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# REMAPPING DEBATE

Asking "Why" and "Why Not"

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## Corroding pipelines

**Original Reporting** | By David Cay Johnston | Energy, Environment, Regulation



The aftermath of the pipeline explosion  
in San Bruno, California

December 14, 2010 — A natural gas pipeline exploded Sept. 9 in the San Francisco Peninsula suburb of San Bruno, shooting a wall of fire hundreds of feet into the sky for more than 90 minutes as Pacific Gas & Electric utility crews had to fight rush hour traffic to reach manual shut-off valves, one of them more than 30 miles from the blast. The explosion — which left a crater 40 feet deep — killed eight people, injured 60 more, and severely damaged or destroyed 120 homes.

Many survivors in the surrounding area told reporters they had no idea that a 30-inch, high-pressure pipeline laid in 1956 ran through their neighborhood.

Neither did city officials, says Mayor Jim Ruane, even though federal safety rules require that pipeline operators periodically alert residents to the presence of pipelines and train first responders.

Nationwide, pipeline blasts and fires kill a person every three weeks and burn or injure someone more than once a week.

Those are small numbers, as the pipeline industry emphasizes. But they reflect luck more than serious safety planning. As open spaces where pipelines were laid decades ago become developed, aging pipelines remain in use, and inspections have lagged, the risk of deadly blasts that can wipe out a block of homes, offices, stores or even schools and hospitals, grows.

As the number of people at risk increases, questions about the manner and scope of government regulation in this area become more urgent, as do questions about why the government has failed take a host of safety-enhancing actions recommended by, among others, the National Academy of Engineering and the National Transportation Safety Board.

Why, for example, do the Department of Transportation and its [Pipeline and Hazardous Materials Safety Administration](#) rely so heavily on after-blast reviews, rather than on prevention?

Why do some key safety recommendations from the National Academy of Engineering and the National Transportation Safety Board gather dust? Among these are developing model land use ordinances and standard setbacks for construction near pipelines as part of a risk-based safety strategy, addressing potential damage to natural gas pipelines whose shipping may not have complied with safety rules, and requiring pipeline operators to have a system to calculate estimated release of gas or liquids.

Why has PHMSA not tightened its regulations over time, but instead granted safety waivers? Why doesn't PHMSA focus on ways to improve detection of corrosion and other damage to pipelines? And why hasn't PHMSA followed the Transportation Safety Board recommendation that it measure the effectiveness of mandatory notices to people who live or work in zones where a blast would result in certain death or injury?

## **A massive network**

There are three categories of natural gas pipeline systems, one of which poses much greater risks than the others.

The system with the fewest issues so far gathers gas at wellheads and takes it to processing stations. In Fort Worth and some other Texas towns, these gathering lines have begun to attract public concern, an issue that may increase with development of shale gas fields beneath and near cities and towns in Pennsylvania, New York, Colorado and other states.

The largest part of the system is distribution, the roughly 2.1 million miles of small bore pipes that carry natural gas to homes, offices and other buildings. Damage caused by backhoes and other excavation equipment is the largest danger here, but the risks are primarily to careless operators.

The potentially most dangerous system is the one linking gas gathering and gas distribution, the roughly 300,000 miles of pipelines up to 42-inches in diameter that transports gas long distances. The Pipeline and Hazardous Materials Safety Administration has jurisdiction over about 174,000 miles of this system. The rest do not cross state lines and are regulated by state safety agencies.

Gas transmission pipelines operate at pressures of up to 1,500 pounds per square inch. By way of comparison, many home power washers emit water at roughly the same pressure.

