ACHILLES' HEEL

About those Indian Point Guerrillas...

DAILY NEWS: "A multimillion-dollar fire that wrecked an auxiliary building at Consolidated Edison's nuclear generating complex on the Hudson River south of Peekskill Nov. 4 was determined yesterday to have been deliberately set...it was learned that a 'prime suspect' has been identified and an arrest is expected shortly."

They're bluffing. They don't have the slightest idea which guerrillas did this!

* * *

On November 4, 1971 a fire caused approximately $10 million of damage to electrical equipment in connection with the construction of Consolidated Edison Company's new nuclear power plant No. 2 at Buchanan, N.Y. The cause of the fire was described as "suspicious" and "possible arson" by police and insurance officials. In the meantime, two conservation groups had petitioned the AEC to stop construction of nuclear plant No. 3 contending that the Indian Point area cannot take the impact of three nuclear plants and two additional nuclear plants planned for the future. The arrogant criminals of the AEC and Consolidated Edison conspired to go ahead with construction although a full environmental review of the facility had not been completed. Such legal machinations by lawyers representing environmental groups are naive and utterly ineffective. If the American people wish to save themselves and their children from murder planned by the AEC and the utility companies, including designers and constructors of nuclear power plants, it will require more positive methods such as sabotage or arson. Here is why.

Albert Speer, Hitler's Minister of Armaments, in a recent Playboy interview stated, "There is, unfortunately, no necessary correlation between intelligence and decency; the genius and the moron are equally susceptible to corruption." Capitalist America produces more than 50% of the world's goods and is literally trampling upon the Earth, polluting the air, water and earth with wastes from its industries. There may be only 30 years left to control "normal pollution,"but the pollution is reversible and can be stopped, although we stand at a point where the very survival of man is being threatened.

However, there is one form of pollution that is not reversible or controllable and is the ultimate catastrophe awaiting life and the environment on this planet. And that is "radiation pollution!" Aside from a nuclear war, which would completely destroy all life, the next most dangerous "radiation pollution" is that radioactivity resulting from the industrial use of atomic energy for electric power generators. These atomic power reactors are so dangerous that insurance companies will not cover them; Congress pays $500 million of insurance on each plant in case of a nuclear accident. The dangers from the so-called peaceful uses of atomic energy stem from three sources: the possibility of

2/25 JTK JN VR

50-247 incident

a nuclear accident, the disposal of nuclear wastes and the dispersal of radioactive gaseous wastes to the air at the site or discharge into water including thermal pollution of nearby lakes and rivers.

Government Frankenstein scientists-engineers of the Atomic Energy Commision, including the criminals of the Congressional Joint Committee on Atomic Energy, have been stifling any criticism of the atomic energy program and have purposely lied in order to underestimate the risks from nuclear radiation. The AEC had arbitrarily set a radiation tolerance of 0.17 Rads (Radiation Absorbed Dose) per year as a permissible radiation dosage for human beings. John Gofman, a professor of medical physics at Berkeley and a research associate of the AEC's Lawrence Radiation Laboratory, disagreed with this arbitray determination and stated, "The statement that there's some number that's safe is an absolute, unmitigated lie." Scientists such as Ernest J. Sternglass, professor of radiation physics, have contended that nuclear reactors at Indian Point and at Brookhaven National Laboratory have increased infant mortality in the surrounding areas.

Accidents with serious release of radioactive material into the environment have occurred in England and America. In 1969 the reactor core of the Enrico Fermi breeder-test plant near Detroit melted down when a coolant line became clogged. On May 11, 1969 a plant located in Rocky Flats near Denver, Colorado had a fire that burned $20 milion worth of plutonium. This AEC plant fabricated plutonium into nuclear triggers for hydrogen bombs. There is a long history of explosions, fires and plutonium spills occurring at this plant with many workers overexposed to plutonium. AEC-sanctioned nuclear enterprises have contaminated the Colorado River, Lake Mead, Great Salt Lake and the Columbia River. It was the AEC criminals who permitted the removal of more than 300,000 tons of uranium mill tailings to be used as construction fill in towns like Grand Junction, Colorado. With a history of criminal negligence going back to the 1940's, can we accept the word of the AEC concerning the safety of nuclear reactors when such reactors have shut down due to "malfunctions" in Michigan, New Jersey, New York and Minnesota?

Consider the subject of the burial of radioactive wastes from nuclear reactors in special AEC storage caves or in barrels dumped far out to sea. At the proposed atomic waste disposal dump near Lyons, Kansas of an abandoned salt mine, geologists found that water could seep into the atomic burial areas. Geologists contend that such areas must be water free; if not, the salt may dissolve and allow radioactivity from the nuclear waste to move to the surface. Some subterranean emissions may continue for hundreds of thousands of years. In the town of Lewiston, near Niagara Falls, federal radiation experts found radioactive "hot spots" in a field where contaminated radioactive equipment (tank drums, pipes, etc.) were stored. The level of radioactivity showed some levels of 5 millirads an hour whereas the AEC considers 1 millirad an hour the maximum permissible level. The magazine Ecologist has pointed out that of 183 atomic waste storage tanks in the states of Washington, South Carolina and Idaho, nine have failed so far! These failures occurred less than 20 years and yet the contents of the tanks are utterly lethal for thousands of years.

The loss of the nuclear submarine Thresher in 1963 contributed to the radioactive pollution of the oceans. The oceans are being polluted through leaks and discharges from atomic ships and power plants. Embryo fishes with deformed backbones have been found in the Irish Sea due to theradioactive pollution caused by the Windscale nuclear power station on the British coast. A Dr. Jerold M. Lowenstein of the University of California Medical Center at San Francisco stated, "Every living thing on and under the sea is being poisoned with radioactive wastes." Containers of high-level radioactive wastes mixed with concrete are being dumped into international waters whose hazards are yet to be reckoned with by future generations. Lord Ritchie-Calder, president of the Conservation Society of England in an interview on Nov. 23, 1968 stated, "When scientists and decision-makers (read capitalists and AEC) act out of ignorance and pretend it is knowledge, then they are putting the whole world in hazard."

There are 22 conventional nuclear-powered plants now in operation in the U.S. These reactor plants are of the boiling-water type where the heat of a reactor is used to convert water into steam, which then drives turbine generators to produce electricity. A new type breeder-reactor is being developed that also uses fission to make both steam and more fissionable material such as plutonium 239. In these breeder plants, liquid sodium would be used to carry the heat from the reactor to the plant's turbo-generators. However, extreme caution must be used to keep the sodium from coming in contact with air or water, as it bursts violently into flame on contact. Another danger is that breeder plants tend to clog and cause melting of the core, as happened in the Enrico Fermi plant. But the AEC decision makers are very optimistic that these reactors can be designed and built to keep these catastrophes from happening. Boiling-water reactors depend on emergency coolant waters to reach the reactor core to prevent a melt down. Recent tests conducted in a mock-up reactor last November and December (1970) at Idaho Testing Site showed that in <u>six</u> straight tests, where the plant's primary cooling loop was ruptured, the emergency coolant waters failed to get through to the reactor because of steam accumulations. Ralph E. Lapp, a nuclear physicist, stated that <u>future</u> nuclear power plants should be designed and constructed to insure that the coolant reaches the reactor core within <u>ten</u> seconds. Any longer, he contends, might mean a violent chemical explosion that could spread radioactive materials for miles. If this is true of the boiling-water type reactor, imagine the extreme danger that would result from liquid metal fast breeder reactors where no coolant, like water, can be used under any circumstances.

Why has the AEC spent more than $600 million on the development of liquid metal fast breeder reactors? The reasons are that by the end of the century the world's available supply of uranium may be exhausted. The fast breeder reactor, which converts uranium 238 to plutonium 239, is expected to produce enough plutonium 239 not only to replenish itself but also produce enough for another reactor (boiling-water type) over a period of 20 years.

