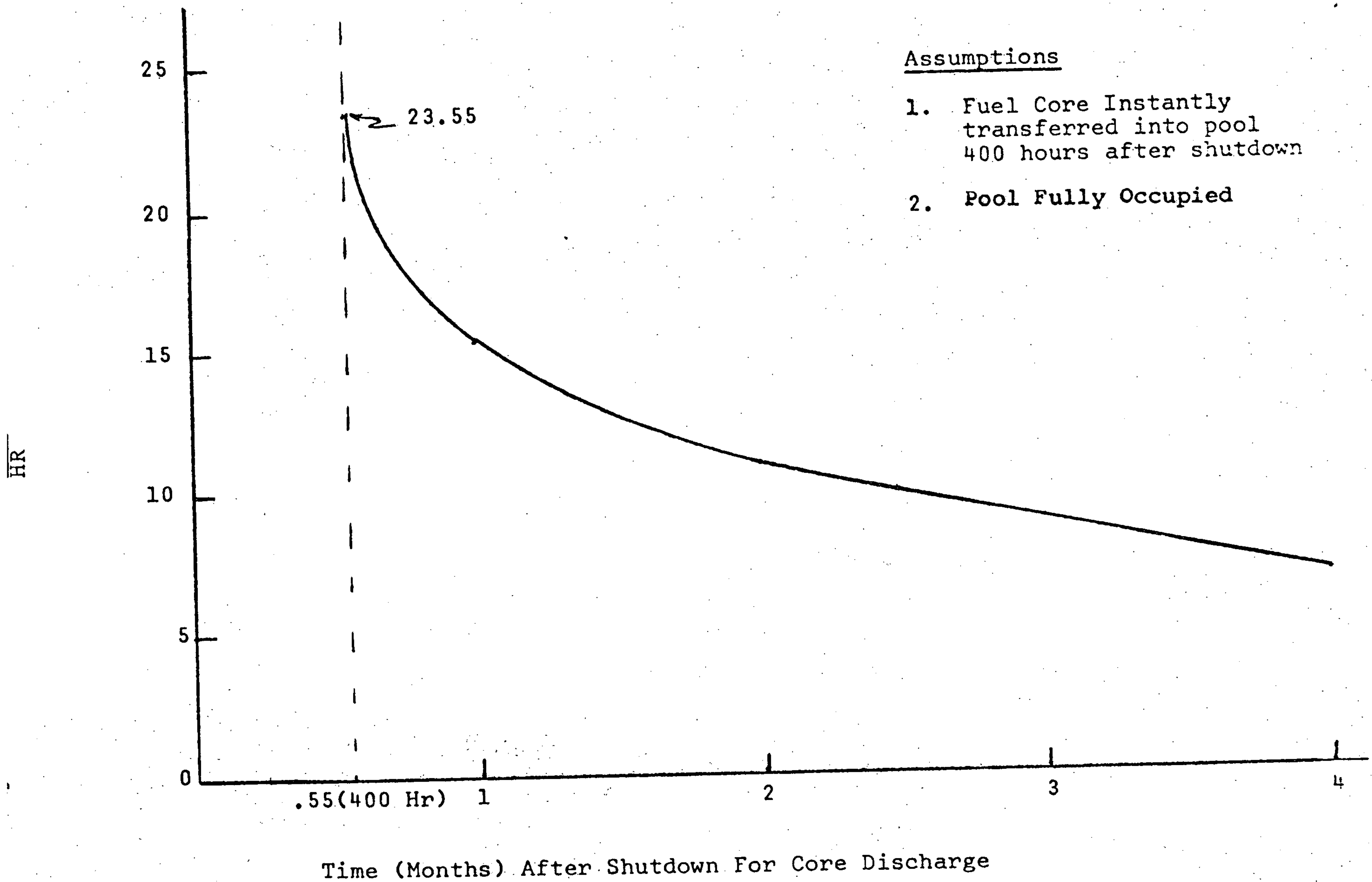


Figure B-3 - Fuel Pool Heat Load For storage of Entire Reactor Core

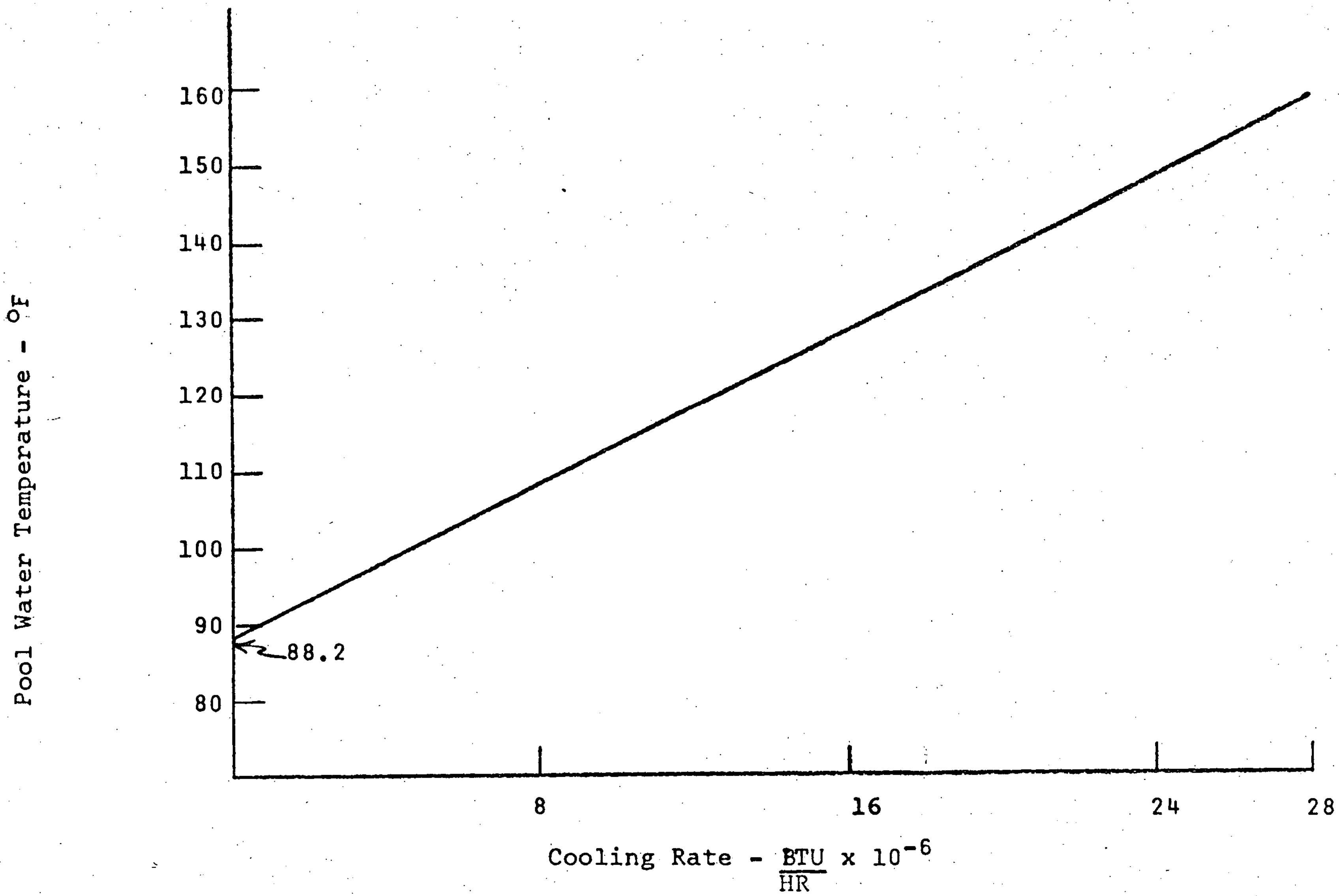
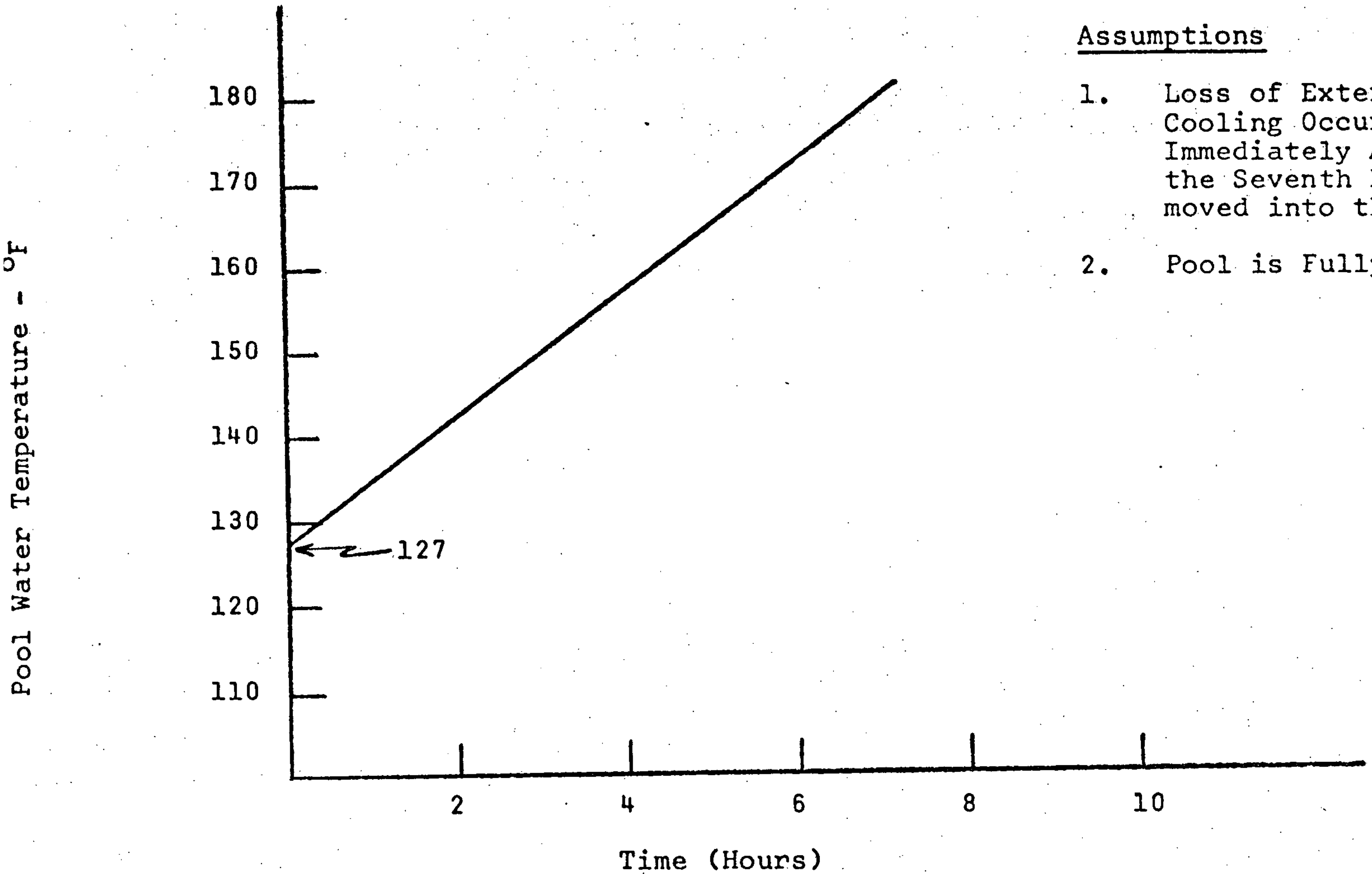


Figure B-4 - Spent Fuel Cooling System Heat Removal Capability



Assumptions

1. Loss of External Cooling Occurs Immediately After the Seventh Region is moved into the Pool.

2. Pool is Fully Occupied.

Figure B-5 - Fuel Pool Temperature With No External Cooling for Normal Fuel Storage

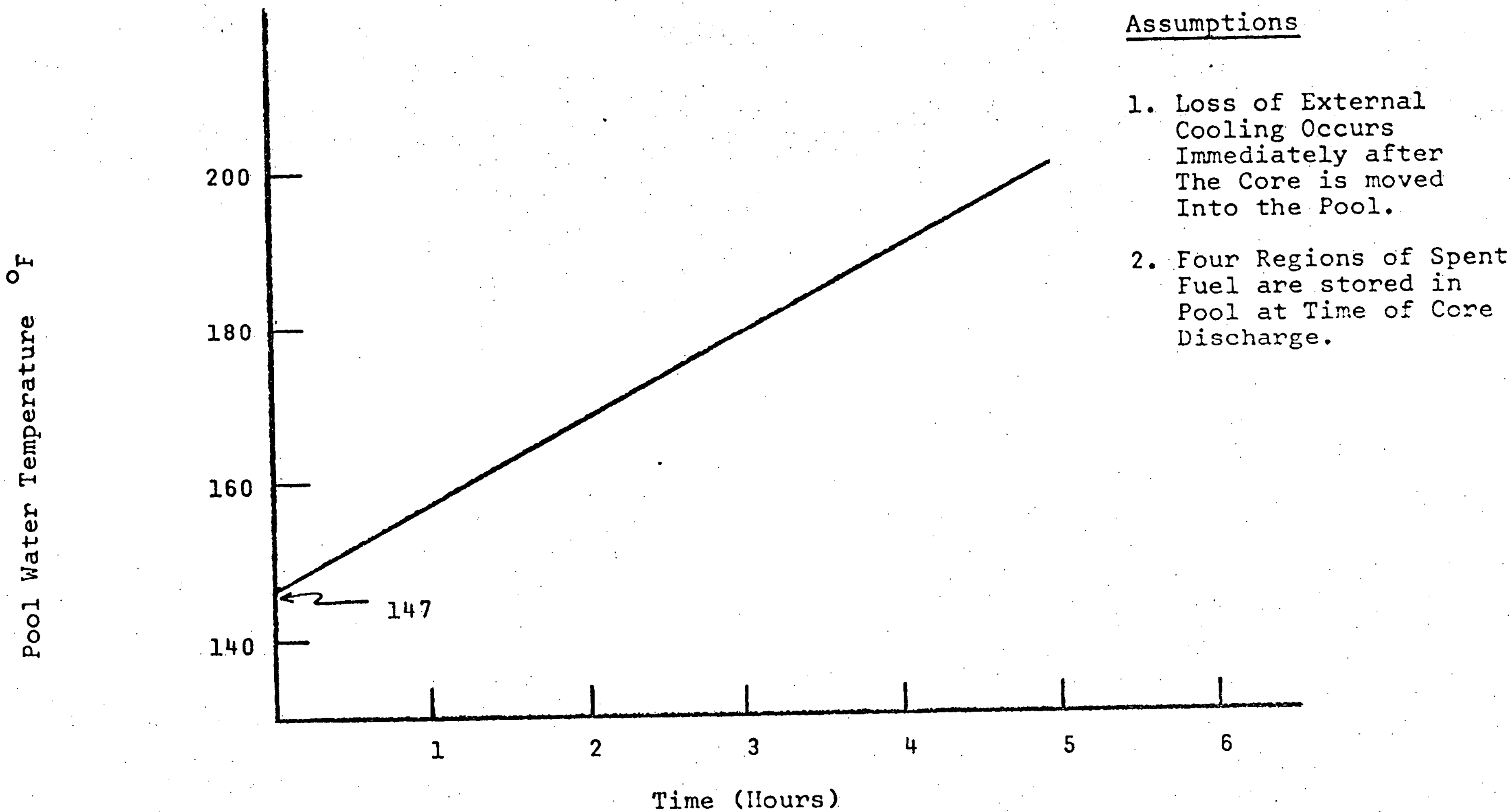


Figure B-6 - Fuel Pool Temperature With No External Cooling During Storage of Entire Reactor Core

ATTACHMENT B

APPLICATION FOR AMENDMENT TO
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Consolidated Edison Company of New York, Inc.
Power Authority of the State of New York

Indian Point Unit No. 3
Docket No. 50-286
Facility Operating License No. DPR-64

June, 1976

5. During reactor vessel head removal and while loading and unloading fuel from the reactor, T_{avg} shall be $\leq$140°F and the minimum boron concentration sufficient to maintain the reactor subcritical by at least 10% Δk/k. The required boron concentration shall be verified by chemical analysis daily.