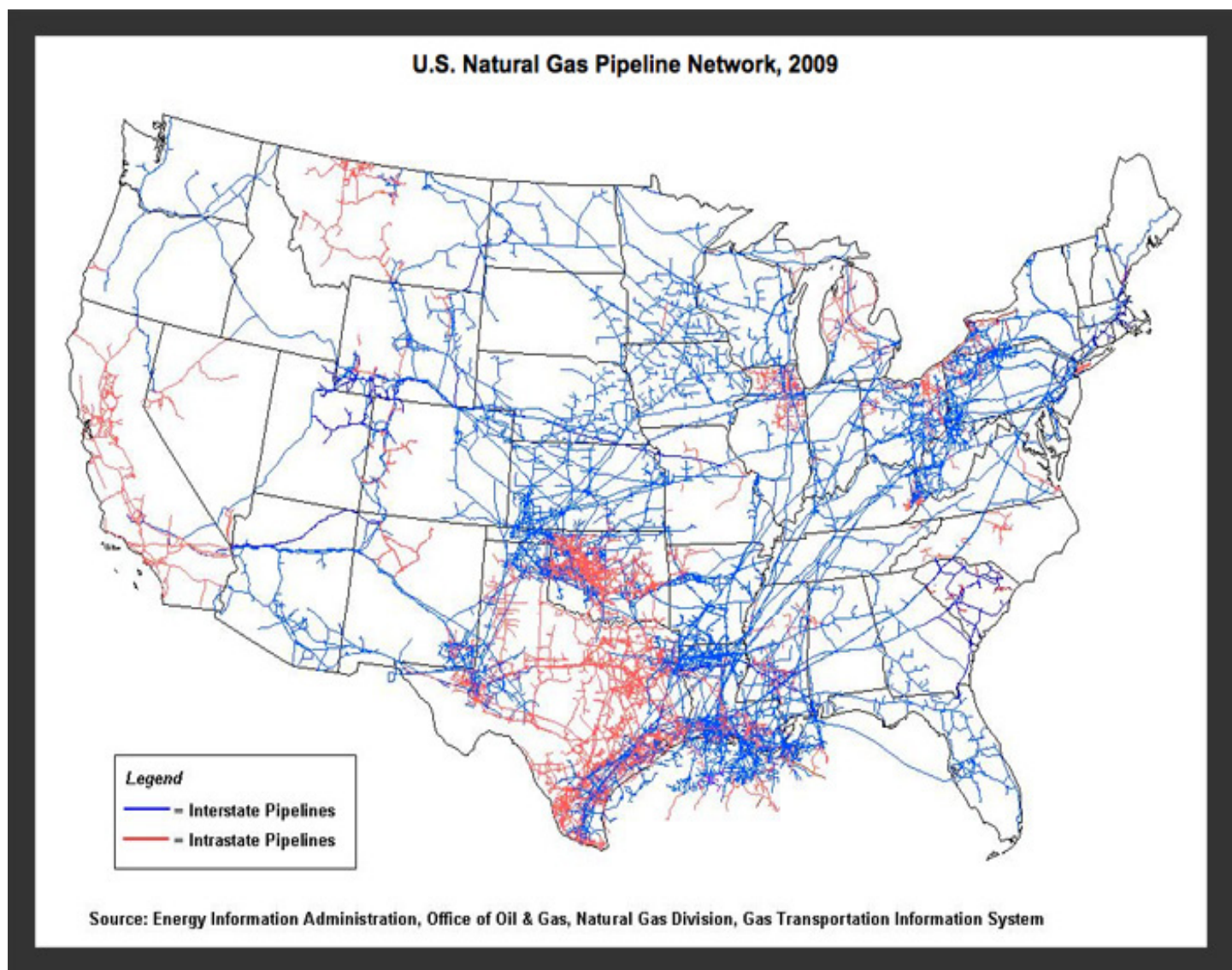
The outlet on a home power washer, however, is but a fraction of an inch across, whereas pipelines are up to 42 inches in diameter, propelling massively more volume and generating enormously higher overall force. (The San Bruno pipeline, which was 30 inches in diameter, actually did its damage operating at the lower pressure of 1,000 pounds per square inch.)

For natural gas pipelines the size and pressure of the one in San Bruno, the fatal fire zone for flat land is 660-feet in every direction, with buildings and trees giving the fleet footed at the outer edges some chance of escape.