In the U.S. the total electric utility installed capacity as of Dec. 31, 1970 amounted to 335 million kilowatts. Of this total, 7.5 million kilowatts are operable nuclear plant capacity. 44 million kilowatts

representing 53 nuclear plants are presently being constructed. 35 million kilowatts representing 36 nuclear plants are planned (reactors ordered).

Between 1970 and 1990 the utilities are expected to increase their capacity from 335 million kilowatts to 1.1 billion kilowatts. In 1969 the AEC estimated that this additional capacity will require at least 255 new sites of 500,000 kilowatt plant capacity, of which 164 are expected to be nuclear plants. In the Northeast alone, about 100 nuclear plants will have to be built where fewer than ten are now operating. If these plans are carried out, every major body of water in the Northeast will be rimmed with nuclear plants.The total estimated cost for all new utility construction is somewhere between $300 million and $350 million.

Government investment in fission research for 1971 amounted to $103 million whereas its investment in fusion research amounted to $28 milion, which had to be reduced by $400,000 from the previous year. By this determination the government had indicated its preference for "radiation pollution" in attempting to get a demonstration breeder system by 1980 rather than invest in obtaining a positively "clean" reactor which is only possible under the fusion process.

There are at least ten fusion reactions being considered for reactors. In one of the fusion reactions, light atoms such as deuterium and tritium, which are forms of hydrogen, are fused or combined to form heavier atoms such as helium and a single neutron which is ejected at 14.1 million electric volts. To gain energy from this process, the neutron penetrates and heats a lithium blanket around the reactor which is then circulated through a heat exchanger to produce steam for power generation. Unlike the fission process which is "dirty" and manufactures a variety of "radioactive" by-products dangerous to man, fusion is a "clean" process and produces no "radioactive" material at all.Fission involves the splitting of atoms and is so incredibly complex that it requires nonstop monitoring by automatic instruments and nonstop monitoring of the instruments by men. At the end of the fission reaction the spent fuel is so dangerous that it must be stored in underground tanks for hundreds of years. Despite this, truckloads of this waste are driven through towns.

In fusion processes there is no danger whatsoever of a "runaway" or "accident" as is possible in a fission plant where the core can melt and release radioactive fumes. Fusion, on the other hand, is so dependent on a difficult to achieve combination of factors that any accident would shut down such a plant, not turn it loose in a rampage. There is another gain or asset from fusion reactors in that they may "burn up" some of the radioactive wastes from fission reactors, and also there would be reduced thermal pollution because of improved efficiencies from use of high temperatures and direct conversion to electricity.

There has been significant progress made in controlled fusion research within the last few years in both the Soviet Union and the U.S. The best estimates are that a fusion demonstration reactor could be constructed by 1985, sooner with a crash program, and with significant commercial impact by the year 2000. If the difference in achieving a breeder reactor by 1980 and/or a fusion reactor by 1985 amounts to a bare 5

years, then the emphasis placed by government and industry on the "radiation pollution" breeder plant is nothing less than murder.

Until such time as fusion reactors are developed on a commercial scale, all fission plant research, development and construction must be stopped, and all existing fission plants must be dismantled or destroyed or sabotaged as occurred recently at the Indian Point plant. The murder must be stopped by any means since the arrogant morons and "genius"-hoodlum scientist-enigineers will not listen to any logical, scientific studies or pleas showing that their activities are detrimental to mankind. Research companies such as General Electric, Westinghouse, Babcock and Wilcox and Bechtel Corporation must cease work on fission research or they will be held accountable for their crimes. The scientist-engineers employed on such projects should seek other employment or transfer to non-nuclear research. Anarchistic science (!) coupled with anarchistic capitalism(!) will not be tolerated.

The development of non-nuclear conventional plants such as hydroelectric or steam plants using low sulphur content coal will be permitted to be constructed. However, the control of pollution at these plants must be so rigid as to prevent arrogant bastards from violating strong anti-pollution laws. Federal, state or local boards responsible for cleaning up the country's air and water pollution must not be permitted to continue to cover up for the criminals. They, in fact, are the representatives of the corporations who have been destroying the environment. These corporations have planted their stooges on 35 state boards and have, in fact, increased pollution. Air pollution has increased within the last four years from 142 million tons of contaminants to well over 200 million tons.

As the president of the Monsanto Enviro-Chems Systems recently stated, "We are all living in a fool's paradise if we think that industry will do anything until it is forced to."

<u>The time has come to force them</u>.

The effective guerrilla attack on Con Ed's Indian Point Nuclear Plant No. 2 indicates that some people agree with this. It also indicates that they know the right time and place.

(Pass this on.)

Issued by

<u>Project</u>: <u>Achilles</u>' <u>Heel</u>

William J. Cahill, Jr.
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-3819

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

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Morris

In our report of December 6, 1971 we described the electrical splices to be used in the repair of cables affected by the fire of November 4, 1971. In Section C of that report we stated that the outside of each splice would be covered by a fire resistant heat shrinkable tube to provide fire protection equivalent to the cable outer jacket. We also stated that completed sample joints would be subjected to the same fire tests as the original cable.

When these tests were made it was found that the fire resistance of the splice could be significantly improved by placing another fiberglass sleeve over the fire resistant heat shrinkable tubing. The reason for this is that in some cases when subject to very intense flame the original heat resistant tubing, although it did not burn, did tear after a short time and expose the splice materials beneath it to the flame.

We have conducted extensive fire tests in accordance with our original report on the modified splice and conclude that the fire resistance of the splice in all cases is superior to the original design and indeed is superior to the unspliced cable with its Asbestos braid jacked uninterrupted. For this reason we plan to modify the splicing and terminating instructions in our December 6, 1971 report by adding the following general note.

16. All splices will be covered with Hygrade Thermoflex Flexible Fiberglass sleeving. This sleeving will overlap the cable asbestos jacket by at least two inches and be tied at each end with fiberglass cord.

2/1 KK VJ JK RS JK JN RC JH

Resulted from CO'I Action
Licensee wasn't going to perform flame test
until CO'I urged them

50-247 regular

The addition of the fiberglass sleeving will not reduce the thermal rating of the cables nor will it produce congestion in the splice boxes because in spite of its excellent fire resistant characteristics it is very thin and does not significantly affect the diameter of the splice. The fiberglass sleeving conforms to NEMA standard VSI-1962 and is closely woven to provide maximum abrasion resistance and high flexibility.

Very truly yours

William J Cahill Jr.

William E. Caldwell, Jr.
Vice President

Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003
Telephone (212) 460-5181

December 6, 1971

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

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Dr. Morris

We submit for your review the enclosed Indian Point Unit No. 2 report entitled, "Restoration Plan for Primary Auxiliary Building and Equipment" which details the program being conducted by the Consolidated Edison Company to repair the damage sustained by the facility as a result of the November 4, 1971 fire incident. This report is submitted as a supplement to the various correspondence and communciations between the Consolidated Edison Company and the Atomic Energy Commission since November 4, 1971.

As we advised in our letter of November 24, 1971, it is our intention to restore the primary auxiliary building and its equipment to the conditions which preceded the fire and to meet in all respects the Unit No. 2 Final Facility Description and Safety Analysis Report. The enclosed report discusses the effects of the fire, the repair program in progress and the associated test program to assure ourselves that the safety and reliability of the facility will be preserved in accordance with the approved design.

We are presently revising the Unit No. 2 schedule for subcritical testing taking into consideration the effects of the fire and the repair program setforth in the report. We will review the planned execution of these tests with the Divisions of Reactor Licensing and Compliance prior to their commencement.

Con Edison now estimates that it will take about three (3) months to complete repairs of the November 4, 1971 fire damage in the Primary Auxiliary Building (PAB). Work is scheduled for completion by March 1, 1972 with criticality scheduled for April 1, 1972.

Our Nuclear Facilities Safety Committee has maintained a continuing review of the activities that are being conducted at the Unit No. 2 facility with regard to the repair operations to assure itself as to the adequacy of the efforts undertaken. The Committee has concurred with the restoration program described herein.

enc.

