

The Trillion-Gallon Loophole: Lax Rules for Drillers that Inject Pollutants Into the Earth



The remains of a tanker truck after an explosion ripped through an injection well site in a pasture outside of Rosharon, Texas, on Jan. 13, 2003, killing three workers. The fire occurred as two tanker trucks, including the one above, were unloading thousands of gallons of drilling wastewater. (Photo courtesy of the Chemical Safety Board)

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On a cold, overcast afternoon in January 2003, two tanker trucks backed up to an injection well site in a pasture outside Rosharon, Texas. There, under a steel shed, they began to unload thousands of gallons of wastewater for burial deep beneath the earth.

The waste – the byproduct of oil and gas drilling – was [described in regulatory documents](#) as a benign mixture of salt and water. But as the liquid rushed from the trucks, it released a billowing vapor of far more volatile materials, including benzene and other flammable hydrocarbons.

Interactive Graphic



State-by-State: Underground Injection Wells

The truck engines, left to idle by their drivers, sucked the fumes from the air, revving into a high-pitched whine. Before anyone could react, one of the trucks backfired, releasing a spark that ignited the invisible cloud.

Fifteen-foot-high flames enveloped the steel shed and tankers. Two workers died, and four were rushed to the hospital with burns over much of their bodies. A third worker died six weeks later.

What happened that day at Rosharon was [the result of a significant breakdown](#) in the nation's efforts to regulate the handling of toxic waste, a ProPublica investigation shows.

The site at Rosharon is what is known as a "Class 2" well. Such wells are subject to looser rules and less scrutiny than others designed for hazardous materials. Had the chemicals the workers were disposing of that day come from a factory or a refinery, it would have been illegal to pour them into that well. But regulatory concessions won by the energy industry over the last three decades made it legal to dump similar substances into the Rosharon site – as long as they came from drilling.

Injection wells have proliferated over the last 60 years, in large part because they are the cheapest, most expedient way to manage hundreds of billions of gallons of industrial waste generated in the U.S. each year. Yet the dangers of injection are well known: In accidents dating back to the 1960s, toxic materials have bubbled up to the surface or escaped, contaminating aquifers that store supplies of drinking water.

[There are now more than 150,000 Class 2](#) wells in 33 states, into which oil and gas drillers have injected at least 10 trillion gallons of fluid. The numbers have increased rapidly in recent years, driven by expanding use of hydraulic fracturing to reach previously inaccessible resources. ProPublica analyzed records summarizing more than 220,000 well inspections conducted between late 2007 and late 2010, including more than 194,000 for Class 2 wells. We also reviewed federal audits of state oversight programs, interviewed dozens of experts and explored court documents, case files, and the evolution of underground disposal law over the past 30 years.

Our examination shows that, amid growing use of Class 2 wells, fundamental safeguards are sometimes being ignored or circumvented. State and federal regulators often do little to confirm what pollutants go into wells for drilling waste. They rely heavily on an honor system in which companies are supposed to report what they are pumping into the earth, whether their wells are structurally sound, and whether they have violated any rules.

More than 1,000 times in the three-year period examined, operators pumped waste into Class 2 wells at pressure levels they knew could fracture rock and lead to leaks. In at least 140 cases, companies injected waste illegally or without a permit.

In several instances, records show, operators did not meet requirements to identify old or abandoned wells near injection sites until waste flooded back up to the surface, or found ways to cheat on tests meant to make sure wells aren't leaking.

"The program is basically a paper tiger," said Mario Salazar, a former senior technical advisor to the Environmental Protection Agency who worked with its injection regulation program for 25 years. While wells that handle hazardous waste from other industries have been held to increasingly tough standards, Salazar said, Class 2 wells remain a gaping hole in the system. "There are not enough people to look at how these wells are drilled ... to witness whether what they tell you they will do is in fact what they are doing."

Thanks in part to legislative measures and rulemaking dating back to the late 1970s, material from oil and gas drilling is defined as nonhazardous, no matter what it contains. Oversight of Class 2 wells is often relegated to overstretched, understaffed state oil and gas agencies, which have to balance encouraging energy production with protecting the environment. In some areas, funding for enforcement has dropped even as drilling activity has surged, leading to more wells and more waste overseen by fewer inspectors.

“Class 2 wells constitute a serious problem,” said John Apps, a leading geoscientist and injection expert who works with the U.S. Department of Energy’s Lawrence Berkeley National Laboratory. “The risk to water? I think it’s high, partially because of the enormous number of these wells and the fact that they are not regulated with the same degree of conscientiousness.”

In response to questions about the adequacy of oversight, the EPA, which holds primary regulatory authority over injection wells, reissued a statement it supplied to ProPublica for [an earlier article](#) in June.

“Underground injection has been and continues to be a viable technique for subsurface storage and disposal of fluids when properly done,” a spokesperson wrote. “EPA recognizes that more can be done to enhance drinking water safeguards and, along with states and tribes, will work to improve the efficiency of the underground injection control program.”