There are another 200,000 miles or so of petroleum pipelines that also use high pressure to move gasoline, kerosene and jet fuel, often heated to a scalding temperature of 158 degrees Fahrenheit.

So far most transmission pipeline blasts have taken place in rural or suburban areas, but transmission pipelines also run into all big cities.

“Imagine a pipeline blowing up in Manhattan with its high rise apartment buildings and hospitals,” said Carl Weimer, executive director of the [Pipeline Safety Trust](#), a nonprofit financed with damages from a pipeline rupture, (see box on next page).



## POTENTIAL IMPACT IN A HIGH-DENSITY AREA

In Manhattan, the entry points for high pressure natural gas pipelines include the tip of the island, the Lower East Side and near Tudor City in midtown, as well as near the mouths of the Holland and Lincoln tunnels and the George Washington Bridge — all areas with multi-story apartments and some with high rise office buildings.

Imagine a natural gas line erupting here.

The good news is that buildings would limit the range of the fireball, Dan Nigro, retired chief of the New York Fire Department, said.

But flames would pour from the cratered area so long as the gas flowed, igniting flammable materials in the streets.

Professor Glenn Corbett, who teaches fire safety management at John Jay College in Manhattan and is also a fire captain in New Jersey, said when a ruptured pipeline exploded in Edison, N.J., in 1994 it took more than 600 manual turns of a valve to shut off the gas, a process that took six hours.

“There is no question you will ignite some surrounding buildings,” Professor Corbett said.

His colleague, Professor Charles Jennings, said a Manhattan pipeline blast “could be much worse than San Bruno just because it is a much denser area.”

Fuel tanks in vehicles, underground heating oil storage tanks, and urban furniture could all add to the flames.

Once the electric power stopped, those in elevators would be trapped.

People in tall buildings would have to navigate emergency stairwells, a difficult task for the elderly and disabled. “The chance of this happening is very small, but if it does happen, the costs in life, in services being shut off and reconstruction would be enormous,” Corbett said.

New York City building codes exempt buildings built through the 1980s from having to incorporate many design features that for decades have been standard in many other cities.

These include high-rise apartment buildings that do not have sprinkler systems, and other multiple dwellings that have fire escapes that are behind locked doors.

Con Edison, which distributes natural gas in much of Manhattan, conducts annual training drills with the New York Fire Department in case one of the high-pressure transmission lines ruptures. The most recent training was last weekend, spokesman Chris Olert said.

## From unregulated to lightly regulated

Until 2002 America's roughly 2.5 million miles of natural gas and liquid petroleum pipelines were not subject to any mandatory safety inspections. Even now, regulation is mostly left to trusting pipeline owners. They must develop "integrity management plans" and inspect the entire pipeline every seven years, with some exceptions. The government employs only 88 auditors nationwide, about 20 fewer than authorized in its budget, to review pipeline safety reports and conduct some field inspections.

### WHAT DO THE DOCUMENTS SHOW?

Paul Blackburn runs Plains Justice, a public interest law firm in Vermillion, South Dakota, a town on the border with Nebraska. Blackburn, who previously worked as an energy regulatory lawyer in Washington, is engaged in several public interest actions aimed at dealing with damage from pipeline ruptures and to make a proposed new pipeline from Canada into the United States safer.

He obtained some pipeline company safety planning reports under the Freedom of Information Act. Blackburn said he expected to read detailed emergency response and evacuation plans, including emergency contact numbers and an assessment of firefighting resources. In fact, "I found there was almost nothing in the file, it was pathetic," Blackburn said, adding that the files he reviewed show that "the government basically rubber stamps industry documents" with little to no evidence it questioned, much less challenged, anything the companies proposed.

The Pipeline Safety Improvement Act that President George W. Bush signed in 2002 was expected to cost the industry \$11 billion over 20 years, but instead its actual implementation will cost just \$4.7 billion because, the U.S. Energy Information Administration said, the law gave the Office of Pipeline Safety "some discretion" in deciding what actions pipeline companies must take. The discretionary actions include requiring fewer and less expensive shut-off valve systems, and exempting some pipeline segments from internal inspections that use inline information tools. These tools, known as "pigs," travel down pipelines and use lasers to measure damage to pipeline walls.