Very truly yours

William E Caldwell

LK - 1/10 RC - 11/26
VT - 1/10 FN - 11/16
RF - 12/8 JH - 11/30
JK - 12/16

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COPY SENT REGION

INDIAN POINT STATION UNIT NO. 2

RESTORATION

PLAN FOR PRIMARY AUXILIARY BUILDING & EQUIPMENT

DECEMBER 6, 1971

Consolidated Edison Company, Inc.

4 Irving Place

New York, New York 10003

8110210204

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SECTION A

Indian Point Unit No. 2 Fire

Summary and General Description

Previous correspondence with the Atomic Energy Commission described (1) the circumstances leading up to, and resulting from the occurrence as well as an evaluation of the safety implications of the November 4, 1971 fire in the Indian Point Unit No. 2 Primary Auxiliary Building (PAB) and (2) the intention of the Consolidated Edison Company to restore the PAB and its equipment to the condition which preceded the fire and to meet in all respects, the Indian Point Unit No. 2 Final Facility Description and Safety Analysis Report. Also, at prior meetings with the Commission, the restoration program, as detailed in this report, was discussed and reviewed.

It is highly improbable that an incident of the nature of the November 4, 1971 fire can occur during operation since fire hazards such as the wooden shed in which the fire occurred have been removed. Flammable maintenance sheds will not be permitted in buildings having plant functions. Compartments that are required in these buildings for storage of tools, spare parts or other maintenance items will be made from steel plate, expanded metal lathe or other non-flammable material. Also, flammable materials will be stored in specially designated areas of the plant and a minimum inventory will be maintained. For example, a minimum quantity of hydrazine for use in Indian Point Unit No. 1 and Unit No. 2 will be stored in the conventional plant area of Unit No. 1 at a location where a fire would not involve the nuclear plant equipment of either unit. Frequent inspections by operating personnel, as well as audits by the Company's Safety Services Bureau and the Nuclear Facilities Safety Committee, will assure compliance with this requirement.

Thus, we have taken steps to prevent a recurrence of a similar fire during operation. In addition, the plant is designed for a safe shutdown in the event of a fire or similar incident. The November 4, 1971 incident showed that the electrical cable is flame resistance and does not propagate fire. We have reviewed the circumstances during and after the fire and are convinced that the plant would shut down safely from power if the fire occurred during operation.

We have reviewed the appropriateness of making design changes to attain greater separation of electrical equipment and have concluded that such changes would require virtual redesign of the plant's control and electrical systems, involving impracticable rearrangements of equipment and structures while not contributing significantly to the safety of the plant. The Control Rod Scram System is designed to assure ability to scram even under contingencies such as a fire, and the inherent ruggedness of the basic plant design provides core cooling after scram by natural circulation and permits manual execution of the simple steps needed for safe shutdown. Alternate means for injecting feedwater and borated makeup water, even if normal modes are out of service, assure long-term safe shutdown under abnormal contingencies.

A summary and general description of the proceeding report sections follows:

Section B - Fire Effects

This section lists the equipment affected by the fire in the PAB. The lists were complied as a result of a comprehensive program to ascertain those components that could have been damaged by the fire. Visual inspections, calibrations checks, megger tests, local functional tests, etc., were utilized in determining which components were effected. Sections C and D of this report also discuss supplementary methods employed to determine the fire effects sustained by the plant's structures and components.

Section C - Repair of Electrical Damage

This section discusses the repair procedure to be used for the electrical cables and equipment damaged by the fire. Included are the splicing specifications, tools to be used, test procedures and the proof test to be employed. Alternate repair methods are also discussed.

Section D - Structural and Mechanical Effects and Investigation of Potential Chemical Effects

This section discusses the non-destructive investigative program implemented to ascertain those structural and mechanical components affected by the fire environment and the associated repair program. Although the plans for non-destructive and laboratory testing have been developed, tests results have largely not been received to date. The program to determine whether there were chemical effects to otherwise unaffected components is also discussed in this section.

As the final step in the restoration program we will perform an operational retest on every system or component that was subjected to the fire environment. This retest program will serve as a final check on the inspection and repair programs carried out to restore the plant to its completed state in full accordance with the original design criteria and the rules and regulations of the Commission.

SECTION B

Indian Point Unit No. 2 Fire

Fire Effects

The following local control panels on El. 80' and 98' appear to have suffered only smoke and water exposure and are usable. These are to be checked out and cleaned as necessary to be put in good condition:

A. Charging Pump Local Controls
B. Heat Tracing Distribution Panels
C. Heat Tracing Annunciator Panels
D. Gas Stripper Panel
E. Waste Evaporator Panels
F. Gas Analyzer Panels
G. Waste Evaporator Main Control Board
H. Drumming Room Panel

The following items have been identified as being effected to the extent they must be renovated or replaced.

A. MCC 26A
B. MCC 26B
C. MCC-27
D. Lighting Distribution Panel 22
E. Lighting Distribution Panel 211
F. Lighting Distribution Panel 213
G. 480 Volt Lighting Distribution Panel 23
H. Boric Acid Tank Heaters (4)
I. Lighting Switchgear and Transformers
J. All Electrical Cable on EL. 80' - Reference Drawing 9321-F-3060 Between Grid Marks 4 and 8
K. All Cable Tray and Conduit Associated With the Cable in Item J, in Area of Item J
L. All Lighting Fixtures in the Area of Item J
M. 600 Volt Transfer Switch

Inspections have been made of the instrumentation in the PAB with the following results:

A. Instruments which require repairs or replacement:

PI-1303	FC-106A
PI-1304	FC-106B
PI-1305	TIC-107
PI-1306	PI-138
FI-664	PT-139
LT-102	TI-667
LT-106	FI-666
PI-136	FCV-111A
FC-102A	FT-173A
FC-102B	TI-665
FI668	

BA Evaporators - Tank Level 21 and 22

Gas analyzer Package Items A5-1067A and AT-1067B

Limit Switches, Valves 876A and 876B

B. Instruments which require further evaluation to determine repair requirements:

TIC-103	LG-1078
TIC-107	LT-1078
LC-101	PT-1077
TIC-100	PI-600
CI-1136	PC-600
FI-647	PC-1175S
CE-1136	FIT-111
LT-931	FI-110
LT-932	PI-108
FT-930	PI-109
RE-18	FM-110
TI-665	
LT-628	
LT-S28A	

C. Instruments with accumulation of soot which will be cleaned and checked:

LT-1012	LT-112
LT-1013	LT-112D
PT-1025	PT-139
PC-1035	TT-164
PC-1028	LT-165
LT-1030	FT-134
LT-1032	PT-135
FT-173A	TIC-149

The following pumps on EL. 15' were submerged and must be replaced:

A. Sump Tank Pump - Serial #769-A-524-1 (Gould Model - 3196)

B. Sump Tank Pump - Serial #769-A-524-2 (Gould Model - 3196)

The following relief valves must be replaced:

A. Isolation Valve Seal Water Tank
B. Component Cooling Water Surge Tank
C. Penetration & Weld Channel Press. System - Air Receiver Relief Valves

The following motors must have end cover removed, motor inspected and meggered.

A. Boric Acid Transfer Pump Motors (2)
B. Containment Spray Pump Motors (3)
C. Charging Pump Motors #21, 22, 23 (3)
D. Waste Evaporator Package #21 (1)

E. Primary Water Pump Motors (2)
F. Monitor Tank Pump Motors (3)
G. Makeup Water Pump Motor (1)
H. Refueling Water Pump Motor (1)

Valve repairs are to be made as follows:

A. Replace air operators, positioner and limit switches on valves:

FCV-111A
FCV-110A
HCV-104
HCV-105

B. Disassemble, inspect and replace diaphragms on diaphragm valves (Grinnel and Kerctest) at Boric Acid Mixing Station, EL. 98'.

