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NYT: Beneath Cities, a Decaying Tangle of Gas Pipes.

It is a danger hidden beneath the streets of New York City, unseen and rarely noticed: 6,302 miles of pipes transporting natural gas.

Leaks, like the one that is believed to have led to the explosion that killed eight people in East Harlem this month, are startlingly common, numbering in the thousands every year, federal records show.

Consolidated Edison, whose pipes supplied the two buildings leveled by the explosion, had the highest rate of leaks in the country among natural gas operators whose networks totaled at least 100 miles, according to a New York Times analysis of records collected by the federal Department of Transportation for 2012, the most recent year data was available.

The chief culprit, according to experts, is the perilous state of New York City's underground network, one of the oldest in the country and a glaring example of America's crumbling infrastructure.

In 2012 alone, Con Edison and National Grid, the other distributor of natural gas in the city, reported 9,906 leaks in their combined systems, which serve the city and Westchester County. More than half of them were considered hazardous because of the dangers they posed to people or property, federal records show. (There are more than 1.2 million miles of gas main pipes across the country. Last year, gas distributors nationwide reported an average of 12 leaks per 100 miles of those pipes.)

Most of the leaks in New York proved harmless, simply dissipating into the soil or air. But when gas finds an ignition source, the results can be deadly. Three separate episodes in Queens in recent years killed people, and a half-dozen others in the city left people injured, according to federal records dating back 10 years.

Elsewhere in the country, a rupture in a major pipeline in San Bruno, Calif., in 2010 caused an [explosion](#) that killed eight people. In 2011, a leak from an 83-year-old cast-iron main in Allentown, Pa., caused a [blast](#) that killed five people.

"It's like Russian roulette," said Robert B. Jackson, a professor of environment and energy at Stanford University who has studied gas leaks in Washington, D.C., and Boston. "The chances are, you are going to be lucky, but once in a while, you're going to be unlucky."

Striking in federal records is just how frequently there are near misses.

Last year, a Bronx woman awoke in the middle of the night to the pungent odor of gas. Her husband checked it out, but after smelling nothing unusual, he lit a cigarette. Suddenly, there was a flash of fire that left his face badly burned. In 2011, a 28-year-old man in Bayside, Queens, saw smoke coming from a basement utility room just before a small explosion blew the door open. The cause was traced to a leak in a 54-year-old steel main in the street nearby.

Nearly half of the gas mains operated by Con Edison and National Grid were installed before 1940, according to federal records. More than half of the mains are made of cast iron, wrought iron, or unprotected steel — materials that are vulnerable to corrosion and cracking, especially in cold weather. Indeed, there was another scare in the city on Saturday when a leak from a crack in a 108-year-old cast-iron main, maintained by Con Edison, in the Bronx caused the Fire Department to briefly evacuate two apartment buildings.

Communities across the country have been struggling to replace thousands of miles of these old, metal pipes with pipes made of plastic or specially coated steel that are less prone to leakage. Few, however, face as daunting a challenge as New York City.

To replace all of the old mains in its network right now would cost as much as \$10 billion, Con Edison estimates. Much of that expense would fall on the residents and businesses that use the gas for heating and cooking.

Despite the high cost and logistical hurdles, alarmed regulators at the state's Public Service Commission have ordered the company to significantly step up its replacement schedule, from 50 miles of pipe a year to 70 by 2016, in the city and in Westchester. Even at that rate, it would still take nearly three decades for the utility to finish swapping out what regulators have identified as the most leak-prone pipes.

As a result, infrastructure experts say there could easily be more explosions like the one this month in East Harlem.

After the blast, federal investigators identified a leak in the gas main, but they are still not certain what caused it or if it was the source of the gas that exploded.

Federal records show the New York City utilities have been able to cut into their leak numbers as they have replaced mains. National Grid, in particular, has made improvements. Its rate of leaks per 100 miles of gas mains still ranks among the highest in the country, but it is significantly better than Con Edison's.

