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

November 30, 1973

Re Indian Point Unit No. 2
Docket No. 50-247
Facility Operating
License No. DPR-26

Mr. James P. O'Reilly, Director
Directorate of Regulatory Operations
U. S. Atomic Energy Commission
Region 1
631 Park Avenue
King of Prussia, Penn. 19406

Dear Mr. O'Reilly

In accordance with the discussion held on November 27, 1973 with Mr. Brunner of your office, this letter is to provide you with supplemental information concerning the incident which occurred at Indian Point Unit No. 2 on November 13, 1973.

SEQUENCE OF EVENTS AND PLANT CONDITIONS

Supplementing the sequence of events which was provided in our letter of November 14, 1973, a detailed review of instrument strip charts and computer log printout confirms the sequence presented in our letter with the additional information presented below:

The initial conditions prior to the incident were as follows:

The reactor was critical at approximately 7% power with reactor coolant system temperature at 547°F. The steam and feedwater system was warmed up with the main turbine at approximately 1750 rpm preparatory to synchronization of the unit to the system. The level in No. 22 steam generator was approximately 40%. At 7:40 a.m., there was a turbine trip due to high level in No. 23 steam generator. This resulted in the shutdown of the in-service No. 21 main boiler feed pump. All steam generator levels started decreasing. The turbine trip resulted in the starting of the two motor-driven auxiliary boiler feed pumps. The feedwater regulating valves for these pumps were preset at 50%, thereby initating flow to all four steam generators. Shortly after the turbine trip, the Operations Engineer was at the location of the regulating valves investigating the cause of the high level in No. 23 steam generator which initiated the trip, when he observed that the feedwater line

to Steam Generator No. 22 experienced a shaking accompanied by a loud noise. At 7:45 a.m., there was a reactor trip due to low-low level in No. 2J steam generator. Following the reactor trip, the primary system temperature (T_{avg}) stabilized at about 533°F, and the steam generator pressure stabilized at about 750 psig in all generators.

Subsequent to the starting of the motor-driven auxiliary feed pumps, proper steam generator levels were restored in all but No. 22 steam generator. The level in No. 22 steam generator continued to decrease, indicating that sufficient flow from the auxiliary boiler feed pumps was apparently not reaching the steam generator. The Watch Foreman made several checks including verifying system lineup, auxiliary feedwater regulating valve operation, and discharge pressure in an attempt to verify the apparent lack of flow to Steam Generator No. 22. None of these efforts was successful in restoring Steam Generator No. 22 level.

At approximately 8:30 a.m., a second shaking accompanied by a loud noise was observed in No. 22 feedwater line by operating personnel in the auxiliary feed pump building. At approximately 9:10 a.m., several indications of leakage inside containment were observed by plant operators. The level in the waste holdup tank was increasing. The discharge valves for the containment sump pumps were shut, and the containment sump level indicators were checked. After about 15 minutes, there were indications of a rising sump level and the sump pump valves were then put back in the normal position. Containment temperature was observed to be increasing to a maximum of 110°F. Three of the five containment recirculation fan coolers were in service at the time, and the other two fans were then placed in service and additional cooling water was supplied by opening the bypass around the temperature control valve. The containment humidity recorder was also indicating increased humidity in containment to a wet-bulb temperature of approximately 90°F, and the containment recirculation fan cooler units condensate collection system weirs indicated rising levels. At about this time, the main steam isolation valves on No. 22 steam generator, and the manual isolation valve upstream of No. 22 feedwater regulating valve were shut.

At approximately 9:40 a.m., the steam-driven auxiliary feed pump was started. High pump discharge pressure was indicated, and the No. 22 steam generator level did not respond. At the time this

pump was placed in service, additional shaking accompanied by a loud noise was observed on the No. 22 feedwater line. The situation was analyzed as being a probable break in the feedwater line to No. 22 steam generator inside containment, and the decision was made to cool down the primary system. At the same time, it was decided to make a containment entry to verify and locate the break. Cooldown commenced at approximately 10:10 a.m. to bring the plant to the cold shutdown condition. A containment entry was made at 10:15 a.m. and visual observation indicated a possible break in the feedwater line in the vicinity of the containment penetration. At approximately 10:45 a.m., while cooling down the primary system, a safety injection signal was initiated due to high differential steam pressure between No. 22 steam generator and the other three steam generators. At approximately 11:05 a.m., No. 22 steam generator was completely isolated by shutting the manual stop valves in the auxiliary feedwater and chemical feed lines. This steam generator showed approximately 2% level by the wide range instrumentation at this time. The reactor coolant system temperature had decreased to approximately 450°F.