C. Remove limit switch compartment, check limit switches, reassemble operator so that the motor is horizontal and limit switch compartment is up:

MOV-H333

D. Remove manual operator, clean, inspect, repack and replace:

Manual valve 766A

E. Replace following valves in Component Cooling Hx Line

A-4
A-5

F. Remove limit switch cover, inspect limit switches per drawings. Clean limit switches and replace as required:

MOV-866A
MOV-866B

G. Inspect and repair as necessary - LCV 112A, LCV 112C, TCV 149

Heating and Ventilating

A. Air Handling Unit - Repair as necessary.

B. Duct Work - Replace all damaged sections.

C. Steam and Condensate Piping - Needs thorough visual inspection. Repair insulation as necessary.

Boric Acid Piping - Con Edison has flushed and confirmed clear piping.

PA System, Lighting Fixtures - Inspect and replace effected components as necessary.

SECTION C

INDIAN POINT #2 FIRE

REPAIR OF ELECTRICAL DAMAGE

In order to repair the fire damage at Indian Point and return the plant to operation two basic criteria have been established.

1. The plant will be returned to a condition equivalent to that which would have existed had there been no fire.
2. Repair operations will be conducted in such a manner that the reliability and safety of the plant will not be reduced because of the repairs.

Based on these two principles, it has been decided that the repair procedure should disturb only that wiring and equipment that was damaged or could have been damaged in the fire. New cable will be spliced into the undamaged sections of cable to replace that which was damaged in the fire. The use of splices is based on the fact that a properly designed and installed joint is equivalent to the unspliced cable in both electrical conductivity and insulation.

To demonstrate that the splices do not degrade electrical conductivity, sample joints of each type will be made with the actual tools to be used, and tested for electrical conductivity. The resistance of the connector must be equal to or less than that of an equal length of unspliced conductor. During the repair

work, sample splices will be removed and tested. After the repair is completed, another set of sample joints will be prepared and tested to assure that the tools and splicing technique have been maintained throughout the repair without changes that could affect the quality of the connection.

To demonstrate that the joint insulation is properly applied, each cable will be tested at 2500 volts DC conductor to conductor and conductor to ground. This will prove that the cable and splice is electrically equivalent to new unspliced cable.

Additional tests will be performed to demonstrate that the splices will remain watertight and pullout tests will be performed on sample splices to prove that the tools and technique used produce joints of adequate mechanical strength. These tests are described in the attached test procedure.

An alternate course of action could be to replace all cable involved terminal to terminal. This procedure would require unloading many trays outside the fire area where the damaged cables are intermixed with undamaged cables and installing new cables to replace those damaged. This would result in handling many cables that have in no way been affected by the fire and would increase the chance of damage to these cables. Because of space limitation it is not possible to leave the damaged cables in place and run new cables from terminal to terminal to replace them. To completely remove and replace all the cables throughout their entire length would take a minimum of ten months.

Since the new cables would have to be terminated with compression connectors similar to those used in the splice, the same number of compression connections would have to be made. Instead of being made in one area, however, where no other connection or equipment could be affected, the terminations would have to be made in cabinets and cubicles throughout the plant with the consequent danger of affecting other circuits and the much more difficult job of quality control. Making all the new splices in one area will facilitate the implementation of an effective quality control program because inspectors can be assigned and splicing condition controlled better.

Rather than making a large number of different type terminations in widely separated locations and under varying conditions the splicing program permits most of the repairs to be carried out at one location under carefully controlled conditions using similar operations for all splices. This careful control together with the testing program outlined above, will provide the ultimate assurance that the repaired facilities will be equal or superior to the original installation.

Another variation would be to provide terminal blocks rather than insulated splices to replace the damaged cable. Since many of the circuits involved operate at 480V, it has been concluded

that the use of open terminals would be less reliable than insulated splices. The problem of producing an absolutely watertight terminal box and the danger of failures spreading from one open terminal to another if failures developed at 480 volts have been the principal objections to the use of terminals rather than insulated splices. The addition of mechanical connections necessary with terminal blocks, and the possible, though improbable chance that they could introduce problems of electrical conductivity have also led to the conclusion that simple compression type splices would be superior.

The separation of channels has of course been maintained in the repair and as an added measure of protection, metal boxes will be provided around the splices. Again this provides protection superior to that in the original design and assures that the plant safety will in no way be degraded by the repairs. Studies are being made to assure that no thermal problem will occur in the boxes.

The attached specifications show the details of the splices to be used. The tools and inspection procedures have been selected to insure that all splices will conform with the design specifications. The test program has been designed so that there

is complete assurance that all damaged cable has been replaced.

In all cases the conductors will be joined using compression connectors. The small connectors will be applied with ratchet type hand tools that assure complete compression before the tool can be released. The larger connections will be made with power operated tools and will utilize dies designed so that a number will be imprinted on the connector only if the proper compression has been applied.

All insulation to be used will be heat shrinkable tubing. The primary insulation for individual conductors will be applied first, than a separate heat shrinkable tube to replace the cable jacket and finally a fire resistant heat shrinkable tube to provide fire protection equivalent to the cable outer jacket. Completed sample joints will be subjected to the same fire tests as the original cable. These tests are described in the attached specification EO-6068.

As a final proof that all cable reused has not been affected in any way by the fire, samples of each type of cable in each tray will be taken at the splice location and subjected to extensive electrical and mechanical tests by both Con Edison and the cable manufacturer. Any cable that shows degradation from new condition will be completely replaced. The test procedure to be used is attached.

The detailed design of the splice boxes is now being completed. We will provide the following details as soon as they are available:

1. Mechanical details showing cable entry into the boxes.
2. Details of mechanical support of the cables within the boxes.
3. Details of the physical arrangements of cables and splices within the boxes.

TESTING PROCEDURE FOR SPLICES

Samples of each splice shall be made up without insulation and tested for resistance of connection.

Connectors shall be pressed in accordance with Splicing and Terminating Instructions.

Joint resistance shall be measured by a Wheatstone Bridge and must be equivalent to, or less than, the conductor resistance. Refer to Table III for maximum resistance values for the various conductor sizes involved.

A pullout test shall be made on the compressed connectors according to EEI-NEMA Standard TDJ-162 for full tension connectors.

Samples of a completely insulated joint shall be made up with approximately two and one-half feet of cable extending on either side of the joint. This assembly shall be suspended vertically and clamped so that no horizontal movement at the ends is possible. The center of the joint shall be flexed three inches to either side of center for 5,000 cycles at a rate of 80 cycles per minute. After flexing, the joint shall be laid horizontally in a tank and covered with six inches of one-percent NACL salt water for 8 days. The insulation

resistance from the base surface of the conductor to ground when tested using a 1000 volt D.C. meggar shall be 200+ megohms. Water penetration into the joint shall be determined by dissection and shall not exceed 1/8 inch from the end.

Samples of a completely insulated joint shall be made up with approximately two feet of cable extending on either side of the joint. These samples shall be submitted to a bon-fire test as described in Consolidated Edsion Specification EO-6068.

Samples of a completely insulated joint shall be made with approximately ten feet of cable extending on either side of the joint. A test voltage shall be applied to the sample at an increasing rate of 100 volts per second until breakdown occurs.

TABLE III

RESISTANCE VALUES OF CRIMPED OR INDENTED CONNECTORS

Cable Size (AWG or MCM)	Connector Length*	Micro-Ohm Conductor Resistance
#12	13/16"	110.0
#10	13/16"	69.2
#8	1-3/8"	73.5
#6	2-5/8"	87.2
#4	2-5/8"	55.4
#2	2-7/8"	38.3
#2/0	3-3/8"	22.5
#4/0	3-5/8"	15.2
350	4-3/8"	11.1

*One-quarter (1/4) inch added to connector length

Con Edison
Consolidated Edison Company of New York, Inc.
4 Irving Place, New York, N Y 10003

Purchase and Test
All Districts

Fire and Heat Resistance Tests on 600V Power and Control Cable and Switchboard Wires

SCOPE

1. This specification covers the fire and heat resistance tests to be performed on 600V power and control cable and switchboard wires as a requirement for Company acceptance.

GENERAL

2. When performing any of the tests outlined in Paragraphs 4 and 5 of this specification on a sample of wire or cable, an approved wire or cable shall be submitted to the same test(s) at the same time so that a performance level is established for the test sample under the same test conditions.

