pipeline explosion occurred in Umualia, Abia on June 19, killing over 105 people (BBC News, 2003). A similar cause was reported: that thieves had punctured the pipeline and scavenged for fuel, two months prior to this event (IOL, 2003). Locals claimed that the owner was informed of the breakage several days before the accident but failed to stop the leakage (IRIN, 2003).

A natural gas pipeline ruptured and exploded at the Pecos River near Carlsbad, New Mexico on August 19, 2000 (NTSB/PAR-03/01, 2003). The fire was ignited by a campfire; three vehicles burned, along with vegetation on the riverbanks and the two suspension bridges for the pipelines crossing the river, for almost an hour. All 12 campers were killed, leaving a crater 20 feet deep and approximately 86 feet long, and another crater 46 feet deep approximately 113 feet along the pipe. The El Paso Natural Gas Company (EPNG) employees noticed a 25 per cent drop in pipeline pressure, and it took them nearly one hour to shut the remote area’s pipeline valve (Bridgers, 2004). The cause of the rupture was attributed to severe internal corrosion, as no inspection of the pipeline had been performed for almost 50 years (Fowler, 2007). EPNG spent approximately 86 million dollars for pipeline system modification and 15.5 million dollars in penalties for violating various pipeline safety regulations (USDOJ, 2007); a total of $958,296 losses due to property and other damages was reported (NTSB/PAR-03/01, 2003). One of the victims was compensated 14 million dollars in out-of-court settlements (Billingsley, 2002). EPNG was later acquired by Kinder Morgan Inc., 12 years after the accident (Google Finance, 2014).

A corner section of a nine-storey apartment building was destroyed, and windows in neighbouring buildings in Arkhangelsk, Russia were blown out in an accident that killed 58 on March 16, 2004 (BBC News, 2004). A former employee of the city gas services was arrested, charged with sabotage and later found guilty; he was disgruntled about being fired. Residents reported gas smells to local emergency officials before the explosion, but no action was performed to avoid the accident.

4.5. Pipeline explosion cases in the years 2005–2014

A gas pipeline exploded in Ghislenghien near Ath, Belgium on July 30, 2004. Twenty-four people were killed, and 132 others were injured (ARIA, 2009). Areas six kilometres away from the epicentre of the explosion were affected. However, the adjacent pipeline, located 7 m from the ruptured pipeline, were not affected (Silva et al., 2016). The explosion was initiated by a factory construction machine that clawed the Fluxys pipeline during earthwork (CEMAC, 2014). The pressure between valves accumulated prior to the shut-off process. In the same year, on September 17, another petroleum pipeline exploded in Imore village of Lagos, Nigeria. The NNPC’s damaged pipeline killed more than 12 people, and it was claimed that fuel thieves had punctured the pipeline in an attempt to siphon off petrol (CNN.com, 2004; IRIN, 2004). Two years later, 150 people were killed and everything within 20 m radius from the epicentre of the explosion was incinerated on May 12, when a petrol pipeline exploded at Atlas Creek in Lagos (The Guardian, 2006). NNPC frequently used the same excuses: people insisted on drilling into pipelines despite the dangers (BBC News, 2006a).

Another petrol pipeline exploded in Abule Egba, Lagos on December 26, 2006, killing 466 people (CNN.com, 2006). The cause of the accident was believed to be similar to the previous events: oil theft (International Business Times, 2006). A number of houses were destroyed, along with a mosque and a church. Two years later, a petrol pipeline in Ijegun of Lagos exploded on May 16, 2008, killing at least 100 people (TransWorldNews, 2008). A bulldozer operated by construction workers struck an oil pipeline, and the explosion damaged the Ijegun Primary School and over 15 homes and burned more than 20 vehicles were (Akinola et al., 2008). Ironically, Nigerians often suffer fuel shortages due to corruption, poor management and infrastructure problems even though NNPC is Africa’s largest oil producer (BBC News, 2006b).

In 2010, two crude oil pipeline flows to an oil storage depot owned by the China National Petroleum Corporation (CNPC) ruptured and exploded, simultaneously burning for 15 h on the July 16 in Xingang Harbour, Dalian (VOA, 2010). A total of 1500 tons of oil were spilled, spreading over 946 square kilometres and stretching as far as 90 km along the coast five days later. However, the spill is presumed to have been worse than reported (The World Post, 2010). Nearby tanks of oil were released intentionally to prevent the fire from expanding weeks after the spill was reported. A cleaning process using the cheapest method was implemented (Hogg, 2010), which caused the death of a fire fighter during the cleaning process (Miller, 2011). Economically important activities were severely affected, e.g., tourism and the fishing industry, and the local wildlife areas and aquaculture were extensively damaged and displayed longer-term effects (Greenpeace, 2010). The pipeline resumed service within a week after the event (The World Post, 2010). It was later found that the explosion occurred due to over-pressure of the oil pipeline and it was not the only reason for the serious accident damage (Guo et al., 2013). In 2010, an oil pipeline explosion killed 29 and injured 52 others in San Martín Texmelucan de Labastida of Puebla, Mexico on December 19. A total of 115 homes were damaged, including 32 totally destroyed houses; a five-kilometre radius area was damaged, and a river was polluted (Gould and Rodriguez, 2010). Petroleos Mexicanos (Pemex) claimed that thieves attempting to siphon off the oil were the cause of the explosion, as a hole was found at the pipeline (Agron, 2010; The Associated Press, 2010); explosive energy from this orifice-type gas leakage was partly absorbed by the ground (Guo et al., 2016). Nevertheless, the pipeline was re-opened three days later even though the catastrophic damage can be considered serious, due to the hole size of punctured pipeline as reported (Bariha et al., 2016).

A fuel pipeline spilled and exploded on September 12, 2011 in Nairobi, Kenya; approximately 100 people were killed and 116 others injured (Gentleman, 2011; Ndonga, 2011). The leak was in the equipment of the state-owned pipeline company, Kenya Pipeline Company (KPC), and locals collected the leaking fuel that flowed into the sewer due to valve failure under pressure, making it impossible to prevent leaking (BBC News, 2011b). KPC never showed any indication of accepting responsibility; the victims’ compensations were denied due to the reluctance of the slum settlers to move away from the pipeline – they have no place to go (BBC News, 2011b). Two years later, on August 6, a gas explosion was caused by a leak in a residential area of Rosario, Argentina. Twenty-two were killed and 60 others injured (Clarim.com, 2013); a nine-storey building collapsed, and the neighbouring buildings experienced structural failures (La Nacion, 2013a). Broken glass from damaged buildings covered the streets, and cars were trapped in an underground parking lot. The leak was reported to Litoral Gas, but they claimed they never received such call (La Nacion, 2013b). However, employees were sent for leak detection in the building, and one tried to evacuate people (La Nacion, 2013c). The employees were improperly trained to manage such a situation. Nevertheless, an out-of-court settlement offering approximately 1200 USD per square meter of collapsed building was proposed, including compensation to the relatives of the deceased (La Capital, 2013).

On November 22, 2013, an oil pipe leaked, caught fire and exploded in the city of Qingdao, Shandong province of China, killing at least 35 people and injuring 166 others (Saudi Press Agency, 2013). The pipeline ruptured and leaked onto a street and into the sea before it was successfully shut off (Byrnes, 2013).