



Steam Report: Bubble-Collapse Water Hammer Caused Lexington Avenue Incident

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NEW YORK, NY, Dec 27, 2007 (MARKET WIRE via COMTEX News Network) -- The steam pipe rupture at Lexington Avenue and East 41 Street on July 18 was caused by a bubble-collapse water hammer that generated a momentary force against the pipe's wall that was more than seven times greater than the pipe's normal operating pressure, according to reports issued today by two independent experts commissioned by Con Edison. The pipe itself was found to be in good condition and did not contribute to the event.

Con Edison also released an action plan in conjunction with the experts' findings that includes the replacement of all 1,654 steam traps on the system; enhanced rain response procedures; new repair oversight protocols; and research and development on steam trap design, as well as new steam trap inspection and testing procedures. The replacement of the steam traps and the development and implementation of improved procedures and protocols have been completed.

"We are committed to operating the steam system in a safe and reliable manner," said William G. Longhi, senior vice president of Central Operations. "We are also committed to applying what we've learned to enhance the safety of our equipment in a complicated underground environment."

According to the experts' findings, unusually heavy rains the morning of July 18 led to high levels of external water accumulating around the deeply buried steam pipe, cooling the pipe and causing above-normal condensate (steam turning into water) to form and collect within it.

Post-incident investigation also revealed that the capacity of the pipe's two steam traps was affected by epoxy materials, injected by an outside contractor who had sealed a leaking flange (joint) months earlier. Some of the materials appeared to have ultimately entered the traps and hampered their operation.

Steam traps usually drain ordinary amounts of condensate accumulating within steam pipes but the compromised traps could not drain the large amount of condensate produced when the pipe was surrounded by water.

During periods of heavy rain, Con Edison safety patrols routinely check for steam vapor, which may be a sign of cool water contacting a hot steam main. A crew had patrolled the scene earlier in the day, at approximately 11:30 a.m., finding no vapor, which caused the safety patrol to conclude that no further action was necessary.

Tapes from a nearby security camera obtained during the investigation, however, revealed steam vapor at the site from about 9 a.m. until 10:10 a.m., after which it stopped, indicating substantial amounts of external water had accumulated around the steam main by that time and had cooled it.

The investigation further revealed that just before the rupture at 5:56 p.m., a routine adjustment elsewhere on the steam system changed steam flow, prompting some steam to enter the cooled condensate that had already collected in the main, creating a steam bubble.

The steam bubble's contact with the cooled condensate caused the steam to condense (change) to water very rapidly, creating a void in the pipe and causing the surrounding water in the pipe to rush to fill the void left as the steam bubble collapsed. The rushing water slammed against water rushing from the other side, creating a large momentary pressure pulse, likely in excess of 1,200 pounds per square inch. This event, called a bubble-collapse water hammer, caused the pipe rupture.

Tests confirmed that the pipe's failure was caused by overpressurization due to a water hammer, rather than other factors. Tests on the pipe revealed no significant corrosion, with adequate strength and appropriate safety margins for normal operation. Age of the pipe, installed in 1924, was determined not to have been a factor.

Reports issued today were completed by ABS Consulting Group (incident investigation technical analysis) and Lucius Pitkin Inc. (metallurgical testing and materials analysis), who conducted independent investigations at Con Edison's request. The reports, as well as Con Edison's Action Plan, will be posted the company's Web site at www.coned.com

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(Editor's Note: Hard copies of The ABS Consulting Report, the Lucius Pitkin Inc. Report, and the Con Edison Action Plan/Recommendations are available upon request).

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