3. The Transmission and Distribution Engineer will review the results of all testing and determine the suitability of the sample construction for use.

4. The following flame tests shall be performed on all 600V power and control cables and switchboard wires, except where specified:

a. A.S.T.M. Vertical Flame Test
As a preliminary test, the A.S.T.M. vertical flame test, designation D-470-64T, shall be performed only on 600V control cable and switchboard wires. All cables which do not meet this test shall be considered to have failed and shall not be submitted to any additional testing.

b. Con Edison Vertical Flame Test
With the cable in a vertical position, a burner flame with the tip of the inner cone of the flame at the outer surface of the cable covering, is held on the cable for five (5) minutes. The time to ignite the cable is noted and after removing the flame, the time that the cable continued to flame and the extent of the burning are noted.

The flame shall be supplied by a Fischer Burner No. 3-902, 40mm. diameter head, using natural gas with the tip of the inner cone of the flame adjusted for 1900 degrees F.

GENERAL (Cont'd)

All cables which do not meet this test shall be considered to have failed and are not to be submitted to any additional testing.

c. Con Edison Bon Fire Test

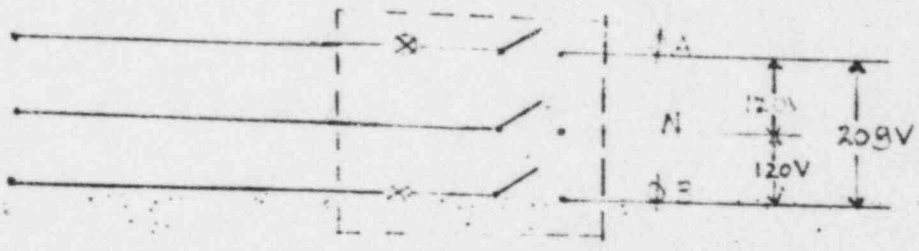
This test shall be performed on 600V power and multiconductor cable.

Several cables to be tested, the number depending on service conditions, shall be three feet in length each. The cables to be tested shall be grouped in a bundle and exposed to an oil flame produced by igniting transformer oil in a 12 inch diameter pail. At the start of each test the oil level is adjusted to 2-3/4 inches below the rim of the pail. The grouped cables shall be placed horizontally over the center of the pail, with the lowest conductor 3 inches above the top of the pail. The flame is applied for five minutes.

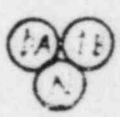
All cables shall be meggered at 1,000V before and after the test.

Throughout the test a voltage shall be applied to the cables as shown in the diagram below:

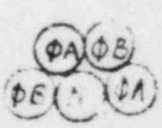
Open Circuit Test Cables



The cables shall be grouped in such a way that each cable is in contact with the others as shown below:



Should there be more than three cables, they shall be grouped as shown below:



HEAT TESTS

5. The following heat tests shall be performed on all 600V network power cables which pass the flame tests mentioned previously:

a. Oven Test
A sample of cable approximately one foot in length is placed in an oven and heated at 260° C for four hours. The sample is then examined for damage. There shall be no signs of blistering, cracking, etc. All cables which do not meet the requirements of this test shall be considered to have failed and are not to be submitted to any additional testing.

b. Roasting Test
Several cables to be tested, the number depending on service conditions, each approximately twenty (20) feet in length are grouped in a bundle and placed in a four inch duct. Current, as determined by the Transmission and Distribution Engineer, is applied to raise the temperature of the conductor to 260° C in two hours. Immediately after this temperature is reached, the cable is removed from the duct and the insulation is examined for damage. There shall be no visible signs of blistering, cracking, etc.

Frank E. Fischer
Transmission and Distribution Engineer
Electrical Engineering Department

Edward D. Ishaq:mp

REVISION O:	FILE
	Purchase and Test Manual No. 6

TESTS REQUIRED ON SAMPLES OF CABLE TAKEN FROM INDIAN POINT # 2 AFTER FIRE

1. Tests on Conductor

The conductor shall meet all the requirements of annealed copper wire per ASTM B3. The direct current resistance of solid or Class B stranded uncoated conductors at 20° C or 25° C shall not exceed by more than 2 percent the values in Tables 2-9 and 2-11 of IPCEA Publication No. S-61-402 (Second Edition - 1968).

2. Tests on Insulation

The insulation shall meet the following physical requirements when tested in accordance with IPCEA Publication No. S-61-402 (Second Edition - 1968) paragraphs 6.4.11 and 6.4.12.

Tensile strength, minimum	1500 psi
Elongation at rupture, minimum	100 %

After air oven test at 121° C ± 1° C for 168 hours.

Tensile strength, minimum percent of unaged value	70
Elongation at rupture, minimum percentage of unaged value.	65

3. Tests on Jackets (PVC)

PVC jackets shall meet the following physical requirements when tested in accordance with IPCEA Publication No. S-61-402 (Second Edition - 1968) paragraphs 6.4 and 6.9.

Tensile strength, minimum	1500 psi
Elongation at rupture, minimum	100%

After air oven test at 100° C ± 1° C for 5 days.

Tensile strength, minimum percentage of unaged value	85
Elongation at rupture, minimum percentage of unaged value	60

After oil immersion at 70° C ± 1° C for 4 hours.

Tensile strength, minimum percentage of unaged value	80
Elongation at rupture, minimum percentage of unaged value	60

Heat distortion, 121° C ± 1° C maximum percentage	50

Heat shock, 121° C ± 1° C	no cracks
Cold bend, ⁻35° C ± 1° C	no cracks

In addition to the above tests each sample shall be checked for eccentricity of the insulation around the conductor.

Each sample shall have a representative section submitted to a dielectric proof test voltage of 1.5 kV A.C. for 1 minute per ASTM D 1389-62.

All samples which pass the dielectric proof test shall be submitted to a dielectric breakdown test per ASTM D149-64.

Each sample shall have a representative section submitted to an insulation resistance test per ASTM D-257-66. The minimum insulation resistance shall be 50 megohms per 1000 feet.

All results of the previously described testing are to be certified and submitted to the Transmission and Distribution Engineer. Each test sample shall be clearly identified as to the type and tray number.

SAMFLES TO BE TAKEN ON INDIAN POINT #2 CABLES

Tray 36 c

One 2 foot sample of each of the following:

1) 1/c #1
2) 1/c #10
3) 1/c #8
4) 1/c #2
5) 1/c #2/0
6) 1/c #4
7) 1/c #6

Tray 15c - 14c K_1 + K1B

1) 3/c #12
2) 2/c #12
3) 12/c #12
4) 5/c #12
5) 1/c #10

Tray 09H (D level)

1) 3/c #12
2) 9/c #12
3) 5/c #12
4) 1/c #10
5) 7/c #12
6) 12/c #12
7) 2/c #12
8) 1/p #16

Tray 15c K1

1) 9/c #12
2) 12/c #12
3) 1/c #10
4) 3/c #12
5) 5/c #12
6) 7/c #12

Tray 15c K2

1) 5/c #12
2) 12/c #12
3) 7/c #12
4) 1/c #10
5) 9/c #12
6) 3/c #12

Tray 14c K1b

1) 7/c #12
2) 5/c #12
3) 12/c #12
4) 9/c #12
5) 3/c #12
6) 1/c #10

Tray 14c K2B

1) 7/c #12
2) 9/c #12
3) 3/c #12
4) 12/c #12

Tray 13c (F level)

1) 1/c #10
2) 1/c #4
3) 7/c #12
4) 3/c #12
5) 9/c #12
6) 1/c 4/0
7) 1/c 2/0
8) 1/c #1
9) 1/c 350
10) 1/c #12
11) 5/c #12

Tray 86c (J level)

1) 3/p #22
2) 1/p #16
3) 2/p #16

Tray 06c (C level)

1) 1/c 350
2) 1/c 750

Tray 34c (D, F, J level)

1) 3/c #12
2) 1/c #12
3) 7/c #12
4) 1/c #8
5) 1/c #6
6) 2/c #12
7) 1/p #16
8) 1/c #4

12"Tray 2JS1 2JS2 2JS3 2QQ1

1) 1/c 750 (2JS1)
2) 1/c 750 (2JS2)
3) 1/c 750 (2JS3)
4) 1/c 750 (2QQ1)

Conduit 2QP1

1) 1/c 350

Splicing and Terminating Instructions

A. General Notes

1. No splices shall be made in cables, except where specific instructions to the contrary are given. Where splices are unavoidable, they shall not be accomplished without prior notification and approval by UE&C.

