JAN 23 1974

Docket No. 50-247

LICENSEE: Consolidated Edison Company of New York, Inc.

FACILITY: Indian Point Unit 2

SUMMARY OF MEETING RE FEEDWATER LINE BREAK

On January 14, 1974, representatives of the licensee and their consultants met with the Regulatory staff to describe and discuss a report, which was filed later on the same day, summarizing corrective action taken following failure of a main feedwater pipe on November 13, 1973. The failure, apparently caused by water hammer, was a 180° circumferential break in the main feedwater pipe to Steam Generator 22. The location of the break was inside containment and adjacent to the penetration. Blowdown of the steam generator resulted in bulging of the containment liner in the vicinity of the feedwater pipe.

A list of attendees is attached.

Significant points discussed in the meeting are summarized below:

1. Analysis. Con Ed and its consultants have performed analyses that indicate that the horizontal run of feedwater piping to the sparger in Steam Generator 22 results in unstable flow and creation of water slugs. This occurs when the water level in the steam generator falls below the sparger. The instability is caused by partial draining of the horizontal feedwater piping and introduction of a large heat transfer surface at the resulting steam-water interface. Maximum estimated force due to a slug of water impinging on a pipe elbow would be 300,000 pounds which exceeds the force that the piping can withstand. Analysis indicates that the piping failed during unrestrained rebound from a fixed restraint located at an elbow near containment.

   Con Ed has analyzed the deformed containment liner assuming that it is subjected to DBA pressure, earthquake, and prior cyclic pressure loads. Between rows of studs spaced at 28 inches, little movement is expected. However, between rows of studs spaced at 56 inches, flattening of the liner against the concrete containment is expected. Nevertheless, the analysis indicates that the liner would not fail the liner.

Con Ed has also estimated the maximum fluid temperature at the break in the feedwater line during blowdown of the steam generator. The result is 300°F. Therefore, the maximum temperature of the liner and the concrete was less than 300°F. Con Ed concludes that damage to the concrete would not occur at that temperature.

2. Testing. Con Ed has performed a 24-hour, 47 psig leak test of the containment liner. Their interpretation of the data indicates that the leak rate is less than 0.029%/day which is significantly less than the 0.1%/day allowed for an integrated leak test. However, questions regarding the analysis of the data were not satisfactorily answered.

   During the pressure increase, deflection of the liner at the largest bulge was monitored with a video and scale arrangement. At 15 psig, deflection saturated at 5/8 inch. Since the analysis predicts flattening, Con Ed concludes that the liner came in contact with the concrete containment at that pressure. Further, Con Ed believes that the bulge amplitude is 5/8 inch rather than 1-1/4 inches as previously reported.

   Test plates with welds which model sections of the bulged liner have been deformed 1-1/2 inches and cycled with no indication of failure.

3. Inspection. Inspection of the feedwater pipe run disclosed that shims were missing from some pipe restraints and that the fixed restraint from which the pipe rebounded was damaged. The estimated force required to cause the damage observed is 300,000 pounds. Further, a section of pipe was bulged in the horizontal run.

4. Repair. Damaged sections of piping were removed and replaced. The pipe restraints were repaired and the missing shims were installed. The pipe stress was reanalyzed and the piping was recertified per code.

5. Modifications. Although Con Ed believes that malfunction and sudden closing of the feedwater regulating valve did not cause the water hammer, Con Ed recognizes that the potential for an incident of this kind may exist at Unit 2. Therefore, Con Ed is installing a dash pot on each of the four main feedwater regulating valves to preclude excessively rapid closure.

   Because low water level in the steam generator initiated the water hammer and because feedwater control at low power is difficult, Con Ed has trimmed the feedwater regulating valves for better flow

control at low power. In addition, Con Ed is purchasing components for installation of bypass feedwater lines with regulating valves designed for low flow control.

Since analysis shows that the water hammer was caused by a steam-water interface in the long horizontal run of feedwater piping to the sparger, that run was relocated to a lower elevation in order to greatly reduce the amount of steam that can enter the line. The modified line is now similar to those feeding the other three steam generators. We conclude that this modification, of itself, should prevent a water hammer strong enough to damage the piping.

Because the feedwater pipe failed during unrestrained rebound, additional restraints are being installed.

Many strain gages and accelerometers were installed on the feedwater pipe serving Steam Generator 22. In the event that the corrective measures taken are not as effective as anticipated, this instrumentation will provide for early detection and analysis of the anomaly.

Modification of the containment liner will be limited to extending the thermal insulation from the 62-foot elevation up to the 84-foot elevation. If another feedwater pipe failed, the liner would thus be protected from damage due to thermal expansion.

6. Status. The containment pressure test is essentially completed. Containment is pressurized now and pressure is being reduced. The unit will be ready for heatup Friday, January 18, 1974. Licensing has not taken a position which would delay startup; however, we are not now assured the data from the containment leak test has been properly analyzed. Con Ed will provide additional information by telephone on or before January 18. We will call on January 18 regarding startup of the unit.

SUMMARY OF SUBSEQUENT TELECONS

In telephone conversations with Schemel and Woodruff on January 16, Jackson of Con Ed described the two principal containment leak tests that had been performed, i.e., pressurizing containment to 47 psig with the weld channels unpressurized while measuring makeup to containment, and pressurizing the weld channels to 46 psig with the containment at 47 psig while measuring makeup to the weld channels. Con Ed subtracted one makeup rate from the other to obtain the containment leat rate. Con Ed did not measure the makeup to containment during the second test. This measurement would verify the validity of Con Ed's analysis of the data.

On January 17 during a telecon with Woodruff, Jackson stated that Con Ed was performing an additional pressure test; and on January 18, Jackson described the test and the results. The weld channel was pressurized to 46 psig with containment unpressurized while measuring makeup to the weld channel. Because the leak rate obtained in this manner was large relative to the other weld channel test, we concluded that Con Ed's analysis of the data to obtain the containment leak rate was valid.

Subsequently, on January 18 during a telecon with Woodruff, Jackson agreed to supplement the feedwater line report in order to clarify the description of the containment liner leak tests and to describe the additional test which was performed. Jackson stated that Unit 2 would be ready for heatup before the end of the day. Woodruff informed Jackson that Licensing was not requesting that startup be delayed.

/S/

R. W. Woodruff
Project Manager
Operating Reactors Branch #1
Directorate of Licensing

Enclosure:
List of Attendees

cc: Applicant
Docket File
AEC PDR
Local PDR
RP Reading
L Reading
RP Assistant Directors
RP Branch Chiefs
T. J. Carter, L:OR
J. M. Hendrie, L:TR
TR Assistant Directors
TR Branch Chiefs
R. W. Woodruff, L:ORB#1
M. J. Oestmann, L:EP
M. Karman, OGC
E. W. Lyle, OGC
RO (3)
RS (3)
ACRS (16)
~~Principal Staff Participants~~

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SURNAME ➤	RWWoodruff:do	SATeets	RJSchemel	RRMaccary		
DATE ➤	1/23/74	1/23/74	1/23/74	1/ 23/74		

ATTENDANCE

MEETING RE INDIAN POINT-2

JANUARY 14, 1974

Licensing

D. Skovholt*
R. Maccary*
R. Schemel
L. Shao
R. Woodruff
H. Specter*
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W. Hazelton*
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Regulatory Operations

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Consolidated Edison Company

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J. O'Toole
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United Engineers & Constructors

J. Dainora
W. Thayne
G. Duerr
A. Ebner
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J. Grusetskie
B. Scott

Westinghouse

M. Manjoine
O. Aanstad
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J. Stevenson

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