Stephen B. Bram
Vice President

Consolidated Edison Company of New York, Inc.
Indian Point Station
Broadway & Bleakley Avenue
Buchanan, NY 10511
Telephone (914) 737-8116

February 25, 1988

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

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Manhole 21

During the recent Safety System Functional Inspections at I.P. 2, the NRC posed questions concerning maintenance of cable separation and the qualification of three-way splices used in the subject manhole. Con Edison was requested to respond to the matters raised by the NRC by stating our basis for operation, as well as intended short term and long term actions.

Based on our analysis of available short term options, we have elected to initiate enhancements to the manhole. We believe this can be done in a timely manner within the next two weeks and that the existing splices will retain sufficient margin to preclude failure in this time period. Commencing Thursday, February 25, 1988, we have excavated the manhole and will replace the existing three-way splices and also provide further assurance that the cable routing in the manhole satisfies the applicable separation criteria. All three way splices associated with alternate safe shutdown pumps 23 and 24 will be replaced with a new splice ("crab joint") whose design is different than the existing splices. The fabrication and installation of the crab joint will be qualified by the use of procedures, the presence of Q.C. inspectors with specific inspection hold points, and by the utilization of personnel who have been pre-qualified in splicing techniques. In addition, a series of splice acceptance tests will be conducted to ensure that adequate mechanical strength is developed in the crimping process and that the electrical integrity of the completed splice has not been affected during fabrication.

We have evaluated the new splice with respect to its service in a wet sand environment. The most significant aspects of the splice design are those features which would prevent moisture intrusion into the mechanical splice itself. This consists of the Raychem heat shrink tubing and the EPR (Ethylene Propylene Rubber) insulation. Our Environmental Qualification files support the application of Raychem heat shrink tubing and EPR under post LOCA submerged conditions for a period of one year. The post LOCA environment is a much more severe environment than the conditions existing in manhole 21 under normal plant operation.

A041
1/1

Our selection of the new splice is predicated upon extensive satisfactory application of this splice in the Con Edison system for many years. Based upon this experience we anticipate that the actual splice life will be many years in excess of the post LOCA life of one year as currently supported by our Environmental Qualification files. To remove all doubt as to the actual life of the splice we intend to subject the splice to accelerated testing in an environment which simulates the conditions of manhole 21. This testing will be completed prior to one year so that if results conflict with our expectations appropriate corrective action can be pursued.

Both the cable and the new splices for pumps 23 and 24, as well as the other four feeders, will be meggared to demonstrate the acceptability of the existing cable and the new splices. Future periodic tests to determine whether degradation has occurred are under evaluation.

The cable routing will be inspected to ascertain compliance with our cable separation criteria. A conservative bounding analysis indicates a minimum separation between cables of 4" is required without arc-proofing tape. We have elected to use arc-proofing tape, which reduces the required separation distance to 1 3/4". To the extent possible within the confines of the manhole, cable separation will be maximized. The arc-proofing tape consists of a polyvinyl chloride cloth impregnated with a fire retardant substance. Qualification of the arc-proofing tape has been demonstrated by short term "tidewater" tests which simulate service under submerged brackish conditions. As applied at Indian Point, (two layers half-laped), the tape induces no adverse affects upon the cable such as loss of heat dissipation.

It should be noted that it is considered highly unlikely that an arcing fault could take place within the manhole under a normally wet sand filled condition. Were a fault to develop in the manhole the fault would be to ground, resulting in automatic relay operation. The relays are set to operate for a 500 ampere fault.

In addition to the above actions, all cables will be labeled, the sand will be replaced and the manhole cover modified to prevent water intrusion.

For the longer term, all of the cable routing and splices within the manhole are under evaluation. There may exist feasible alternative configurations involving new cable runs which would further enhance feeder reliability. The new cable pulls, with new cable routing, might possibly eliminate the three way splice altogether as well as further enhance cable separation. The overall benefit of such alternatives would have to be considered relative to the additional benefits already achieved by the short term program. A schedule for completion of our analysis of the options will be available within a month.