2. Splicing at penetration pigtails and Reactor Head using Splicing Instructions given in Table I may be accomplished without prior notification and approval. Procedures other than those given in Table I must be approved before accomplishment.

3. Connections to penetration built-in terminal lugs and assemblies shall be treated as terminations.

4. Tool installed, compression type connectors shall be applied with the connector manufacturer's recommended rachet type tools only.

5. Bolted connections at terminations shall be made with silicone bronze hardware.

6. Single and multi-conductor cables, rated at 1,000 volts or below, shall have all tapes and braids, which are not conductor primary insulation, shields or outermost jackets, stripped back as follows:

   a. Single Conductor Cable (Mylar Tape)

      1) to the termination point of the asbestos braid or lead sheath at both splices and terminations.

   b. Individual Conductors of Multi-conductor Cable (Mylar Tape and/or Glass Braid)

      1) for a minimum distance of three (3) inches beyond the termination of the primary insulation of the individual conductors at splices.

      2) for a minimum distance of one (1) inch beyond the termination of the primary insulation of the individual conductors at terminations.

   c. Multi-conductor Cable (Mylar Tape, Fabric Tape, Asbestos Tape, Zinc Tape, Glass Braid and/or "Kerite" braids and tapes).

      1) to the termination point of the outermost sheath (Lead) or jacket (PVC, Silicone Rubber or Asbestos Braid) at both splices and terminations.

7. Unless otherwise indicated, cables described in General Note #6 shall have each sheath and/or jacket stripped back, at splices and terminations, to a point that will provide a minimum space of one (1) inch between the termination of the sheath and/or jacket and the termination of the next inner sheath and/or jacket. Inside cabinets, racks, and main control boards, outer jacket and/or sheath shall be stripped back to the cable entrance. (Leave glass braid intact.)

8. Splices in individual conductors of multi-conductor cables rated at 1,000 volts and below, shall be staggered to minimize the total diameter of the completed splice. Splices of individual conductors at penetrations shall be staggered and pigtails cut to eliminate any excess cable.

9. Heat shrinkable tubing and expanded molded parts shall be "Thermofit" brand heat shrinkable products, as manufactured by the Raychem Corporation of Menlo Park, California.

A. General Notes (Cont'd)

9. (Cont'd)

a. Class "A" heat shrinkable product shall be Raychem type "sticky" SCL, selectively cross-linked polyvinyl-chloride tubing with a meltable adhesive inner wall, classifed as Raychem compound RT-862. (For proper wall thickness, use only manufacturing numbers MO22 and T806).

b. Class "B" heat shrinkable product shall be Raychem type TCS, irradiated, modified, ultra-violet resistant, polyethylene tubing with interior surfaces coated with Raychem mastic #394-A.

c. Class "C" heat shrinkable product shall be Raychem type "Kynar" tubing, as described in Raychem Specification RT-850.

d. Class "D1" heat shrinkable product shall be Raychem type SFR silicone rubber tubing as described in Raychem Specification RT-1140 (see General Note #12).

e. Class "D2" heat shrinkable product shall be Raychem polyolefin expanded molded parts as described in Raychem Specification RT-301 (see General Note #12).

10. Class "D1" and "D2" heat shrinkable products shall be used in conjunction with a silicone rubber adhesive, which is applied to the splice or termination to produce a watertight seal. Silicone rubber adhesives shall be room temperature vulcanizing, type RTV, as manufactured by the General Electric Company of Waterford, New York.

a. Class "X" adhesives shall be one-part adhesive/sealant, G.E. Co., type RTV-102, packaged in disposable tubes. Class "X" adhesive shall be used with Class "D1" tubing only. The adhesive shall first be applied to the connector, after which the tubing shall be slipped over and centered on the joint. Then apply the adhesive liberally under the ends of the tubing and shrink in place.

b. Class "Y" adhesive shall be a two-part (compound plus curing agent) adhesive/sealant, G.E. Co., type RTV-615, packaged in frozen cartridges, containing pre-weighted, pre-mixed and deaerated compound. Class "Y" adhesive shall be used with Class "D2" molded parts only. The adhesive shall be injected into the boot, formed by the molded parts, completely filling it and eliminating voids, AFTER the molded parts have been shrunk in place. (See Figure 1).

1) Compound packaging and compound application guns shall be by Semco Sales and Service Inc., of Los Angelos, California.

11. Heat shrinkable tubing shall be shrunk in place with either an electrically heated air blower, or a gas fired catalytic heater. OPEN FLAMES SHALL NOT BE USED. Blower and heater shall be as manufactured by the Raychem Corporation.

12. Splices and terminations of triaxial and coaxial cables shall be made with Amphenol, fifty (50) ohm, splicing and terminating connectors for triaxial and coaxial cable, as manufactured by Bunker-Ramo Corporation of Oak Brook, Illinois. Such splices and terminations shall be made strictly in accordance with the connector manufacturer's instructions.

13. Splices and terminations of all cables, other than triaxial and coaxial cables, shall be made in accordance with Tables I, II, and III below.

Splicing and Terminating Instructions (Cont'd)

A. General Notes (Cont'd)

16. Each cable will be "rung out" for identification and each cable will be tagged with an identification number at the splice box.

17. A two-foot sample of each type of cable in each tray will be removed for electrical examination of the insulation. Each sample is to be tagged with an identification number and sent to the Con Edison Technical Services Bureau, 708 First Ave. New York City for test.

18. Hand tools will be used on all wires up to and including #4 AWG during splicing.

    a. The stripping tool shall be Ideal Industries #45-090C for conductor sizes #8 to #12. One tool shall be used for each different conductor size with only the one effective notch (all others ground out). The stop limit shall be adjusted on each tool to limit the length of insulation stripped. The tool shall be readily identifiable as to the size of connector it can be used on.

    b. The compression tool shall be Burndy Hytool MR-4. One tool shall be used for each different conductor size with only the one effective notch (all others ground out). The tool shall be readily identifiable as to the size of connector it should be used on.

19. Power compression tools shall be used on all wires above #4 AWG.

    a. Thomas & Betts head UT15 and electric pump #15596 or equivalent Burndy tools with "circumferential" type dies shall be used to compress the connectors. The dies shall imprint a clearly identifiable size number upon the compressed fitting. WED Co. quality control shall visually check each connector after it is compressed to assure that the above number is imprinted and is clearly identifiable.

    b. An electricians knife shall be used to strip the insulation and jacketing materials from single and multiconductor cables. Care shall be taken not to nick conductors or insulations during these operations.

20. At the completion of the splicing each circuit shall be "rung out" for proper identification.

21. A 500 volt DC insulation resistance test shall be made before splicing on the section of the cable to be reused. A 2500 V insulation resistance test will be made on each cable after the splice is completed. The tests shall be made both between conductors and from conductor to ground.

Splicing and Terminating Instructions (Cont'd)

A. General NOtes (Cont'd)

14. Wherever field conditions prevent using the exact procedures specified in these splicing and terminating instructions, a modified procedure, to suit the field condition, shall be devised and submitted to UE&C for approval.

15. Splicing and terminating instructions for each type cable are given in numerical order from Tables II and III, which is not necessarily the order of installation. For this reason, it is necessary to read all parts of the instruction before attempting any particular operation.