EFFECTS OF INCIDENT ON PLANT EQUIPMENT

Feedwater Piping to No. 22 Steam Generator

A visual inspection of the 18-inch diameter feedwater line inside containment indicated a fracture adjacent to a fillet weld between the feedwater line and the end plate which is welded into the penetration sleeve in the containment wall. The fracture extended approximately 180° around the pipe. The origin of the fracture was at the 3 to 4 o'clock position (from inside the containment when facing the containment wall). At the 3 to 4 o'clock location, the fracture was at the toe of the fillet weld. The fracture appeared to have propagated up to the 12 o'clock position, and down to the 6 o'clock position, and its path led away from the toe of the weld approximately 1/2 inch. Immediately above the 3 o'clock position, a short branch of the crack traveled along the toe of the weld.

The fractured portion of the pipe was offset from that portion remaining in the penetration so that at the 12 o'clock and at the 3 o'clock positions, it was raised 1/4 of an inch. The maximum measured width of the crack was 5/32 of an inch.

Re Indian Point Unit No. 2
AEC Docket No. 50-247
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A survey of the feedwater piping to Steam Generator No. 22 inside containment included removal of insulation at Steam Generator No. 22 feedwater pipe nozzle area, points of restraint (hangers, snubbers, pipe whip restraints) and elbow welds. Visual and magnetic particle inspections performed at these critical areas indicated no abnormalities. In addition, two 5 radius sweeps of piping (about 13 feet of pipe per sweep) were stripped of insulation and visual and magnetic particle inspections indicated no abnormalities. Inspection of pipe alignment was performed using surveying equipment. This survey indicated that movement had occurred with a small permanent deformation shown by an approximate 3/4 inch clearance at the elbow restraint near the penetration (prior clearance had been nominally zero). Radiography was performed at the Steam Generator No. 22 feedwater nozzle to pipe weld and two elbow welds. No unacceptable indications were found by these inspections. Visual examination of the feedwater piping indicated some relative movement of insulation had occurred, but these indications were not necessarily related to this incident (some relative movement of insulation can be expected with normal heatup and cooldown expansion of feedwater piping).

A survey of feedwater piping to Steam Generator No. 22 outside of containment indicated local cracking and spalling of insulation on piping immediately outside the penetration area. However, visual examination of the balance of the piping revealed no abnormalities.

Valves

Inspections to date of valves have indicated no external damage. The regulating valve in the main feedwater piping to No. 22 Steam Generator was opened and inspected and no incident-related damage observed; however, the valve has been removed from the system and sent to the manufacturer for more detailed inspection, and any required adjustments or maintenance.

Auxiliary Boiler Feed Lines

The auxiliary boiler feed lines and valves were inspected and no abnormalities were found.

Re Indian Point Unit No. 2
AEC Docket No. 50-247
Facility Operating
License No. DPR-26

Electrical Equipment

An inspection after the incident was made to determine the condition of electrical equipment within containment. At Elevation 68 feet, a few minor traces of water were noticed, but the area otherwise appeared dry. At Elevation 46 feet, the presence of approximately 6 to 8 inches of water over the entire floor area was observed. An inspection of the cables and electrical equipment in the area of the electrical penetrations indicated that the lowest cable tray running on the floor along the missile shield wall was partially submerged in water (the cable in this tray, however, is designed and tested for such conditions). The cabling in the upper trays appeared dry. The level of the cable tray immediately above the lowest tray was observed to contain moisture on the bottom of the cables, but appeared dry on top. The electrical penetration area appeared intact. The lowest tray in this area was above the water level. The cabling did exhibit evidence of having been sprayed with water. There were a number of splices in this area in cabling, but no obvious water damage to the splices. An inspection of other areas within containment indicated that all valve operators, transmitters and two drain tank pump motors were located well above the water level, and the equipment, including fittings, appeared dry.

The electrical equipment inside containment appears to have suffered no adverse effects from the feedwater line leak. No electrical equipment is located in the immediate vicinity of the feedwater piping penetrations. It should be noted that all safeguards related equipment inside containment is designed to operate under substantially more severe containment moisture and heat conditions than those resulting from the leak in the No. 22 feedwater line.