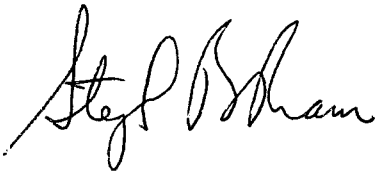
Questions have also been asked with respect to the number of service water pumps necessary for various conditions of operation. For fire protection, in order to proceed to cold shutdown, either pump 23 or 24 should be operable. If these pumps are not available the plant would stay at hot shutdown until a pump was operable. For the accident scenario, peak containment pressure is the most significant consideration. The I.P.-2 Containment Spray pumps are capable of removing the heat load during the injection phase and no service water pumps are required. For the accident

with a loss of offsite power, the minimum requirement for the essential header must be satisfied. Two service water pumps must be available.

We believe the above discussion is responsive to the issues that we were asked to address. Attached hereto is documentation supporting the basis for the short term program.

If there are any questions concerning this letter please contact Mr. Jude G. Del Percio, Manager, Regulatory Affairs.

Very truly yours,



cc: Ms. Marylee M. Slosson
Project Directorate I-1
Division of Reactor Projects I/II
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Paul Swetland
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

E. Wenzinger
Region I
U.S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, PA 19406

Senior Resident Inspector
P.O. Box 38
Buchanan, NY 15011

ATTACHMENT

The attachment is a very conservative bounding analyses. Among other things it assumes maximum power transfer to fault, takes no credit for realistic clearing time (7 cycles verses 17 seconds) and quenching effect of moist sand.

ATT. Tom Wong

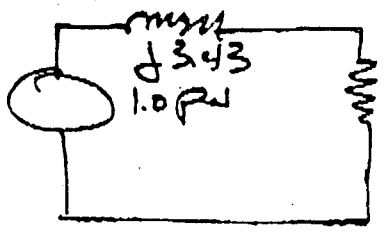
FAULT AT 480 VOLT BUS. FOR SERVICE WATER PUMP MOTORS.

$$I \text{ PER UNIT} = \frac{35{,}000}{120{,}000} = .29 \text{ P.U.}$$

$$Z = \frac{V}{I} = \frac{1.0}{-j.29} = j3.43 \text{ P.U.}$$

MAXIMUM POWER TRANSFER

Z SOURCE EQUAL TO ~~Z~~ FAULT.



$$Z = 3.43 + j\,3.43 = 4.85 \angle 45°$$

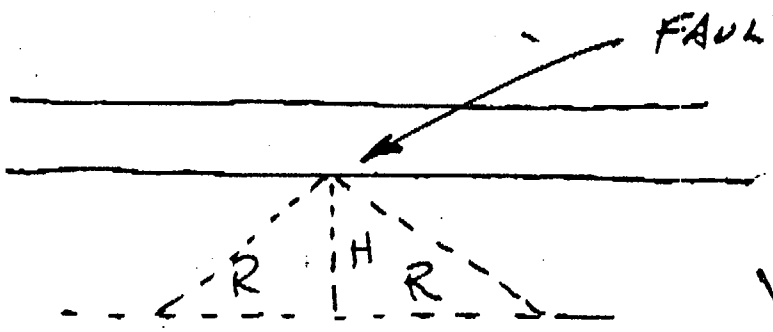
$$I = \frac{1.0}{4.8 \angle 45} = .2062 \angle -45°$$

$$P = I^2 R \cdot (.2062)^2 (3.43) = 14.58 \text{ PU.}$$

$$P_{ACT} = P_{PU} \times P_{BASE} = (14.58)(100 \text{ MW})$$

$$= 14.6 \text{ M WATTS.}$$

FAULT EXPOSURE FROM ONE CABLE TO ANOTHER IS THE VOLUME OF A CONE



$$V = \frac{\pi}{3} R^2 H$$

$$2H = R$$

$$V = \frac{\pi}{3} R^2 \frac{R}{2} = \frac{\pi}{6} R^3$$

MAXIMUM SEPARATION FOR NON ARC PROOFED CABLE

$$Q = mC\Delta t$$

$$\Delta t = \frac{Q}{mC}$$

WHERE:

m = MASS

C = SPECIFIC HEAT

Δt = TEMPERATURE IN °F

Q = BTU.