Some at the EPA and at the Department of Justice, which prosecutes environmental crimes, say the system’s blind spots suggest that many more violations likely go undiscovered – at least until they mushroom into a crisis.



That’s what happened at Rosharon.

The accident prompted the EPA to examine what else had been dumped at the site, ultimately [exposing a scheme](#) by a company that was not involved in the explosion, Texas Oil and Gathering, to pass off deadly chemicals from a petroleum refining plant as saltwater from drilling. The switch saved the company substantial fees by allowing it to dispose of the material in a Class 2 well, instead of a more stringently controlled well for hazardous waste, federal investigators said.

Texas Oil and Gathering’s owner and operations manager were convicted of conspiring to dump illegal waste and violating the Safe Drinking Water Act. Both declined to comment for this article.

Texas officials acknowledged that they had not looked beyond the paperwork submitted by the operators using the well. The delivery trucks weren’t inspected; the wastewater was not sampled.

“Staff had no reason to believe at the time that such testing was necessary at this facility,” Ramona Nye, a spokeswoman for the Railroad Commission of Texas, which regulates the oil and gas industry activity in the state, wrote in an email. “The likelihood of unpermitted material being disposed of is low.”

William Miller, the EPA’s chief investigator on the case, points out that the only reason anyone was held accountable for injection-related violations was because the site blew up.

“If you can get the stuff down the well how is anyone ever going to know what it was?” said Miller, who retired from the EPA in 2011. “There is no way to recover it. It’s an easy way to commit a crime and not have any evidence left of it afterwards.”

States and Industry Resist Environmental Protections

One reason that Texas Oil and Gas was able to dump toxic waste for years without getting caught is that environmental regulations governing how the oil and gas industry disposes of material underground were weakened almost as soon as they were written.

A series of injection accidents beginning in the 1960s – involving pesticide waste in Colorado, dioxins in [Beaumont, Texas](#), and drilling waste that spread for miles through a drinking water aquifer in Arkansas – prompted lawmakers to impose tougher rules on injection wells.

Wells were [divided into classes](#), depending on the source of the waste they handled. Class 1 wells for chemical, pharmaceutical and other industrial wastes, along with Class 2 wells for the oil and gas industry, were subjected to tough controls under the Safe Drinking Water Act of 1974. From the start, the EPA says, oil and gas waste was treated as less toxic than waste from other industries, but all such material was seen as dangerous to drinking water.

Companies drilling the wells were required to do geological modeling to ensure that surrounding rock layers would not allow waste to escape through fissures or fault lines. They also were required to check for the presence of other wells that could be a conduit for contamination. The EPA set baseline standards and mandated periodic inspections for defects. In many cases, states oversaw their implementation.

The ink had barely dried on the new regulations when the oil and gas industry – aided by sympathetic state regulators who thought their existing oversight was sufficient – began arguing that its waste should be treated differently.

Industry officials lobbied for state oil and gas agencies, some of which already had rules in place, to oversee Class 2 wells, not federal or local environmental officials. Some argued state energy regulators had greater expertise in well construction and regional geology.

In 1980, California Rep. Henry Waxman sponsored a measure that allowed the EPA to delegate authority to oversee Class 2 injection to state oil and gas regulators, even if the rules they applied varied from the Safe Drinking Water Act and federal guidelines.

A few years later, Dick Stamets, New Mexico's chief oil and gas regulator at the time, told a crowd of state regulators and industry representatives that the Waxman amendment was a biblical deliverance from oppressive federal oversight for the drilling industry.

“The Pharaoh EPA did propose regulations and there was chaos upon the earth,” Stamets said. “The people groaned and labored, and great was their suffering until Moses Section 1425 (the Waxman amendment) did lead them to the Promised Land.”

In the late 1980s, the EPA moved to impose more stringent measures on injection wells after Congress banned injection of “hazardous” waste. The new rules barred underground dumping unless companies could prove the chemicals weren't a health threat. To earn permission to inject the waste, companies would have to conduct exhaustive scientific reviews to dispose of hazardous materials, proving their waste wouldn't migrate underground for at least 10,000 years.

The energy industry moved preemptively to shield itself from these changes, too. The Safe Drinking Water Act prohibited the EPA from interfering with the economics of the oil and gas industry unless there was an imminent threat to health or the environment. The industry argued that its waste was mostly harmless brine and that testing and inspecting hundreds of thousands of wells for waste that would qualify as “hazardous” would delay drillers or cost them a fortune.

“It would have been crippling to U.S. oil and gas production,” said Lee Fuller, vice president of government relations for the Independent Petroleum Association of America. Fuller was a former

staff member for the Senate Environment and Public Works Committee, whose ranking member at the time, the late Texas Sen. Lloyd Bentsen, led the fight against the hazardous waste rule. “So yes, the industry was very aggressively seeking some mechanism to address those consequences.”