6. Direct communication between the control room and the refueling cavity manipulator crane shall be available whenever changes in core geometry are taking place.

7. The containment vent and purge system, including the radiation monitors which initiate isolation, shall be tested and verified to be operable within 100 hours prior to refueling operations.

8. No movement of fuel in the reactor shall be made until the reactor has been subcritical for at least 100 hours. In the event that more than one region of fuel (72 assemblies) is to be discharged from the reactor, those assemblies in excess of one region shall not be discharged before a continuous interval of 400 hours has elapsed after shutdown.

9. Whenever movement of irradiated fuel is being made, the minimum water level in the area of movement shall be maintained 23 feet over the top of irradiated fuel assemblies seated within the reactor pressure vessel.

10. Hoists or cranes utilized in handling irradiated fuel shall be dead-load tested before fuel movement begins. The load assumed by the hoists or cranes for this test must be equal to or greater than the maximum load to be assumed by the hoists or cranes during the refueling operation. A thorough visual inspection of the hoists or cranes shall be made after the dead-load test and prior to fuel handling. A test of interlocks shall also be performed.

11. The fuel storage building emergency ventilation system shall be operable whenever irradiated fuel is being handled within the fuel storage building. The emergency ventilation system may be inoperable when irradiated fuel is in the fuel storage building, provided irradiated fuel is not being handled and neither the spent fuel cask nor the cask crane are moved over the spent fuel pit during the period of inoperability.

In addition to the above safeguards, interlocks are utilized during refueling to ensure safe handling. An excess weight interlock is provided on the lifting hoist to prevent movement of more than one fuel assembly at a time. The spent fuel transfer mechanism can accommodate only one fuel assembly at a time.

The 100-hour decay time following the subcritical condition and the 23 feet of water above the top of the irradiated fuel assemblies are consistent with the assumptions used in the dose calculation for the fuel-handling accident.

The waiting time of 400 hours required following plant shutdown before unloading more than one region of fuel from the reactor assures that the maximum pool water temperature will be within design objectives as stated in the FSAR.

The requirement for the fuel storage building emergency ventilation system to be operable is established in accordance with standard testing requirements to assure that the system will function to reduce the offsite doses to within acceptable limits in the event of a fuel-handling accident. The system is actuated upon receipt of a signal from the area high activity alarm or by a manually-operated switch. The system is tested prior to fuel handling and is in a standby basis.

The minimum spent fuel pit boron concentration and the 90-day restriction of the movement of the spent fuel cask to allow the irradiated fuel to decay were specified in order to minimize the consequences of an unlikely sideways cask drop.

When the spent fuel cask is being placed in or removed from its position in the spent fuel pit, mechanical stops incorporated on the bridge rails make it impossible for the bridge of the crane to travel further north than a point directly over the spot reserved for the cask in the pit. Thus, it will be possible to handle the spent fuel cask with the 40-ton hook and to move new fuel to the new fuel elevator with a 5-ton hook, but it will be impossible to carry any object over the spent fuel storage area with either the 40 or 5-ton hook of the fuel storage building crane.

ATTACHMENT C

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June, 1976

Safety Evaluation

Item 8:

Add, "In the event that more than one region of fuel (72 assemblies) is to be discharged from the reactor, those assemblies in excess of one region shall not be discharged before a continuous interval of 400 hours has elapsed after shutdown."

Safety Evaluation

For the case of a single region discharge, the existing waiting time requirement of 100 hours assures that the pool water temperature is well below the design objective. For a full-core discharge, the added requirement of 400 hours total waiting time will limit the decay heat generation rate in the spent fuel pool so that the pool water temperature will not exceed the FSAR design objective (150°F). The decay heat calculation was performed in accordance with the NRC branch position paper (Auxiliary and Power Conversion Systems Branch Position, Section 9.2.5, Appendix A, Residual Decay Energy for Light-Water Reactors for Long-Term Cooling).

The proposed changes have been reviewed by the Station Nuclear Safety Committee and the Consolidated Edison Nuclear Facilities Safety Committee, and both committees concur that these changes do not represent a significant hazards consideration and will not cause any change in the types or increase in the amounts of effluents.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC.	)	Docket Nos. 50-3
(Indian Point Station, Unit Nos. 1 and 2)	)	50-247
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. and POWER AUTHORITY OF THE STATE OF NEW YORK	)	Docket No. 50-286
(Indian Point Station, Unit No. 3)	)	

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document entitled "Application for Amendment to Operating License" by mailing copies thereof, first class postage prepaid and properly addressed, to the persons listed below on this 28th day of June, 1976.

Michael C. Farrar, Esq.
Chairman, Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. John H. Buck
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Atomic Safety and Licensing Appeal Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. Lawrence R. Quarles
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Frederic S. Gray, Esq.
Acting Assistant Chief Hearing Counsel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Hon. George V. Begany
Mayor, Village of Buchanan
Buchanan, New York 10511

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Carmine J. Clemente, Esq.
New York State Atomic
Energy Council
99 Washington Avenue
Albany, New York 12210

David S. Fleischaker, Esq.
Roisman, Kessler and Cashdan
1712 N Street, N.W.
Washington, D.C. 20036

Secretary
U.S. Nuclear Regulatory
Commission
Washington, D.C. 20555
Attention: Chief, Docketing
and Service Section (21)

Hope M. Babcock

LeBOEUF, LAMB, LEIBY & MacRAE
Attorneys for Consolidated Edison
Company of New York, Inc. and
Power Authority of the State of
New York

IMBER

DIL. FAC. 50-3, 247, 286

The Legislature of Rockland County

County Office Building

New City, New York 10956

914-638-0500

BERNARD R. FALLON
Chairman

VICTORIA K. SEIGERMAN
Clerk

DOCKETED USNRC JUL 12 1976 Office of the Secretary Docketing & Service Section

June 22, 1976

Mr. William A. Anders, Chairman
Federal Nuclear Regulatory Commission
17920 Norfolk Avenue
Bethesda, Maryland

Re: Resolution No. 378 - Memorializing the Federal Nuclear Regulatory Commission Regarding the Indian Point Reactors.

Dear Sir:

The attached resolution was adopted by the Legislature of Rockland County at its June 15, 1976 meeting.

We would appreciate your using your good offices to implement the intent of this resolution.

Very truly yours,

Victoria K. Seigerman
Clerk to the Legislature

VKS:mu
Enc.