Containment Liner

Areas of the containment liner above the feedwater pipe penetrations showed slight inward deformations. The areas where these local deformations were observed extend from approximately Elevation 73 feet to Elevation 75 feet, and cover a length of approximately 40 feet, extending clockwise on the northwest side of containment starting in the area of the feedwater line penetrations. There is no visual evidence of any reduction in containment liner integrity. In addition, the weld channel penetration and pressurization system air consumption in this area of containment following the incident was normal.

Re Indian Point Unit No. 2
AEC Docket No. 50-247
Facility Operating
License No. DPR-26

Steam Generator No. 22

An internal inspection of the steam drum and the area above the tube sheet was made through existing inspection openings. In addition, the feedwater ring inside the steam generator was inspected internally by fiber optic means. These inspections indicated no abnormalities. Representatives from the manufacturer (Westinghouse) took part in the above inspections as well as inspections conducted on the support structure. The results of the support structure inspection also indicated no evidence of distress, unusual movement or other anomalies.

Investigations Being Conducted

1. Fluid System (Water-Hammer) Analysis and Dynamic Stress Analysis of piping in feedwater line to Steam Generator No. 22 (including feedwater ring inside the steam generator and piping supports). These hydraulic and stress analyses include a parametric study of possible modes to postulate worst-case conditions. Preliminary results from these analyses have been used to identify potential high stress areas for special examination.

2. Hydrostatic leakage tests on the 18-inch check valve in the feedwater piping to No. 22 steam generator. Results indicate negligible leakage past the valve seat.

3. Investigations of various mechanisms to determine probable cause of incident.

4. Chemical analysis of surface deposits from Steam Generator No. 22 tube sheet area.

5. Examination of all feedwater piping penetration areas inside containment.

6. Metallurgical examination of failed section of feedwater piping. These examinations are being performed at both the Con Edison Metallurgical Laboratory and the Westinghouse Research Center. These complete metallurgical examinations include tensile, and hardness tests, and electron microscopy.

7. Retrieval and review of past plant operating records and history.

8. Survey, examination, and testing of any potentially affected electrical and instrumentation systems.

9. Survey and analysis of containment liner conditions.

10. Additional investigation as dictated by results of above investigations.

REPAIR WORK UNDERWAY

Con Edison is proceeding expeditiously on the repair work to damaged components, being careful, however, not to interfere with the investigations underway. Repair work underway is as follows:

1. The failed section of feedwater piping has been removed and is being replaced with a new section of feedwater piping. The section to be replaced extends from the first elbow outside of containment, through the penetration, to near the first elbow inside containment (see Figure A attached to this report). In addition, the containment penetration end plates and expansion joint are being replaced. The undamaged containment penetration sleeve and penetration cooling coil will be retained.

2. As mentioned previously, the feedwater regulating valve in the feedwater line to Steam Generator No. 22 has been removed and sent to the vendor for inspection and maintenance as necessary.

3. All damaged or removed insulation will be replaced or repaired as necessary.

4. All piping supports and other components and/or structures removed for access will be reinstalled.

Re Indian Point Unit No. 2
AEC Docket No. 50-247
Facility Operating
License No. DPR-26

CONCLUSION

The plant is being maintained in a safe shutdown condition while necessary repairs and investigations are being conducted. Inspectors from Regulatory Operations are being kept fully informed of the progress of the investigations and repair effort, and are themselves directly observing several of the inspection efforts that Con Edison is conducting. These efforts by Con Edison personnel (with support of Westinghouse and their sub-contractor personnel) are directed to assure that Indian Point Unit No. 2 is returned to service in an expeditious manner with full assurance that the health and safety of the public will be protected. Con Edison will continue to keep the Atomic Energy Commission informed of the progress of our efforts.

Very truly yours

William J. Cahill, Jr.