B. Table II

TABLE I - SPLICING AND TERMINATING INSTRUCTIONS

SERVICE	INSULATION VOLTAGE CLASS (V)	FOLLOWING PROCEDURES LISTED FOR SPLICING (see Table II)
Power	600	S02, S05, S06, S11, S11-A, S13, S21 and general notes 16, 17, 18, 19, 20 and 21.
Power	600	S02, S07, S09, S11-B, S13, S15-A S18, S21 and general notes 16, 17, 18, 19, 20 and 21.
Power & Control	600	S02, S07, S09, S11-B, S16, S16-A S21 and general notes 16, 17, 18, 19, 20 and 21.

C. Table II

TABLE II - PROCEDURES FOR SPLICING

PROCEDURE NUMBER	DESCRIPTION
S01	Under no circumstances shall any splicing be allowed without the prior notification and approval of procedure of UE&C Inc.
S02	Similar to procedure number S01, except that splicing at penetration "pigtails" will be allowed without prior notification and approval.

C. Table II (Cont'd)

TABLE II - PROCEDURES FOR SPLICING (Cont'd)

PROCEDURE NUMBER	DESCRIPTION
S03	See Splicing and Indoor Terminating Instructions UE&C Spec. No. 9321-05-113-4, for 8KV Grounded Neutral Cable (Type B and Type C) dated July 2, 1970.
S04	In line splices of single insulated conductors #6 AWG - #4/0, shall be insulated and sealed with Raychem, Class "D2" double diameter boots and Class "Y" silicone rubber adhesive.
S05	Splices of insulated conductors, #6 AWG and larger, shall be made with Burndy, long barrel, "Hydent," compression connectors. Primary insulation on each conductor shall be butted as close to the connector as possible.
S06	Splices between conductors of different size, in the range of #6 AWG and larger, shall be made in accordance with procedure number S05, except that Burndy type Y-R reducing adaptors shall be used to accommodate the smaller conductor.
S07	Splices of insulated conductors, #8 AWG and smaller, shall be made with Burndy, short barrel, "Hydent," compression connectors. Primary insulation on each conductor shall be butted as close to the connector as possible.
S08	Shield tape drain wires shall be crimped using Burndy Hylink compression connectors. Solid drain wires shall be crimped and soldered to insure a good connection. Where no compression connector is available, drain wires shall be soldered.
S09	Splices between conductors of different size, in the range of #10 AWG to #22 AWG, shall be made with A-MP Inc. (Aircraft Marine Products Inc., Harrisburg, Pennsylvania) step-down type, pre-insulated, "Diamond Grip," compression connectors, except that the connector insulation shall be removed before installation. Primary insulation of each conductor shall be butted as close to the connector as possible.
S10	In-line splices of single, insulated conductors, #8 AWG and smaller, shall be insulated and sealed with Class "D1" heat shrinkable tubing (see General Note #11) and Class "X" silicone rubber adhesive (see General Note #12). a. Tubing and adhesive shall extend over the single conductor primary insulation for a minimum distance of two and one-half (2½) inches from the termination of the insulation on each side of the splice.

C. Table II (Cont'd)

TABLE II - PROCEDURES FOR SPLICING (Cont'd)

PROCEDURE NUMBER	DESCRIPTION
S11	In-line splices of single, insulated conductors, #6 AWG and larger, shall be insulated and sealed with Class "B" heat shrinkable tubing (see General Note #11). a. Tubing shall extend over the single conductor primary insulation for a minimum distance of two (2) inches from the termination of the insulation, on each side of the splice.
S11-A	Splices made in accordance with procedure number S11 shall be fire-proofed with Class "C" heat shrinkable tubing (see General Note #8 and #9). Class "C" tubing shall overlap the Class "B" tubing and/or the asbestos braid jacket by a minimum of 1½ inches at each end.
S11-B	In-line splices of single insulated conductors, #8 AWG and smaller, shall be insulated and sealed with Class "A" heat shrinkable tubing (see General Note #11). a. Tubing shall extend over the single conductor primary insulation for a minimum distance of two (2) inches from the termination of the insulation, on each side of the splice.
S12	Wye or tee splices shall be taped with "Scotch" brand electrical tape No. 70. Tape shall be built up to 1.5 times the conductor primary insulation thickness.
S13	Similar to procedure number S12, except tape shall be No. 33.
S14	After stripping back the outer PVC jacket as required, a lead sleeve shall be formed over the spliced conductors and wiped to the cable's lead sheath, in accordance with standard utility practice, by splicers and lead wipers proficient in such practice. After wiping is completed, the lead sleeve shall be filled with a suitable insulating compound, which is compatible to the materials with which it comes in contact.
S15	In-line splices of silicone rubber insulated multi-conductor cables shall be completed by continuing the outermost silicone rubber jacket of the cable across the splice with a 5/8 inch Class "D1" heat shrinkable tubing and Class "A" silicone rubber adhesive. a. Tubing shall extend over the outermost jacket for a minimum distance of two (2) inches from the termination of the jacket on each side of the splice.

C. Table II (Cont'd)

TABLE II - PROCEDURES FOR SPLICING (Cont'd)

PROCEDURE NUMBER	DESCRIPTION
S15-A	In-line splices, of insulated single conductor, multi-conductor, or multi-pair cable, shall be completed by continuing the outermost jacket of the conductor across the splice with Class "C" heat shrinkable tubing (see General Note #11). a. Tubing shall extend over the outermost jacket for a distance of two (2) inches from the termination of the jacket on each side of the splice.
S16	In-line splices of insulated multi-conductor cable shall be completed, by continuing the outermost jacket (not braid) of the cable across the splice, with Class "B" heat shrinkable tubing (see General Note #11). a. Tubing shall extend over the outermost jacket (not braid) for a distance of two (2) inches, from the termination of the jacket, on each side of the splice.
S16-A	Splices completed in accordance with procedure number S16 shall be fire-proofed with Class "C" heat shrinkable tubing (see General Notes #8 and #9). Class "C" tubing shall overlap Class "B" tubing and/or the asbestos braid jacket by a minimum of 1½ inches at each end.
S17	Wye or tee splices shall be completed by continuing the outermost jacket of the cable across the splice with "Scotch" brand electrical tape No. 27. Tape shall be built up to a thickness equal to that of the outermost jacket of the conductor.
S18	Similar to procedure number S17, except tape shall be No. 33.
S19	Lead jacketed splices shall be completed by continuing the PVC overall jacket across the splice with half-lapped "Scotch" brand electrical tape No. 33. Tape shall be built up to a thickness equal to that of the PVC jacket.
S20	Splice those single conductors which do not terminate on terminal blocks with "Scotchlok" brand insulated electrical spring connectors. Splices outside of amplifier cabinets, terminal boxes and wireways will not be permitted. (This procedure does NOT apply at penetrations).

C. Table II (Cont'd)

TABLE II - PROCEDURES FOR SPLICING (Cont'd)

PROCEDURE NUMBER	DESCRIPTION
S21	For special splices at penetrations, main control boards, injunction boxes, and at reactor head, see Sketches SS1 - SS11 on UE&C Drawing 9321-F-33363.

Sketch No.	Cable Type
SS1	G
SS2	D
SS3	Jork
SS4	F
SS5	N4
SS6	N3
SS7	D
SS8	D to E
SS9	M4 to N5
SS10	K
SS11	N8

D. Table III

TABLE III - PROCEDURES FOR TERMINATING

PROCEDURE NUMBER	DESCRIPTION
T01	See Splicing and Indoor Terminating Instructions UE&C Spec. No. 9321-05-113-4, for Three Conductor 8KV Grounded Neutral Cable (Type B and Type C, dated July 2, 1970.
T02	The outer PVC jacket shall be stripped back from the end (barrel end) of the terminal lug for a minimum distance of nine (9) inches and the lead sheath shall be terminated without wiping, a minimum of seven (7) inches from the termination of the PVC jacket (see General Note #8). The PVC jacket and the lead sheath shall each be served with a section of Class "C" heat shrinkable tubing (see General Note #11).

a. Tubing serving the lead sheath shall extend for a minimum distance of two (2) inches over the lead sheath on one end and one and one-half (1½) inches over the conductor primary insulation on the other end.