28 - DISTRIBUTION - To EDO for Appropriate Action. Cys to: Chairman, PE, OCA
GC, Secy, PA. RF 12

8B2

Reference No. 4278
6/15/76

RESOLUTION NO. 378 OF 1976
MEMORIALIZING THE FEDERAL NUCLEAR
REGULATORY COMMISSION REGARDING
THE INDIAN POINT REACTORS

Meehan/Colman/unanimous

WHEREAS, the Federal Nuclear Regulatory Commission (hereinafter referred to as NRC) is currently holding hearings as to whether the Ramapo Fault is a capable fault, and

WHEREAS, the Indian Point Reactors are located within 3000 feet of the Fault, and

WHEREAS, all of Rockland County lies within close proximity to the reactors, and

WHEREAS, the Health and Social Services Committee of the Legislature of Rockland County after hearing the testimony of Betsy Pugh, Secretary of the Environmental Council recommends that the Legislature adopt this resolution, now, therefore, be it

RESOLVED, that the Legislature of Rockland County urgently requests that:

1. The NRC initiate a coordinated effort to exchange information and research among all agencies that have a responsibility for predicting earthquake-prone structures so that all pertinent facts related to seismic research shall be uncovered.

2. The NRC should request in its 1977 Budget an appropriation of funds for seismic research so that it will no longer have to rely on private utility research.

3. The NRC conduct a study to learn whether the Indian Point reactors can withstand an earthquake of greater intensity than they were designed for.

4. The NRC institute a program of earthquake predictions so that scientists could forecast the time, place and magnitude of earthquakes and

(continued on reverse side)

---

*NOTE: Original illegible, retyped in the Office of the Secretary

ereby permit as much time as possible for Emergency Services to become
erative.

5. The NRC hold hearings concerning the Ramapo Fault near
the area of the Fault in order that those residents primarily concerned
ill be able to attend without suffering severe hardship,
nd be it further

RESOLVED, that the Clerk to the Legislature of Rockland County
hall send a copy of this resolution to the following individuals:

The Chairman of the Federal Nuclear Regulatory Commission

Honorable Jacob Javits

Honorable James Buckley

Honorable Benjamin Gilman

Honorable Linda Winikow

Honorable Richard Schermerhorn

Honorable Robert Connor

Honorable Eugene Levy

Betsy Pugh

nd to the Legislatures of the Counties of Orange, Putnam and Westchester.

6/18/76

DOCKETED USNRC JUN 24 1976 Office of the Secretary Docketing & Service Section

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
CONSOLIDATED EDISON COMPANY OF	)	DOCKET NOS. 50-3
NEW YORK, INC., and POWER AUTHORITY OF	)	50-247
THE STATE OF NEW YORK	)	50-286
(Indian Point Station, Units 1, 2 and 3)	)	(SEISMIC)

ADDITIONAL
AMENDED ANSWERS OF THE NEW YORK STATE
ATOMIC ENERGY COUNCIL (JANUARY 16, 1976)
TO CONSOLIDATED EDISON COMPANY OF NEW YORK,
INC., INTERROGATORIES OF NOVEMBER 17, 1975

1. We have not found any evidence that the Ramapo Fault has exhibited evidence of physical offset at or near the ground surface at any time within the past 500,000 years.

2. We have no evidence indicating that the Ramapo Fault has a structural relationship to faults presently known to be capable.

3. We do not rely upon any of our field work concerning the capability of the Ramapo Fault.

Respectfully submitted,

Leo Burd

Leo Burd
Associate Attorney
Department of Commerce
Atomic Energy Council

DATED: Albany, New York
June 18, 1976

State of New York
ATOMIC ENERGY COUNCIL
Department of Commerce
99 Washington Avenue
Albany, New York 12245

CHAIRMAN

COMMISSIONER OF COMMERCE

STAFF COORDINATOR
DR. WILLIAM E. SEYMOUR
DEPUTY COMMISSIONER
DIV. OF INDUSTRIAL SCIENCES
AND TECHNOLOGIES

June 18, 1976

Michael C. Farrar, Chairman
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dr. John H. Buck
Atomic Safety and Licensing Appeal Board
U.S. Nuclear Regulatory Commission
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Washington, D.C. 20036

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
Attention: Chief, Docketing and Service Section

RE: Consolidated Edison Company of New York, Inc. (Indian Point Station, Units 1, 2 and 3) Docket Nos. 50-3, 50-247, 50-286

Gentlemen:

Enclosed please find: (1) Testimony of Dr. James F. Davis, Dr. Paul W. Pomeroy, Dr. Robert H. Fakundiny, and Dr. Leo M. Hall on Behalf of the New York State Atomic Energy Council on Issue III; and (2) Additional Amended Answers of the New York State Atomic Energy Council (January 16, 1976) to Consolidated Edison Company of New York, Inc., Interrogatories of November 17, 1976; both documents dated June 18, 1976.

Sincerely,

Leo Burd

Leo Burd
Associate Attorney

Enclosures

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of	)	
	)	
CONSOLIDATED EDISON COMPANY OF NEW YORK, INC. and POWER AUTHORITY OF THE STATE OF NEW YORK	)	DOCKET NOS. 50-3, 50-247, 50-286
	)	(Show Cause - Seismic)
(Indian Point Station, Units 1, 2 and 3	)	

TESTIMONY OF DR. JAMES F. DAVIS,
DR. PAUL W. POMEROY,
DR. ROBERT H. FAKUNDINY, and
DR. LEO M. HALL
(PANEL)

ON BEHALF OF THE NEW YORK STATE ATOMIC ENERGY COUNCIL

ON ISSUE III

Filed: June 18, 1976

TESTIMONY ON ISSUE III

III. Capability of Faults at Indian Point or Vicinity

A. Introduction

The criteria for determining capability of faults as provided in Appendix A 10 CFR Part 100, Section III(g) are:

"(g) A 'capable fault' is a fault which has exhibited one or more of the following characteristics:

(1) Movement at or near the ground surface at least once within the past 35,000 years or movement of a recurring nature within the past 500,000 years.

(2) Macroseismicity instrumentally determined with records of sufficient precision to demonstrate a direct relationship with the fault.

(3) A structural relationship to a capable fault according to characteristics (1) and (2) of this paragraph such that movement on one could be reasonably expected to be accompanied by movement on the other."

Using these criteria, in 1973 the geotechnical advisors to the New York State Atomic Energy Council (NYSAEC) reviewed the Final Safety Analysis Report for Indian Point Unit No. 3 and concluded that more geologic and seismologic data were required in order to assess whether the Ramapo or other faults which pass near the site were capable of generating a damaging earthquake and to re-evaluate the determination of the Safe Shutdown Earthquake (SSE) accelerations needed for design based upon that assessment of possible capability. In 1974 the NYSAEC recommended to the

USAEC, now NRC, that new work be undertaken by Consolidated Edison, including new geological mapping and the establishment of an earthquake monitoring network in the vicinity of the plant and along nearby segments of the Ramapo fault. Geological mapping began in 1974 and the network became operational in 1975. Our current position is that the geological data filed by the licensee with the NRC to date, although voluminous, still leaves the question of capability open and that the seismological data, collected to date, suggests there is seismicity along at least portions of the Ramapo fault system such that continued assessment of capability is needed before the issue can be decided.

III-B Recent Movement on Faults at Indian Point

The geological investigations of the Indian Point site and its vicinity conducted by Consolidated Edison of New York, Inc. since the docketing of the Indian Point Unit No. 3 FSAR have been done by Dr. Nicholas Ratcliffe and by the Staff of Dames and Moore.

1. Ratcliffe (1975)

Patcliffe (1975) reported two new significant geological conclusions about Indian Point and its surrounding area. First there were faults at the site, that had never been reported before in all the geological discussions submitted by Consolidated Edison to the USAEC and NRC. Secondly there is a complex system of faults on both sides of the Hudson River in the area of the Hudson Highlands and that these fault sets had the same structural orientations and indications of sense of movement as those exposed at the site.