Just 7 percent of natural gas lines and 44 percent of petroleum lines are subject to mandatory inspection under the 2002 safety rules, which are supposed to apply to densely populated and environmentally sensitive areas.

The principal problem with the 2002 law, critics including engineering experts say, is that it relies too much on self-reporting, allows inadequate safety warnings, and lacks teeth when it comes to penalties. From 2002 to 2008, PHMSA collected 294 fines averaging almost \$55,000; in 2009, the agency collected 12 fines averaging almost \$145,000.

To put the scope of the fines in context: in 2006, the most recent year for which full data are available, the collective net income of the transmission pipeline industry (gas and petroleum) totalled more than \$5 billion.

The 2002 law was seen by supporters as a first step, which they anticipated would lead to more encompassing regulations of transmission pipelines. But no further substantive changes to transmission pipeline regulations were ever put in place.

The Department of Transportation insists that it and PHMSA — its pipeline office — take safety issues seriously. “Safety is the number one priority,” wrote department spokesperson Maureen Knightly in an email reply to Remapping Debate’s inquiries (a request for an interview was denied). Knightly’s email stated that PHMSA conducted 800-900 inspections a year, and provided generalized assurances that PHMSA “reviews all available data to determine inspection frequency and focus.” But she did not respond to questions about the reasons PHMSA is seeking expanded authority to grant safety waivers, or about what steps it has taken to inform people who are not property owners (such as workers, shoppers and children) that they are near a pipeline granted a safety waiver.

Pipeline Safety Trust’s Weimer considers the Transportation Department’s safety-first claims almost laughable.

“The overarching problem with the current pipeline safety regulatory system is the undue influence that the pipeline industry has on every aspect of how those regulations are designed and enforced,” Weimer said. “The industry deluges rule making processes with their public relations people and lawyers, and most regulators have either come from the industry they now regulate or plan to go to work for that industry once they leave government service.”

At pipeline safety conferences, Weimer said, he is often the only one present who is not an industry advocate or regulator.

The entire approach to pipeline safety stands in stark contrast to the way government and industry deal with airline safety issues, where the focus is on preventing crashes through the use of engineering, analysis and data collection, says Rick Kessler, a pipeline engineer who worked on pipeline issues as a Capitol Hill staffer and is now a volunteer vice president of the Pipeline Safety Trust.

Kessler said that, if the Federal Aviation Administration operated on the same rules as PHMSA, “I wouldn’t get on a plane.”

The San Bruno incident demonstrated how reliance on manual safety valves, in buildings where only a few pipeline company workers have keys, hinders the ability to quickly stop the flow of gas that is feeding a fire. The National Transportation Safety Board had previously urged wider use of automatic shut off valves, as well as closer spacing between valves, but its recommendations have gone nowhere because of the costs and concerns about the reliability of automated valves given the design of the systems of which they are a part.

The PHMSA administrator, Cynthia Quarterman, is among those who come from the pipeline industry. She was an outside lawyer for Enbridge, owner of a pipeline that dumped nearly a million gallons of fuel into delicate Michigan marshes last July.

Quarterman, who has recused herself from Enbridge matters, called for tightening pipeline regulations after the San Bruno blast. “We inherited a program that suffered from almost a decade of neglect,” Quarterman told the House Transportation and Infrastructure Committee last spring. “We have set a new course.”

## Safety waivers and notices

The federal government has given a small but growing share of these lines waivers from the safety rules, in some cases allowing high-pressure pipelines to operate when corrosion has eaten through more than 28 percent of the pipeline wall.

Federal officials say that the waivers do not compromise safety, and are used mostly in areas where pigs cannot be used to inspect pipelines internally. They add that operators are required to inform customers of the presence of pipelines.