Con Edison has made progress, too. But last year, when regulators were considering whether to let Con Edison raise its rates, the commission's staff voiced concerns about the company's attitude toward safety.

The staff testified that Con Edison had 695 violations of the state's gas pipeline safety regulations over the previous three years. Not all of those violations were classified as "high risk," but the regulatory staff said any failure to follow the rules was "a serious issue that could either directly or indirectly lead to an incident causing serious public harm."

A spokesman for Con Edison, Michael Clendenin, responded by saying the company "takes compliance with the commission's regulations very seriously." He added that the complexity of New York City's infrastructure probably accounts for the utility's high rate of leaks, but added, "We attend to hazardous leaks immediately."

Deaths Over a Decade

In order to ignite, gas has to pool in a confined space until it makes up at least 5 percent of the air. Then, any flame or spark — even the flipping of a light switch — can set it off.

In the last decade, The Times identified from federal records 22 significant gas ignitions in the city; a dozen of these were categorized in federal records as full-fledged explosions.

Not counting the blast in East Harlem, gas-related episodes have killed three people in the city in the last decade and injured 22 others, according to a tally by The Times.

The East Harlem gas explosion, which also injured dozens, was the first fatal one in the city in nearly five years.

In April 2009, Ghanwatti Boodram, 40, a nurse and mother of three, was killed when an explosion leveled her house in Floral Park, Queens. A state [investigation](#) concluded that, among other failures, a Con Edison worker had not adequately checked for gas leaks in the area. The investigation found that faulty electrical wiring had set off a chain of events that created holes in the main, installed in 1950, allowing gas to escape and pool inside the house.

The year before, just minutes after Con Edison crews had restored gas service to a building in Flushing, Queens, Edgar Zaldumbide, 43, tried to light the pilot of his stove. An [explosion](#) followed. He died several weeks later; his 2-year-old daughter was badly burned, and 15 others were also injured. A state investigation concluded that, among other failures, a Con Edison worker had failed to adequately check for gas leaks in the area.

In 2007, as Con Edison workers were searching for the source of a gas leak that had forced residents in Sunnyside, Queens, onto the street, one resident, Kunta Oza, 69, was told by firefighters that she could return to her home. But minutes later, an explosion occurred, killing Ms. Oza.

State regulators concluded that corrosion, as well as overall wear, had contributed to a crack in the gas main, which had been installed in 1927 but was not on Con Edison's priority list to be replaced.

Gas-related incidents that result in fatalities garner the biggest headlines. A review of federal records, however, shows that there have been many smaller, yet still frightening, incidents that attracted no news media attention at all.

One such event occurred on March 6 last year in the Bronx.

At 4 a.m., Ping Ching Li, 57, and his wife, Cindy, were stirred from their sleep by the strong smell of gas in their two-story house. Both went to the garage to investigate, spraying water on the joints of the pipes that feed into the gas meter to check for bubbling. Nothing. They thought, perhaps, that the smell was emanating from their car, so they moved the car to the street.

Later, after Ms. Li returned upstairs, Mr. Li decided to check the garage again, to see if the car had been the source of the smell. He flicked his lighter to smoke a Marlboro Light, then suddenly, Whoosh! There was a blast of fire, and flames circled his head and arms, he recalled in an interview this week. He suffered second-degree burns and was hospitalized for two days at nearby Jacobi Medical Center. Today, Mr. Li said his vision in one eye remains blurry, and his hearing in one ear is greatly diminished.

"I feel very, very lucky," said Mr. Li, who plans to file a lawsuit against Con Edison next week. "If the car were still in the garage, the whole house would have exploded."

Con Edison workers later visited the couple's house and explained that the leak had come from somewhere under their garage. A crack in a six-inch cast-iron main, installed in 1953, was to blame, according to federal records.

Pipe Replacement

Replacing aging mains is the surest way to reduce the number of hazardous leaks. But getting the

old metal pipe out of the ground takes serious time, labor and money.