2. Dames and Moore (1975)

Dames and Moore (1975) report on a series of studies that attempt to determine whether any of the faults on site or in the vicinity were capable. The types of investigations fall into several different approaches including: (a) study of surficial material, (b) Hudson River bottom profiling, (c) fault plane mapping, and (d) study of fluid inclusions within calcite crystals found along these fault planes.

(a) The surficial geology mapping performed by Dames and Moore (1975), short of making many new exposures, is comprehensive for the area they set out to study. They re-examined many of the localities where there might have been possible recent displacement and found none. However, there is no report of their investigating the region around the Dec. 20, 1962 earthquake epicenter or the other epicentral locations along the Ramapo fault which are listed by Page and others (1968) and the area of the March 11, 1976 event. Before it is possible to conclude that there is no expression of recent fault movement disturbing surficial material, these localities would have to be examined.

(b) Seismic surveys in the Hudson River have revealed anomalies in the river sediments which resemble offsets. Further work adjacent to Iona Island and Lents Cove appears to be especially warranted by seismic reflection and bathymetry records presented in the Dames and Moore 1975 report. The information on these anomalies to date is inconclusive, and the possibility that they are the result of recent faulting has not been eliminated, as concluded by the review panel in its letter of January 12, 1976 (p. 6):

> "On the basis of the data available now, it is not possible to establish what their (the anomalies') origin is."

(c) The Dames and Moore report (1975, Plate B3-4) shows the presence of major on-site faults which have three distinct trends: generally east-west, northeast, and north-south. These faults are considered to be post-orogenic in age (Dames and Moore, 1975, p. B5.3-16) and related in trend to those post-orogenic faults reported by Ratcliffe (1975, p. 9) and shown in red by Ratcliffe (1975, Figure 1).

(d) The NYSAEC does not believe that the minimum age of fault movement at the site has been conclusively determined by fluid inclusion studies of calcite crystals found within fault planes. The conclusions reached by Consolidated Edison from study of undeformed calcite crystals has as its main basis the idea that after a calcite crystal generation has formed on some particular fault zone, any later movement on an adjacent or cross-cutting fault will deform that entire generation of crystals (Dames and Moore, 1976, p. k-1).

3. NYSAEC Conclusions about Recent Movement at the Indian Point Site

The position of the NYSAEC is that the capability of the Ramapo fault and the on-site and near-site faults remains an open question. There are possible offsets of river sediments and instrumentally determined macroseismicity associated with the Ramapo Fault, which suggest capability (Dames and Moore 1975, and Lynn R. Sykes, 1976).

III-C Instrumentally Located Earthquakes Geographically Associated With the Ramapo Fault

1. The history of instrumental association of earthquakes with the Ramapo fault begins with the work of Isacks and Oliver (1964). These authors, reporting on the regional seismicity of the New York-New Jersey area, reported seismic events within 300 miles of Ogdensburg, New Jersey--two of which may have been associated with the Ramapo fault. In 1968, Page, Molnar and Oliver reported that a network of seismic stations had recorded four small seismic events (including the two reported by Isacks and Oliver, 1964). According to Page, et al, those four events were:

Table III-C-1

Year	Date	Location	Lat.	Long.	Magnitude
1962	Oct. 13	near Pompton Lakes, N. J.	41.0°N	74.3°W	1.0
1962	Dec. 20	near Pompton Lakes, N. J.	41.0°N	74.3°W	2.0
			(40°58.3'	74°19.8')*	(2.9)*
1964	Nov. 30	near Peekskill, N. Y.	41.3°N	73.9°W	1.0
1966	May 21	near Spring Valley, N. Y.	41.2°N	74.0°W	1.0-1.5

* Information taken from testimony of Prof. Sykes.

The locations of these four events are shown on Exhibit 1 which also shows the location of the Ramapo fault as mapped at the time of Page, Molnar and Oliver publication. The geographical correlation is undeniable.

2. The September 3, 1951 event in Rockland County, N. Y. of Intensity V is located by Coffman and von Hake (1973) at 41.2°N 74.1°W.

Prof. Lynn Sykes, CCPE's witness on this issue has carried out a detailed analysis of the instrumental data using records from seismograph stations in Palisades, N. Y. and in New York City, and he has relocated the event at 41°11.7' N 74°11.7' W with a magnitude of 4.4 and an intensity of V. This location is on or near a major fault in the Hudson Highlands with a strike similar to that of the Ramapo Fault.

3. Consolidated Edison, at the NRC's urging, has installed a network of 12 seismic stations around the Ramapo fault on the east and west sides of the Hudson River. Data from the seismic stations are telemetered via telephone wires to a central recording system at Indian Point. A few stations of this network were in operation by June, 1975 and the network was considered to be fully operational by September 1, 1975. Information on the recordings of the network through March 11, 1976 has been transmitted to the NYSAEC (Cahill, 1976). The NYSAEC has not evaluated the data independently at this time. Several earthquakes have been recorded by this network as follows:

Table III-C-2

Earthquakes Located by the Consolidated Edison Seismic Network

Date	Origin Time	Location	Depth	Magnitude	Felt
1975 June 15	08:08	Wappingers Falls, N. Y. 41°34.80'N 73°50.63'W	5 km	2.0	
1975 July 19	20:59	Fahnstock State Park 41°25.80'N 73°47.25'W	3 km	---	Yes
1975 Aug. 22	17:49	Valley Cottage, N. Y. 41°06.62'N 73°56.45'W	6 km	---	No
1975 Oct. 24	07:04	Wappingers Falls, N. Y. Same as below	---	---	---
1975 Oct. 24	07:08	Wappingers Falls, N. Y. 41°37.32'N 73°58.54'W	5 km	2.0	
1975 Oct. 24	07:43	Wappingers Falls, N. Y. 41°35.55'N 73°55.99'W	3 km	2.2	
1975 Nov. 2	04:09	Wappingers Falls, N. Y. insufficient data to locate			
1975 Nov. 10	03:02	Greenwood Lake, N. Y. 41°10.71'N 74°22.70'W	5 km	1.8	
1976 Mar. 6	04:14	near Montrose, N. Y. 41°15.79'N 73°56.01'W	0 km	1.0	
1976 Mar. 11	21:07	near Pompton Lakes, N. J. (40°57.16' 74°21.20)* ±0.8 km	5 km (0±1.7 km)*	(2.5)*	(IV-V)*
1976 Apr. 13*		northeastern New Jersey* (40°50.3' 74°02.9')*	(0-3 km)*	(3.0)*	(IV-V)*

* Information taken from testimony of Prof. Sykes

The Wappingers Falls' earthquakes result from off loading of rock from the earth's surface associated with quarrying and are outside the range of interest here (Pomeroy, et al, 1976).

Probable earthquakes recorded by the Consolidated Edison network include the following:

Table III-C-3

Date	Origin Time	Location	Depth	Mag.
1975 July 16	06:43	Insufficient data		
1975 Aug. 19	15:56	Insufficient data		
1975 Sept. 5	14:27	Insufficient data		
1975 Oct. 2	20:27	Insufficient data		
1975 Oct. 5	14:31	Insufficient data		
1975 Oct. 8	15:46	Insufficient data		
1975 Oct. 8	19:02	Round Island in Hudson River $41^{o}17.84'N$ $73^{o}58.17'W$	0 km	
1975 Oct. 8	19:22	same as above event at 19:02		
1976 Feb. 12	14:47	Brewster-Carmel, N. Y. area $41^{o}20.63'N$ $73^{o}52.94'W$		<1.5

Thus, in approximately 3 months of partial operation, and 6½ months of reasonably complete operation, the Consolidated Edison seismic network has recorded 3 (and possibly 4) earthquakes and two probably earthquakes near the Ramapo fault system and its possible extensions.