William J. Cahill, Jr.
Vice President

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Copy to John F. O'Leary, Director
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

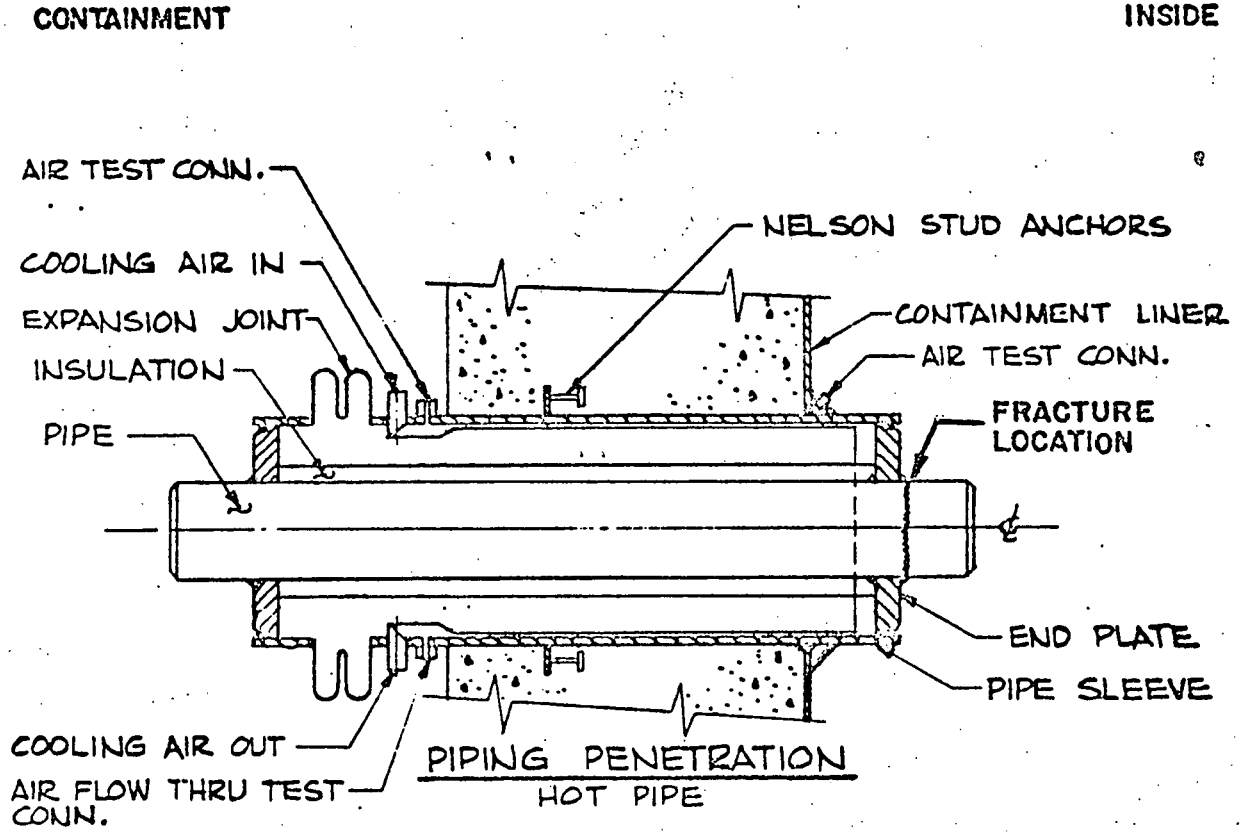
OUTSIDE CONTAINMENT
INSIDE CONTAINMENT
AIR TEST CONN.
COOLING AIR IN
EXPANSION JOINT
INSULATION
PIPE
NELSON STUD ANCHORS
CONTAINMENT LINER
AIR TEST CONN.
FRACTURE LOCATION
END PLATE
PIPE SLEEVE
COOLING AIR OUT
AIR FLOW THRU TEST CONN.
PIPING PENETRATION
HOT PIPE

Figure A

50-247

MEMO ROUTE SLIP
Form AEC-93 (Rev. May 14, 1947) AECM 0240

	See me about this.		For concurrence.		For action.
	Note and return.		For signature.	X	For information.

TO (Name and unit)	INITIALS / DATE	REMARKS
RO Chief FS&EB RO:HQ (4) DL (4) RO Files DR Central Files		CONSOLIDATED EDISON, IP-2 SUPPLEMENTAL INFORMATION CONCERNING INCIDENT ON NOVEMBER 13, 1973
OGC		The above information is forwarded. Distribution will be made by this office to the PDR, Local PDR, NSIC, DTIE, and State Representatives.

FROM (Name and unit)
E. J. Brunner
Region I

PHONE NO. 8-337-1246
DATE 3/4/74

USE OTHER SIDE FOR ADDITIONAL REMARKS

GPO : 1971 O - 445-469