But Theo Theofanous, a professor of mechanical and chemical engineering at UC Santa Barbara and director of its Center for Risk Studies and Safety, said the rules on corrosion and other damage to pipeline walls are not nearly stringent enough and run unnecessary risks. “Safety factors are employed to provide a margin of safety against unexpected causes, Theofanous said. “It is not good engineering practice to ‘use them’ against known deterioration of the structure, so that effectively we end up with a lower safety factor,” he added.

Theofanous noted that a “safety factor of 2 is not uncommon in situations involving high pressures, even if the consequences of failure are modest,” but permitted corrosion levels in the transmission pipeline industry routinely compromise that safety factor even before the occurrence of unexpected events for which one wants to have the full margin of safety available.

That PHMSA may have traditionally been more interested in maintaining public calm than in establishing public vigilance is reflected in its euphemistic language. PHMSA refers to the area of certain death in a catastrophic failure not as a blast zone, but as a “high consequence area.” The same term is applied to swamps and marshes, where an oil spill would cause severe environmental damage.

A sampling of gas pipeline notices sent to property owners shows that they read more like promotional brochures for the pipeline industry than alerts, touting the idea that pipelines are safe except when excavators carelessly puncture pipelines with backhoes and similar equipment.

The euphemistic “high consequence area” warning is typically a single paragraph buried deep in the pamphlet which makes no mention of almost certain death in the burn area.

How effective are these notices? And how well do pipeline operators fulfill their duty to educate first responders about pipeline locations and hazards?

PHMSA has no idea. The agency has not undertaken any studies, surveys or created focus groups to determine if the notices are effective in warning people or in altering their behavior. Further, it has no mechanism to insure that people other than property owners — renters, workers, shoppers, children in schools and playgrounds — are aware they are in the fatal blast zone of high-pressure pipelines.

## Industry safety spending

The website of the American Gas Association states that the most recent annual figure for safety-related spending was \$6 billion nationwide. But no detailed breakdown is provided on how much of that spending is for regulatory hearings, public notices and the training of first responders, as opposed to pipeline inspections and improvements. Indeed, when Remapping Debate asked an industry spokesperson how much the natural gas transmission pipeline industry spends on maintenance, the spokesperson was not sure. Christine Sames, a petroleum engineer who is vice president for operations and engineering at the American Gas Association, said, “I’m trying to recall if anyone pulls together that statistic.”

Sames said she believes that industry maintenance spending over the last “decade or two” has been about \$7 billion annually. If spending has in fact been constant at that level, it would represent a major decrease in real dollars because of the effect of inflation. If constant since 1990, the erosion due to inflation would be 40 percent; even if flat since only 2000, the erosion would represent 21 percent. And that calculation does not take into account the existence of additional pipelines to inspect or the increased age of existing pipelines.

Utility workers across the country said in interviews that they believe they and customers are being put at risk by cost-cutting that they say began with the deregulation of gas distribution.

“All the gas utility companies are basically playing the odds,” said Charlie D. Rittenhouse, president of the Utility Workers of America Local 98 in West Virginia. “They’ve cut the workforces and cut the workforces and cut the workforces while at the same time keeping the CEOs and top executive wages going up and up and up. A major concern for our group and many other groups we deal with [is that] there’s not enough people there to do the work.”

Documents in rate cases filed by several utilities show that they have reduced spending on pipeline maintenance or, in the case of Pacific Gas & Electric, have diverted money approved for increased pipeline maintenance to what the company considered more pressing needs.

PG&E gave Remapping Debate data showing it spent \$698 million over the past seven years on its 6,400 miles of transmission pipelines or about \$15,000 per mile annually. It costs about \$3.7 million per mile to build onshore transmission pipelines in 2010, the Oil & Gas Journal reported, indicating PG&E spends about four-tenths of one percent of construction costs per mile on safety. Just how that money



was spent and whether it was adequate are among the issues being investigated by the California Public Utilities Commission and a State Senate committee.

PHMSA does not analyze data on safety spending, spokesman Knightly said.