4. The earthquake of March 11, 1976 southwest of Pompton Lakes, N. J. (see Sykes, 1976, Fig. 1) is particularly important since it is instrumentally well-located and was felt. There are reports of cracked walls and articles falling off shelves. In Bloomingdale, N. J., an observer reported that the event felt like a truck ran into the building and everyone inside ran out to see what happened. Prof. Sykes has obtained a composite fault plane

solution using data from this event, its aftershock, the December 20, 1962 event and the event of Sept. 3, 1951. Prof. Sykes indicates that "the solution involves predominantly strike slip faulting" and he states that "the fact that a composite solution fits the data from three earthquakes suggests that the mechanisms of the three events are in fact similar and that the composite mechanism solution is indicative of a regional pattern of stress."

It is instructive to consider the above in connection with the historic seismic record which shows several other events in the Pompton Lakes area and other events which could be associated with the Ramapo fault system (Davis, Pomeroy and Fakundiny, 1974). Exhibit 2 shows all the historic data on earthquake occurrences and recent instrumentally located earthquakes close to the Ramapo fault system. This figure shows events clearly associated with the Ramapo fault system and some historic events that appear not to be associated with the Ramapo fault system.

The occurrence of the March 11, 1976 event and the December 20, 1962 event instrumentally located geographically close to the Ramapo fault is certainly suggestive that the fault is capable since the events appear to fit at least one definition of 'macro' seismicity.

III-D Faults with Structural Relationships to Capable Faults

The third criterion for determining whether a fault is capable under Appendix A, Section III(g)(3) is:

> "A structural relationship to a capable fault according to Characteristics (1) and (2) of this paragraph such that movement on one could be reasonably expected to be accompanied by movement on the other."

The major fault system west of the Hudson River in southeastern New York is the Ramapo as shown on Exhibit No. 2 of this testimony. Classically, the Ramapo fault extends for more than 50 miles in a northeast direction from Peapack, New Jersey to the Hudson River at Stony Point, New York, just west of the Indian Point site. Along this trend the Ramapo fault system is a zone that forms the northwest boundary of the Triassic and Jurassic rocks of the Newark Basin to at least the New York State border (see Exhibit 2 of this testimony). The term Ramapo fault has been applied to the structure north of the State line where the fault system continues northeasterly but is separated into several major splays that trend subparallel to each other and pass into the Precambrian Hudson Highlands on both sides of the Hudson River (Ratcliffe, 1971).

Ratcliffe (1975) shows an intimate association of northeast-trending and north-south trending faults that occur in the Hudson Highlands on both sides of the Hudson River. These appear to be the continuation of the Ramapo fault system and are shown by Ratcliffe (1975) as red lines in his Figure 1.

The possibility of movement along faults east of the Hudson River is suggested by the microseismicity which has been recorded in that area by recently installed instruments (see testimony III-C above). While no correlation has been made between individual faults and this small number of events, this matter bears further investigation.

Because of their close proximity and similar structural alignment to post-orogenic faults mapped by Ratcliffe in the Hudson Highlands on both sides of the Hudson River, the faults mapped on site appear to have a relationship such that, if movement occurred on the Ramapo fault system, displacement could occur on a fault at the Indian Point site.

References Cited

Cahill, W.J. Jr., 1976, Letter to Mr. D.B. Vassallo, Chief, Light Water Reactor Branch No. 5, Division of Reactor Project Management from William J. Cahill, Jr., Vice President of Consolidated Edison Company of New York, Inc., dated April 12, 1976, with attached report: Third Quarterly Report - Con Edison Seismic Monitoring Network (December 1975 through February 1976).

Coffman, J.L. and von Hake, C.A., 1973, Earthquake history of the United States: U.S. Department of Commerce, Publ. No. 41-1 Revised edition (through 1970), U.S. Govt. Printing Office, Washington, D.C.

Davis, J.F., P.W. Pomeroy and R.H. Fakundiny, 1974, Statement of the New York State Geological Survey regarding licensing of Indian Point Reactor #3.

Dames and Moore, 1975, Supplemental Geological Investigation of the Indian Point Generating Station.

Dames and Moore, 1976, Letter from Joseph A. Fischer and Bernard Archer to Victor Gonnella, dated January 19, 1976, with Appendices K,L, and M to the Dames and Moore Supplemental Geological Investigation of the Indian Point Generating Station.

Isacks, B. and J. Oliver, 1964, Seismic Waves with Frequencies from 1 to 100 cycles per second Recorded in a Deep Mine in Northern New Jersey, Bull. Seismol. Soc. Am. 54, 1941-1979.

Page, R.A., P.H. Molnar, and J. Oliver, 1968, Seismicity in the Vicinity of the Ramapo Fault New Jersey-New York, Bull. Seismol. Soc. Am. 58, 681-687.

Pomeroy, P.W., D.H. Simpson and M.L. Sbar, 1976, Earthquakes Triggered by Surface Quarrying - The Wappingers Falls Sequence of June 1974 - to be published in Bull. Seismol. Soc. Am. June 1976.

Ratcliffe, N.M., 1971, The Ramapo Fault System in New York and adjacent northern New Jersey: a case of tectonic heredity: Geol. Soc. Am. Bull., v.82, 125-142.

Ratcliffe, N.M., 1975, Letter to Mr. Victor Gonnella, dated June 30, 1975.

Review Panel, Price, R.A., and Coates, D.R., 1976, Report of Review Panel on an Evaluation of the "Supplemental Geological Investigation of the Indian Point Generating Station" conducted by Dames and Moore for the Consolidated Edison Company of New York Inc., dated January 12, 1976 and accompanying Dames and Moore, 1976.

Sykes, L.R., 1976, Testimony of Dr. Lynn Sykes - The Capability of the Ramapo fault: Submitted on May 26, 1976, on behalf of the Citizens' Committee for Protection of the Environment to the Atomic Safety and Licensing Appeal Board.

The NYSAEC has evaluated the work done by Consolidated Edison in terms of on-site mapping and seismic monitoring. The following conclusions have been reached:

1. No unambiguous evidence of Holocene movement along faults has been established by the inspection of unconsolidated material and bedrock outcrops in the area. Thus these observations do not support capability.

2. Apparent offsets in the river sediment near the Indian Point site suggest Holocene movement and these phenomena must be further studied in order to form a firm conclusion regarding possible capability of faulting in the area.

3. New data support the premise that tectonic stress is being released along the Ramapo fault in macroearthquake events as stated in section III-C. This leads the NYSAEC to the following conclusions:

(a) Even though the NYSAEC believes that not enough data are available to make a definitive conclusion as to whether the Ramapo fault or other faults are capable, the NYSAEC believes there is a substantial body of evidence indicating there may be a capable fault at or near the Indian Point site.

(b) The NYSAEC recommends a series of studies in addition to seismic monitoring records. These would include: (1) examination of the apparent offsets in Hudson River sediments near the Indian Point site as indicated by reflection profiling, (2) examination of unconsolidated materials and bedrock exposures for offset in the epicentral areas of the 1951 intensity V event, the 1976 intensity IV to V event and other recent events, (3) rock stress measurements along the Ramapo fault and in the vicinity of the Indian Point plants, (4) continued operation of the seismic monitoring network for at least an additional two year period, (5) explore the feasibility of using the 12 station seismic monitoring network along the Ramapo fault to study the pattern of microseismicity and if possible, identify phenomena which could be precursors of large, damaging earthquakes.

(c) The NYSAEC believes that the on-site faults appear to be sufficiently associated with faulting that can be affected by movement on the Ramapo fault system so that if any fault set is capable, they all should be considered capable under criterion 3.