FOR WET SAND

$m = 120 \text{ lb/ft}^3$

$C = .35 \text{ BTU/lb/°F}$

1 KWH = 3412 BTU.

WORST CASE FAULT : 14.6 MW. WITH CLEARING TIME OF 7 CYCLES (.1169 SECONDS)

$$\frac{14{,}600 \text{ KW} \times .1169 \text{ SEC}}{3600 \text{ SEC/HR}} = .474 \text{ KWH.}$$

$$Q = .474 \text{ KWH} \times 3412 \text{ BTU/KWH} = 1617 \text{ BTU'S}$$

750 MCM CABLE MAX. ΔT FOR ETHYLENE PROPYLENE RUBBER IS:

MAX OPERATING TEMP: 90 °C
MAX SHORT CIRCUIT: 250 °C
$\Delta +$ = 160 °C

$\Delta + = (160)\ 9/5 + 32 = °F$

$= 320° F$

TO DETERMINE MINIMUM DISTANCE BETWEEN ~~ARLF~~ UN ARC PROOFED CABLES IN WET SAND ENVIRONMENT.

$$\Delta T = \frac{Q}{mc}$$

$$m = \frac{Q}{}$$

$$m = \frac{1617}{(.35)(320)} = 14.4 \text{ lb/ft}^3$$

ASSUME FAULT EXPOSURE IS CONICAL

$$V = \frac{14.4 \text{ lb}}{120 \text{ lb/ft}^3} = .1203$$

$$.1203 = \frac{\pi}{6} R^3 = .526 R^3$$

$$R^3 = .2297$$

$$R = .6124 \text{ ft}$$

$$R = .6124 \text{ ft} \frac{12 \text{ in}}{\text{ft}} = 7.35 \text{ in}$$

$$R/2 = H = 3.68 \text{ in}$$

$$H = 3.68 \text{ inches}$$

SEPERATION REQUIRED IS:

4" BETWEEN 750 MCM EPR CABLE NONE ARC PROOFED.

WITH ARC PROOFING TAPE
17 SECONDS AT 3400 °F

$$m = \frac{1617}{(.35)(3400)} = 1.358$$

$$V = \frac{1.358}{120 lb/ft^3} = .01132\ ft^3$$

$$V = \frac{\pi}{6} R^3 = .01132$$

$$R^3 = .02163$$

$$R = .2786\ ft$$

$$H = R/2 = \frac{.2786}{2} = .1393\ ft$$

$$H = .1393\ ft \times \frac{12\ in}{1\ ft} = 1.672\ inches$$

SEPERATION REQUIRED WHEN ARC PROOFING TAPE IS USED

1.75" INCHES BETWEEN CABLES

WITH ARC PROOFING TAPE
17 SECONDS AT 3400 °F

$$m = \frac{1617}{(.35)(3400)} = 1.358$$

$$V = \frac{1.358}{120 lb/ft^3} = .01132\ ft^3$$

$$V = \frac{\pi}{6} R^3 = .01132$$

$$R^3 = .02163$$

$$R = .2786\ ft$$

$$H = R/2 = \frac{.2786}{2} = .1393\ ft$$

$$H = .1393\ ft \times \frac{12\ in}{1\ ft} = 1.672\ inches$$

SEPERATION REQUIRED WHEN ARC PROOFING TAPE IS USED

1.75" INCAES BETWEEN CABLES