## **“De-rating” a pipeline**

Shutting down a pipeline for repairs or replacement is costly, so pipeline owners prefer a different approach as corrosion eats through pipeline walls and water, earth movements, and “dings” from earth-moving equipment damage exterior walls and welds. The pipeline companies just reduce the pressure in the pipeline, explained Gordon Allen Aaker, Jr., a pipeline engineer in Kingwood, Tex., who consults on safety issues to both pipeline companies and those who sue them.

“It’s called de-rating,” Aaker said. He and others say by allowing pipelines to lower the maximum rated pressure at which gas and petroleum can be moved, the rules discourage maintenance and all but completely unavoidable repairs.

He said if engineers determine that a pipeline wall must be an inch thick to operate at maximum pressure the pipeline may be built with steel that is an inch and 3/8ths thick.

That means corrosion can eat through the three-eighths of an inch without compromising safety. But once that corrosion eats into the required inch-thick wall, the response is not to replace the corroded segment, but to just lower the pressure by calculating how much pressure the remaining wall can safely withstand. He said a 30-inch pipeline built for 1,500 pounds per square inch might be reduced in stages to 1,200 pounds and then 900 pounds until, ultimately, it is replaced or simply abandoned. The safety of the protocol relies on the assumption that engineers have accurately estimated erosion rates.

“Allowing producers to de-rate the pipeline does not give them any incentive to maintain the pipeline,” Aaker said.

Why would companies shut down pipelines, and the flow of revenue, “when they can just de-rate it?” asked Aaker, who sees government rules as the underlying problem by creating the wrong incentives for pipeline owners.

## **Preventive action not taken**

Professor Theofanous served on a 2004 National Academy of Engineering committee that issued a 144-page report on how to improve pipeline safety. It focused on the added risks of urban development into what had been rural areas when high-pressure pipelines were laid.

The professor believes the report was heavily influenced by industry concerns, muddling some issues and avoiding the exploration of others, including improving technology to detect corrosion and other damage.

The principal means of detecting leaks in a pipeline now is to fly overhead and look for desiccated grass and trees because leaking natural gas kills plant life at the roots.

Inline inspection tools, or pigs, are sent down some pipelines to test for corrosion, weak welds and other signs of wear and damage. The San Bruno pipeline had never been inspected internally after more than half a century in the ground because its size varies in places, Pacific Gas & Electric said.

Mayor Ruane of San Bruno said that the company's rationale troubles him. "We put a man on the moon decades ago and we can't build a pipeline pig that can measure pipelines of varying size?"

### Can you find the pipeline? (Part 1)

Technically PHMSA does disclose where safety waivers are granted. But the language is cryptic. Here is a typical description, for a third of a mile segment of the Empire State Pipeline in Western New York:

Special Permit Segment 2 - 24-inch Empire State Pipeline mainline, approximately 1,715 feet in length, located in Monroe County, NY from Survey Station 4018 + 73 to Survey Station 4035 + 88; (MP 76.09 to MP 76.42)

Just where is this pipeline? Unless you know the proprietary mile marking system the pipeline company uses you cannot determine the area exempted from the safety regulations.

How about getting map coordinates, street intersections or street addresses at the start and end of the section?

Empire Pipeline's president, Ronald C. Kraemer, was very helpful in explaining some fine points of the regulations, but he would not tell me just where the pipeline and the safety waiver segment are located because the government and the company treat that information as confidential.

The federal Office of Pipeline Safety publishes maps of pipelines, but only state and local government officials who register can get access and then only for the area within their jurisdiction. Citizens can look, but at maps of such low resolution as to be almost useless.

I called the Office of Pipeline Safety at the Department of Transportation as a resident who wanted to locate the segment of gas transmission pipeline cited in the safety waiver above so I could determine if I or my family were affected. I was put through to the standards office, where a very genial government worker listened to my request and said, "I don't think there's a way you can do that."