Indian Point Unit No. 2 Fire

Structural and Mechanical Effects and

Investigation of Potential Chemical Effects

A test program of the structural and mechanical components has been undertaken in the PAB since the fire. Although plans for testing are now fairly well developed, test results have largely not been received to date. Test results are expected in the near future. The testing program includes the following items:

Item 1

Samples of insulation have been removed on a number of pipes in the PAB and tested for water soluble chloride. Test samples will be compared to the original engineering specifications for the insulation. These specifications indicate the maximum chloride concentration permissible in the absence of inhibitor materials in the insulation. Testing is not complete at this time as further sampling is recommended in order to define specifically which areas require insulation removal and replacement and which areas have satisfactory insulation.

Item 2

Structural Testing

a) Structural steel has been measured for distortion. We have found one cross brace directly behind the area of the fire distorted and it required replacement. It is planned to box one column which shows slight distortion, but is otherwise structurally acceptable.

b) Samples have been removed from structural steel in the building and tensile tests have been performed. Such testing indicates that the structural steel meets originally specified properties.

c) Tensile tests have been conducted on structural bolts located in the structure above the fire. The test results have not been received to date.

d) Visual examinations has been conducted on welds in the structure. The results of the examinations have not been received to date.

e) The concrete floor has been cored and core samples are being tested for strength and, in one area, for microstructure to determine whether the fire caused any internal changes in the concrete. A visual examination of all concrete floor slabs has been conducted. One crack

was found above the area of the fire on elevation 98'. Concrete in that area has been removed and will be replaced.

f) Insulated wall panel exterior siding on the building has been examined by the siding manufacturer. All siding on the easterly end of the building will be replaced.

g) The roofing has been examined by the roofing sub-contractor. Portions of the roof are now being repaired.

Item 3

The PAB heating and ventilating unit in elevation 98' has been tested. The motor is satisfactory based on megger testing of the insulation. The fan has been found satisfactory upon visual inspection. Galvanized parts are being re-galvanized. Fan bearings will be serviced. Steam heating coils will be tested for leakage.

Item 4

The weld channel-penetration pressurization air receiver tanks (4) will be inspected after consultation with the ASME code inspector to determine precisely what testing is required. It is planned to inspect and rework as necessary air pressure regulator valves on the air receivers and to replace the air receiver safety valves.

Item 5

In general, motor operated valves are considered to be satisfactory although it is also planned to test the motors by megger. In addition, limit switches on the motor operated valves will be tested in the areas in question. Because there is some question that the fire may have affected the diaphragms in some valve operators, plans have been made to have available spare diaphragms. Also, it will be determined if certain testing can be done on valve diaphragm operators in order to provide a basis for certifying that the operators are satisfactory.

Item 6

To identify the chemistry of the water applied to fighting the fire in the PAB, copies of past water analyses made on the city water, on or about November 4, 1971, will be obtained.

Item 7

By use of steam cleaning, sand blasting and repainting the smoke and heat affected areas are being restored to their original clean condition.

Attachment No. 1 to this section is a report prepared by the Chemical Bureau of the Consolidated Edison Company, which discusses the results of an investigation into the fire effects sustained by the PAB as a result of the November 4, 1971 fire.

SECTION D - ATTACHMENT NO. 1

Fire Effects in Primary Auxiliary Building

Indian Point Unit No. 2

There are four types of fire effects of concern - heat, smoke, water and chemical attack from the hydrochloric acid formed from the burned polyvinyl chloride cable covering.

Heat has buckled a few structural steel members in the immediate vicinity of the site of the fire at the 80' elevation and these will be repaired or replaced. The corrugated steel support for the concrete at the 98' elevation showed some fire effects, but this steel serves no structural function. Heat effects to the concrete may have resulted in differential expansion and possible cracking, but the reinforcement rods would have counteracted this. Some fine cracking was observed in the concrete floors, but this was probably present prior to the fire and is of no major concern. Fire effects to the tanks and piping were probably limited to the areas where paint on the tanks had charred and flaked. Piping joints were marked with plastic tape strips and many components were tagged. No fire effects were observed on the tags or tape. Tests in the laboratory indicate that the tape chars below 400°F, suggesting that the piping had not exceeded this temperature. This would preclude any sensitization of the stainless steel piping or equipment as a result of the fire.

Fire effects in the form of charred paint could be seen on the top and bottom of the Pressurization Air Receiver No. 22, the top of Pressurization Air Receiver No. 24 and the bottom of Boric Acid Tank No. 21. Brinnel hardness measurements were made on the Pressurization Air Receiver No. 22 in areas showing the greatest effects. The measured hardness was in the range of 120 to 143 BHN. These values are satisfactorily low and preclude quenching and hardening as a result of the fire. No distortion was observed in any of the tanks.

Structural effects due to water would not be expected, except on pipe lagging. Pipe lagging which has been affected by water will be replaced. All other surfaces will be cleaned to their original specifications.

Electrical equipment which has been affected by water or combustion products will either be replaced or cleaned to restore them to original design specifications.

It is probable that hydrochloric acid vapors permeated the building since corrosion products removed from copper piping remote from the fire showed greenish deposits. In addition, paper equipment tags changed color from medium blue to a light green. Similar color changes were produced by exposing one of these new tags to hydrochloric acid vapor. Water did not discolor the card.

Carbon steel components exposed to hydrochloric acid would uniformly corrode until either the acid had all reacted or evaporated. This corrosion would not be extensive and even this attack is minimal since most of the piping and other components had been painted and the paint was unaffected. A small amount of corrosion could be observed on some unpainted hangers and in scattered areas on galvanized conduit pipe but this is of no concern.

Acid attack on non-sensitized stainless steel would produce uniform corrosion. This was not observed under high power magnification. Any effect, if present at all, would have been removed in the cleaning, leaving the material in an as new condition. Attack in areas sensitized by welding could produce intergranular corrosion. Since no surface cracking was observed, it is probable that no attack took place. The metallurgy laboratory will attempt to verify this conclusion by duplicating the exposure of sensitized stainless steel to hydrochloric acid. Here also, any surfaces which were painted were unaffected since they were not exposed.

Similarly any painted concrete surfaces can be considered as not having been exposed to the acid. Core samples of concrete have been taken in an area near the fire where the paint had been abraded by constant traffic and another area where the floor had not been exposed to the acid and the paint covering was intact. Chloride determinations will be made in various areas of these samples to determine whether any acid had permeated the surface. Since no rust spots indicative of reinforcing were observed on the concrete surfaces and all surfaces which were repainted are intact, it is probable no significant effect to concrete took place.

Further tests to verify the integrity of all materials in contact with HCl vapors include:

1. Deposit Analyses
2. Water Sample Analyses
3. Concrete Chemical and Mechanical Tests
4. Metallurgical Analyses

Reports on the findings of these tests and any others deemed necessary will be prepared.

Consolidated Edison Company of N.Y., Inc.
4 Irving Place, New York, N.Y. 10003
Telephone (212) 460-5181

November 24, 1971

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

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Dr. Morris:

Our letter of November 14, 1971 submitted a report describing the fire incident which occurred on November 14 and indicated that we would be in contact with your office as soon as further discussions were appropriate.

With regard to restoration of fire damage please be advised that we plan to restore the building and its equipment to the conditions which preceded the fire and to meet in all respects the Unit 2 Final Facility Description and Safety Analysis Report. This restoration will be accomplished by thoroughly cleaning the building, testing its components and replacing or repairing those which are damaged. In particular the motor control centers and lighting switch gear which were damaged will be replaced with new equipment and will be connected to existing undamaged cables with splices, installed and tested in a manner to preserve the reliability of the approved design.

On Wednesday, November 24, 1971 we met with representatives of Region 1 of the Division of Compliance. Our plans for the restoration were discussed at that time and we expect to be in further contact with Region 1 as the work progresses. Should you have any questions regarding this work we are available to meet with your staff and to provide such information as you may require.

Very truly yours,

William E. Caldwell

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