natural gas line explosion demolished a U-shaped three-storey apartment consisting of 36 units of houses, leaving a 20-foot-deep crater beneath the building near LaSalle (Palmer, 1965; Adams, 1965). This event caused 28 fatalities, 39 injuries and 200 homeless (Presse, 2010) and is recorded as the worst pipeline disaster in Canadian history (Palmer, 1965; Johnston, 1965). Two years after this accident, Quebec Natural Gas Corporation (QNG), the pipeline operators were served with $86,000 damage action by one of the victims (Levinson, 1965); $853,275 was claimed by the pipeline operators were served with $86,000 damage action by one of the victims (Levinson, 1965); $853,275 was claimed by

The compensation paid was minimal (The Scotsman, 2011). Two years later, a natural gas line explosion shattered a range of modern shops in Clarkson Toll, Renfrewshire on October 21, 1971 (Clarkston, Scotland, UK) 21 NIL

In the same year, on March 4, in the city of Natchitoches, Louisiana, USA, an underground natural gas pipeline explosion near residential areas destroyed seven houses, leaving a 15-foot-deep, 75-foot-long and 30-foot-wide crater; 10 acres proximity property burnt causes 17 fatalities and at least nine injuries; six cars and three trucks melted; and a saw mill was damaged (The Washington Observer, 1965). The Tennessee Gas Transmission Co. (TGT) was found to be pumping an excessive rate of gas pressure 12 h prior to the accident and shut off the flow only 30 min after the accident (Pearson, 1965). The same pipeline was later found to have exploded previously on May 3, 1955 with no casualties recorded (Beitler, 1965). Three years later, the Marting Arms sport goods store exploded twice on April 6 in downtown Richmond, Indiana. An underground natural gas pipeline ruptured near a five-block pedestrian mall area and destroyed 15 buildings with a total of 41 fatalities, and more than 120 injuries were recorded (Sheeley, 2015). The Richmond Gas Corp. was later found to be legally responsible, and 397 lawsuits were charged, but trial was allowed for one lawsuit; the victims were compensated approximately 5–10 million dollars each.

In 1970, a huge natural gas line explosion demolished 495 houses and buildings and caused 79 fatalities and 420 injuries on August 16 in Osaka, Japan (Akatsuka and Kobayashi, 2010). The event occurred at the elongation construction site of the Osaka city subway line elongation project, caused by a gas leak from a separated joint in the pressure piping, worsened by the weight of passing traffic and construction work. The Osaka Gas Company, Osaka-city and Tekken Corporation were found guilty of negligence, in joint responsibility for not applying appropriate preventive and effective response saves more lives (Wu et al., 2017). The leakage could not be found, but the employee worked overnight. It was later found that the Scottish Gas Board was not guilty in the inquiry, as the location of the pipeline could not be identified by the city developer prior to the unplanned city development and construction (The Glasgow Herald, 1972). The compensation paid was minimal (The Scotsman, 2011). Two years later, a natural gas line explosion blew up a downtown store and the neighbouring café,

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