EXHIBIT 1

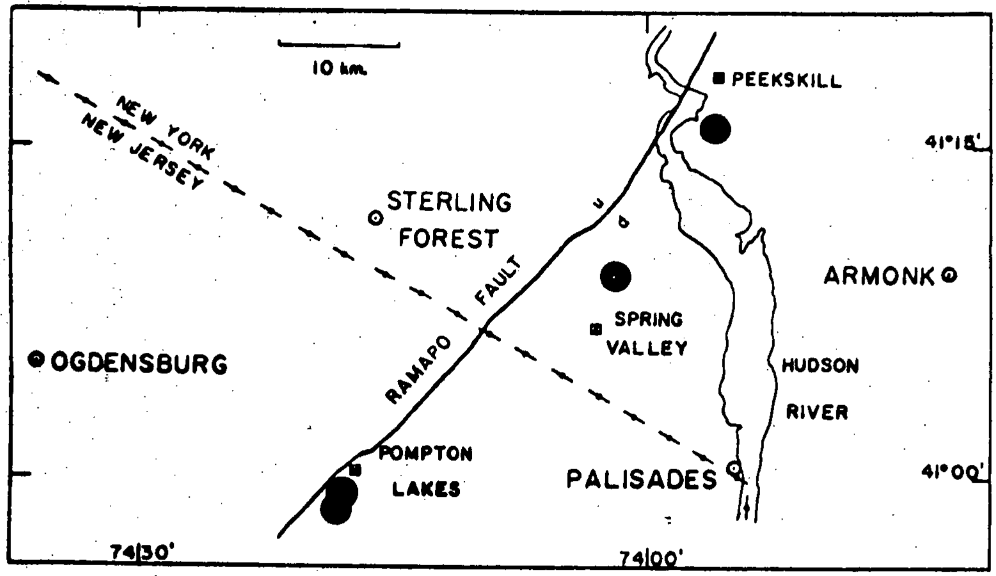
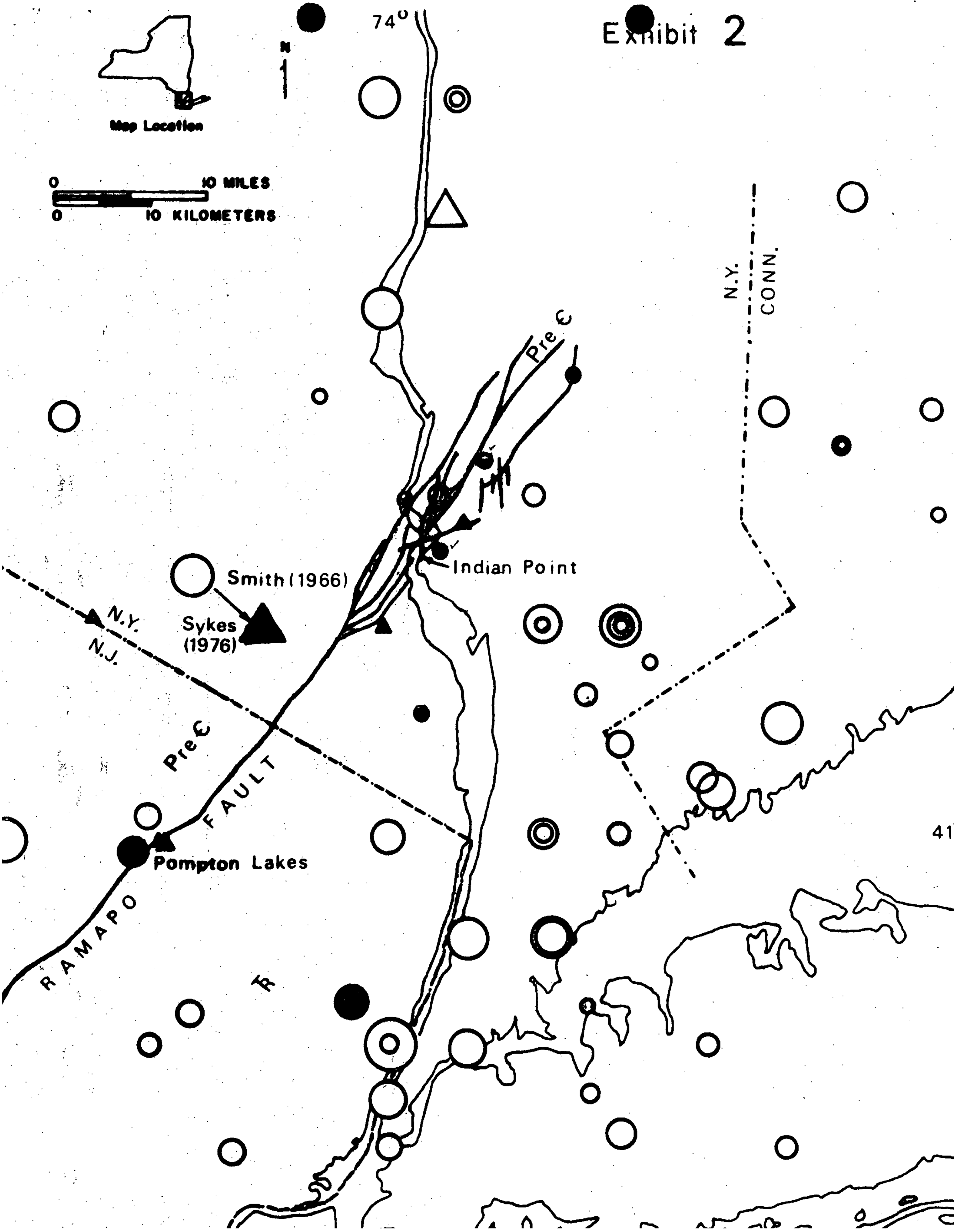


Fig. 1. Map of Ramapo Fault in the region of the New York-New Jersey border. Circles with dots are seismograph stations. Squares with crosses are larger towns in the area. Closed circles are instrumentally determined epicenters.

Exhibit 2


74°
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Map Location
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Indian Point
Smith (1966)
Sykes (1976)
N.Y.
N.J.
Pre Є
RAMAPO FAULT
Pompton Lakes
41

EXPLANATION OF EXHIBIT 2

Historical Earthquakes

Modified Mercalli Intensity Scale

I	○
II	○
III	○
IV	○
V	○
VI	○
VII	○

Epicenters are located at the centers of symbols. The numbers correspond to an accompanying event list. A question (?) after the number indicates an uncertainty in the epicenter location.

▲ Lamont-Doherty Geological Observatory Network*

△ Wappingers Falls events*

● Consolidated Edison Network

◒ Probable earthquakes

Size of △ or ○ is relative to Modified Mercalli intensity.

The undersigned, James F. Davis, being duly sworn, states that testimony has been prepared by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

James F. Davis

Subscribed and sworn to before me

this 18th day of June, 1976.

Notary Public, State of New York
My commission expires: 3/30/77

The undersigned, Paul W. Pomeroy, being duly sworn, states that testimony has been prepared by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Paul W. Pomeroy

Subscribed and sworn to before me

this 18th day of June, 1976.

Notary Public, State of New York
My commission expires: 3/30/77

The undersigned, Robert H. Fakundiny, being duly sworn, states that testimony has been prepared by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Robert H. Fakundiny

Subscribed and sworn to before me

this 18th day of June, 1976.

Notary Public, State of New York
My commission expires: 3/30/77

The undersigned, Leo M. Hall, being duly sworn, states that testimony has been prepared by me or under my supervision, and that the same is true and correct to the best of my knowledge and belief.

Leo M. Hall

Subscribed and sworn to before me

this 18th day of June, 1976.