Last Thursday, a dozen employees of National Grid were digging four feet beneath Troutman Street in the Bushwick section of Brooklyn to uncover a cast-iron gas main. Over the course of a few days, working with a backhoe on the street, they intended to replace a 50-foot segment of that main with a yellow plastic pipe six inches in diameter.

The old main was not leaking badly, but city workers had opened up the street for a separate project, so National Grid, which supplies natural gas to Brooklyn, Queens and Staten Island, took the opportunity to swap out the pipe.

The utility has doubled the pace of its replacement program, to more than 40 miles a year, said William Akley, the company's senior vice president for maintenance and construction. Still, it will take as long as 25 years to get rid of all of the "vintage" pipes, made of iron or bare steel, in the system, he said.

Some other cities, mostly in the Northeast, are proceeding at rates far slower than New York in replacing aging cast-iron pipes, according to Dr. Jackson, the Stanford professor. Baltimore is on track to replace its pipes in 140 years, while Philadelphia will not be done for 80 years, he said.

By contrast, one place that has been among the most aggressive in the country is Ohio. Beginning in 2002, one of the state's major utilities, Duke Energy, which serves the Cincinnati area, was granted approval by state regulators to begin a 10-year, \$700 million program to replace about 1,200 miles of cast-iron and bare-steel gas pipes, said Donald L. Mason, a commissioner at the time with the Public Utilities Commission of Ohio.

The number of leaks per miles for Duke Energy now ranks among the lowest in the country, according to The Times's analysis.

And in 2007, Dominion East Ohio, which chiefly serves Cleveland and northeast Ohio, initiated a 25-year, \$2.7 billion program to replace 4,000 miles of pipe. The amount Dominion spent on leak repairs dropped to \$6 million a year from \$10 million, Mr. Mason said.

No catastrophic event led to the Ohio push. Instead, utility executives and state regulators were concerned that the original 40-year schedule to replace pipes that were already 50 to 75 years old was too slow.

"We felt that we needed to cut this in half, because 40 years was too long," Mr. Mason said.

Restrictive Rules

Con Edison, however, faces a unique conundrum when it comes to the heart of its territory, Manhattan, where the rules on when and how it can disrupt traffic are much more restrictive than elsewhere. As a result, the utility says it can cost as much as \$2,000 a foot, or well over \$10 million a mile, to replace a gas main.

"Some of this aging infrastructure has reached the end of its useful life," said Brigham McCown, a lawyer who was the administrator of the federal pipeline safety agency until 2007. But, he added, "It's a major ordeal in a city like New York to just start digging things up."

Felim McTague, a construction manager for Con Edison, said it was taking about two weeks per block to upgrade the gas mains in the meatpacking district of Manhattan. A crew of seven has to thread the new pipe — coated steel at the intersections, plastic in between — through a maze of

steam pipes, phone lines, TV cables, and sewer and water mains. Every night, they have to cover the hole in the street with thick steel plates that can bear the city traffic.

"It's a tedious process," Mr. McTague said.

Because of how long an overhaul in New York City will take, some experts believe more effort needs to be devoted to detecting leaks and addressing them before they become serious.

Con Edison performs its own leak surveys of its mains at least once a year, sending teams out with sensors to measure the amount of methane in the air, according to officials, and more often in severe weather. The utility is still not doing enough, said Mark McDonald, who investigates gas explosions for insurance companies and property owners.

"Accelerated replacement is not the answer to today's problem; it's the answer to tomorrow's problem," Mr. McDonald said. "What needs to be happening is increased vigilance, increased leak surveys to spot these problems before it gets into someone's house."

Utility companies now largely rely on the noses of their customers to alert them to danger. The gas that flows through the network of pipes under the streets is naturally odorless, so a compound known as mercaptan that smells somewhat like rotten eggs is added.

In the case of the East Harlem explosion, Con Edison officials said a customer's call less than 20 minutes before the explosion was their only warning about a possible leak. The utility quickly dispatched two crews.

They arrived too late.

By [PATRICK McGEEHAN](#), [RUSS BUETTNER](#) and [DAVID W. CHEN](#) MARCH 23, 2014

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