Professor Theofanous said the problem could have been solved long ago. “Yes there are engineering problems, but the reason they have not been solved is a failure of will, not skill,” he said, noting that a prototype pig capable of moving through a pipeline of changing size is being tested, but is not yet in field use.

Even when pigs are used to check inside a pipeline, government rules allow inspections to be conducted as infrequently as once every seven years. When natural gas is contaminated with water and other liquids, that leaves a long time for corrosion to eat into pipeline walls, too long in the view of Theofanous and some other experts, though PHMSA and the industry say in areas of high concern about internal corrosion inspections can be required every four years.

### Can you find the pipeline? (Part 2)

The public affairs office would not take my call. Instead spokeswoman Patricia Klinger had a clerk call me to ask me to email questions. Getting no response, I went to Transportation Secretary LaHood’s office. Maureen Knightly, a LaHood spokeswoman, said exact pipeline locations are withheld because of concerns that Al Qaeda and similar organizations might use maps showing where pipelines are buried to blow them up.

In fact, pipelines are marked with yellow posts at various points along their route. Any would-be terrorist with a little time, therefore, could follow the markings to determine where blowing up a pipeline would do the most damage.

Residents, on the other hand, are not very likely to engage in that kind of scouting mission. Knightly said that if you want to know if you are near a pipeline, and whether it is covered by a waiver, then you “would need to contact [your] state’s one-call center or local underground utility locator.” That number is 811 or, to get a toll-free direct-dial number for the nearest one-call center, 1-888-258-0808.

Calling those numbers will let you find out if you are near a pipeline, but not whether that pipeline has been granted a safety rules waiver.

How reliable the information will be is uncertain, The Houston Chronicle, in 2006, reported that [many pipelines were located far from where they were shown on maps and some were not on maps at all.](#)

If the Transportation rules making it difficult to identify pipelines were in place because of concerns about terrorists, Pacific Gas & Electric, the operator of the San Bruno pipeline that exploded in September, may have some explaining to do. After the explosion, it released to the public detailed pipeline maps, including transmission maps. The company said it did so as part of an effort to restore trust in its pipeline operations.

## A proposal for change

California Senators Diane Feinstein and Barbara Boxer introduced a bill offered by Secretary LaHood six days after the San Bruno blast. It would provide for 40 pipeline inspectors in addition to the 88 now on the payroll and would increase the maximum fine per incident from \$1 million to \$2.5 million. It would also provide for more data collection and a review of whether all pipelines, not just the sections designated as “high consequence areas” should be subject to inspection and safety planning. The Strengthening Pipeline Safety and Enforcement Act of 2010, S.3824, has since languished in committee and will die this month.

Both senators and Rep. Jackie Speier, who represents San Bruno, say they will push for enhanced pipeline safety legislation in the new Congress.

## How long will luck hold up?

In 1999, some 277,000 gallons of gasoline gushed from a burst pipeline into Whatcom Creek upstream from Bellingham, Washington. A high-rise apartment building for low-income seniors and the disabled was just 75 feet from the water’s edge, while the county jail with about 300 inmates was 120 feet from the water. If the gasoline had reached the heart of the city, its downtown could have been effectively blown up.

Instead, two boys had the bad luck and poor judgment to be playing with matches along the water’s edge near the leak. The explosion they accidentally set off killed them, another youth and every other living thing for two miles upstream, but the early explosion meant that the city itself was spared. Because of the lives that likely would have been lost had the gasoline reached downtown, Bellingham’s mayor called the boys “unwitting heroes.”

When a 30-inch El Paso Corporation natural gas pipeline exploded in the New Mexico desert near Carlsbad in June 2000, the blast burned an extended family of 12, some of whom lingered in agony for days before the last of them died. They had camped out 675 feet from the blast site.

The El Paso pipeline, buried at a low spot in the desert that exerts extra pressure on the steel, simply corroded through after more than 50 years, the National Transportation Safety Board ruled.

The Carlsbad pipeline and the San Bruno pipeline that exploded this past September were laid decades before and never inspected, much less maintained.

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