Notary Public, State of New York
My commission expires: 3/30/77

5/13/76

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING APPEAL BOARD

In the Matter of CONSOLIDATED EDISON COMPANY OF NEW YORK, INC AND POWER AUTHORITY OF THE STATE OF NEW YORK (Indian Point Station, Units 1, 2 and 3)	)	Docket Nos. 50-3 50-247 50-286

CITIZENS' COMMITTEE FOR PROTECTION OF THE ENVIRONMENT'S REQUEST TO FILE AN AMENDMENT TO THE SUPPLEMENTAL TESTIMONY OF DR. LYNN R. SYKES, AND RESPONSE TO THE STAFF AND CON EDISON/PASNY REQUEST FOR EXTENSION

The purpose of this motion is to bring to the Board's attention new information regarding Issue #3 (The Capability of the Ramapo Fault) in the above-captioned proceeding, to request permission to amend the supplemental testimony of Dr. Lynn R. Sykes filed April 15, 1976, to incorporate the new information and to respond to the Staff and Con Edison/PASNY request for an extension of time in which to file testimony on Issue #3.

Dr. Sykes' Supplemental Testimony was an analysis of the March 11, 1976 earthquake which occurred in northeastern New Jersey. The new information concerns the need of possibly two corrections to the data from the stations in the Con Edison seismic network received by Dr. Sykes.[1/] First, it appears that the

1/ Dr. Sykes' analysis of that event is based on seismograms from these stations as well as others (See, Supplemental Testimony of Dr. Lynn Sykes, p. 1).

data should include a time correction of .25 seconds. The result of including a .25 second time correction in the analysis of the March 11, 1976 event is to move the epicenter of the earthquake approximately one and one-half kilometers in a northeasterly direction, parallel to the fault. Second, there is some question as to whether the polarities of the stations in the Con Edison seismic network are correct. If some of the polarities are reversed, it may be possible to obtain a discrete focal mechanism for the event.

At the time that Dr. Sykes performed his initial analysis, the information received from operators of the Con Edison network was: 1) that there was a zero time correction; and 2) that the polarities in the stations were correct. In addition, the copies of the seismograms received by Dr. Sykes did not contain a time correction. However ten days to two weeks ago, Dr. Aggarwald,[2/] in analyzing data of quarry blasts from the Con Edison seismic network, began to suspect that the data should contain a time correction. In rechecking with the operators of the Con Edison network, Dr. Aggarwald then determined that there was a .25 second time correction.

Dr. Sykes learned of this on May 7th. In rechecking all the data from the Con Edison network, and in particular data from large underground explosions, questions were raised concerning the polarities of some, if not all, of the stations. Dr. Sykes has requested persons connected with the network to check the polarities on the stations.

2/ A scientist at Lamont-Doherty Geological Observatory with whom Dr. Sykes has been working on this matter.

Dr. Sykes called the undersigned attorney to convey this information on May 11th. The attorney conveyed the information to the Staff and Con Edison that same day.3/

On the basis of the above information, CCPE requests this Board's permission to file an amendment to Dr. Sykes' testimony setting forth the revised location and the change, if any, in conclusions regarding the focal mechanism for the event. The testimony will be filed on May 17, 1976.

Second, CCPE opposes the Staff and Con Edison's request for an extension of time in which to file testimony on Issue #3.

Neither the Staff nor Con Edison/PASNY is prejudiced by complying with the May 14th filing requirement. The time correction and polarity question are two discrete considerations among many that are likely to be addressed by the Staff and Con Edison/PASNY.4/ Should either party wish to respond to the amendment, CCPE has no objection to the filing of such response provided, however, that any response be filed five(5) days in advance of commencement of the hearing on Issue #3.5/

3/ The information was relayed to the New York Geological Survey on May 12, 1976.

4/ See, for example, the matters generally considered by the Staff in the Safety Evaluation Report -- Supplement No. 3, pp. 2-1 through 2-7. And see the Testimony of Dr. Lynn R. Sykes (filed March 19, 1976) which includes: 1) an analysis of the Rockland County event; 2) a review of the relevant scientific literature; 3) an analysis of the microseismic activity in the region; and 4) an analysis of the probable driving mechanism underlying activity on the Ramapo Fault.

5/ Dr. Aggarwald was in contact with the Dames & Moore consultants shortly after learning of the timing error. (Indeed, the consultant wrote to Dr. Aggarwald to confirm their telephone discussion.) Thus Con Edison has had knowledge of this matter for some time. In addition, Con Edison consultants were advised that there might be some question regarding the polarity of the instruments on Monday, May 11th.

On the other hand, CCPE would be prejudiced by the granting of a two-week extension for the filing of testimony on Issue #3, as requested by Con Edison/PASNY.[6/] (CCPE has not seen the Staff request.) Until CCPE receives that testimony, neither the expert nor the attorney will know where to focus their efforts in preparation for this important issue.[7/] In contrast, the Staff and Con Edison/PASNY have had CCPE's main testimony for two full months. Further, Con Edison has had both access to and the experts to analyze the seismic recordings of the March 11th event since March 11th.

Finally, we submit that it is inappropriate that CCPE bear the scheduling burden resulting from the communication of inaccurate information from Con Edison consultants to CCPE consultants.[8/]

6/ CCPE proposed to Con Edison that CCPE file the amended testimony on Monday, May 14th and that the Staff and Con Edison file all testimony on Friday, May 21st. This proposal was not accepted.

7/ The Safety Evaluation Report gives some indication as to the basis for the Staff position; however, CCPE must await the filing of testimony to learn that basis for the Con Edison/PASNY position.

8/ CCPE in no way wishes to imply that Con Edison intended to mislead CCPE. We believe that the "slip-up" was unintentional.

Respectfully submitted,

Dated: 13th May 1976

David S. Fleischaker
ROISMAN, KESSLER & CASHDAN
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Counsel for Citizens' Committee
for Protection of the Environment

RELATED CORRESPONDENCE
DOCKET NUMBER
PROD. & UTIL. FAC. 50-3,247,286

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May 11, 1976

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Office of the Secretary
Docketing & Service
Section

BY HAND

David S. Fleischaker, Esq.
Roisman, Kessler and Cashdan
1712 N Street, N.W.
Washington, D.C. 20036

Re: Indian Point Seismic Show-Cause Proceeding

Dear David:

Please be advised that Consolidated Edison Company of New York, Inc. and Power Authority of the State of New York ("Licensees") confirmed on Monday, May 10, 1976 that Dr. Charles F. Richter will be called as a witness for the Licensees in the above proceeding on issue 3, the capability of the Ramapo Fault.

Dr. Richter is a principal in the firm of Lindvall, Richter & Associates, consultants in earthquake science and engineering, and maintains an office in Los Angeles, California. He is also a Professor Emeritus of seismology at the California Institute of Technology, Pasadena, California. Dr. Richter is the author of the textbook "Elementary Seismology" published by W. H. Freeman and Company (1958), co-author of "Seismology of the Earth" published by Princeton University Press (1954), and author and co-author of more than two hundred papers on seismology and related subjects. He is also a fellow of the Geological Society of America and the American Geophysical Union, and the originator of the Richter Scale.

Dr. Richter's curriculum vitae will be supplied as part of his testimony filed on Friday, May 14, 1976. To this extent, Con Edison's answers filed January 16, 1976 to CCPE's interrogatories numbers 27 and 28, served November 28, 1975, are hereby amended.

Sincerely yours,

Patrick K. O'Hare

Patrick K. O'Hare

cc: Michael C. Farrar, Esq.
Dr. John H. Buck
Dr. Lawrence R. Quarles
Collen K. Nissl, Esq.
Atomic Safety and Licensing Appeal Panel
Hendrick Hudson Free Library
Michael Curley, Esq. (via telegram)
Hon. George V. Begany
Secretary, USNRC