Bentsen had won the industry a temporary reprieve in 1980 by persuading Congress to redefine any substance that resulted from drilling – or “producing” – an oil or gas well as “non-hazardous,” regardless of its chemical makeup, pending EPA study. In 1988, the EPA made it permanent, handing oil and gas companies a [landmark exemption](#). From then on, benzene from the fertilizer industry was considered hazardous, threatening health and underground water supplies; benzene derived from wells for the oil and gas industry was not.

The effect was that the largest waste stream headed for underground injection, that from the oil and gas industry, was exempted from one of the most effective parts of environmental rules governing hazardous waste disposal.

“A blanket exemption without any sense of what the actual chemistry of these wastewaters is, is very concerning,” said Briana Mordick, a geologist at the Natural Resources Defense Council.

Other protections also began to unravel, widening the gap between Class 1 and Class 2 well regulations. Both regulators and the industry regularly refer to drilling waste as “salt water” even though, according to [a 2002 EPA internal training document](#) obtained by ProPublica, “on any given day, the injectate of a Class II-D well has the potential to contain hazardous concentrations of solvents, acids, and other... hazardous wastes.” Once the wastes were defined as nonhazardous, there was little justification for holding Class 2 wells to the same rules as other waste being injected deep underground.

Today, for example, [Class 1 wells for hazardous waste](#) are tested for pressure continuously and are supposed to be inspected for cracks and leaks every 12 months. Oil and gas wells – though the goal is to inspect their sites annually – have to be tested only once every five years.

Injection wells are known to cause earthquakes, so Class 1 wells usually have rigorous seismic and geologic siting requirements. Often, Class 2 wells do not. An EPA staff member might spend an entire year reviewing an application for a new hazardous waste well. Class 2 wells are often permitted in bulk, meaning hundreds can be green-lighted in a matter of days.

Where Class 1 hazardous waste is injected, companies have to inspect a two-mile radius for old wells, making sure contaminants will have no avenue to shoot back up into drinking water aquifers or to the surface. The minimum standard for oil and gas companies is to inspect within 400 yards, even though it is widely believed, according to internal EPA memorandums obtained by ProPublica, that such a rule is arbitrarily defined, runs against “[much existing evidence](#)” and “[may not afford adequate protection](#)” of drinking water.

EPA officials acknowledge that their Class 1 regulations represent the best practices to keep water safe and that the risk of a Class 2 well leaking is no different than the risk of a Class 1 well leaking. The contrast in regulations reflects “varying legal authorities, not varying levels of confidence,” an agency spokeswoman wrote in an email, referring to the mandate not to let environmental rules interfere with the nation’s drilling progress.

State injection regulators counter that much drilling-related waste is put in the same geologic formations that produce oil and gas, in which contaminants like benzene naturally occur. The water close to these wells is often already undrinkable, they say, so lesser protections make sense.

According to the EPA’s most recent inventory, the number of Class 2 wells is near an all-time high.

Oklahoma, Texas, Kansas and California use tens of thousands of Class 2 wells to push out oil and gas or dispose of fracking fluids and “produced” water, as the waste derived from drilling is called. In

North Dakota, [injection permits have increased](#) tenfold, with more wells being permitted in one month – September 2011 – than is typical in an entire year. [New Mexico](#) issued twice as many permits last year as it did in 2007. Ohio injected twice as much waste in 2011 as it did in 2006 and is evaluating applications for dozens of new injection sites, largely for waste exported by Pennsylvania and New York, where such wells are deemed unsafe.

As much as 70 percent of the waste destined for Class 2 facilities would be considered toxic if it were not for the loopholes in the law, according to Wilma Subra, a chemist and activist who sits on the board of [STRONGER](#), a partnership of oil and gas industry representatives and state regulators aimed at bolstering state standards.

Recently, Stark Concerned Citizens, an anti-drilling group, asked Ohio regulators why radioactive materials such as radium weren't identified or disclosed when injected into Class 2 wells.

"The law allows it," Tom Tomastik, a geologist with Ohio's Department of Natural Resources and a national expert on injection well regulation, replied in a Sept. 17 email. "It does not matter what is in it. As long as it comes from the oil and gas field it can be injected."

Well Operators Game Safety Tests

When Carl Weller showed up, shovel in hand, at a Kentucky farm field dotted with injection wells in June 2007, he was acting on a tip. Weller, a contracted EPA injection inspector, was an expert in testing for what regulators call "mechanical integrity," using air pressure to check if wells have leaks or cracks.

Such tests are among the only ways to know whether cement and steel well structures are intact, preventing brine and other chemicals from reaching drinking water.

Using his shovel, Weller dug around the top of a well, unearthing the steel tubing near the surface. A few inches down, he came across an apparatus he had never seen before: A section of high-pressure tubing ran out of the well bore and connected to a three-foot-long section of steel pipe, sealed at both ends. The apparatus appeared designed to divert air pumped into the well into the pipe instead, making the well test as if it were airtight.

"The only reason that I know of that that device would be installed would be to perform a false mechanical integrity test, more than likely because the well itself would not pass," Weller testified in 2009 as part of a case against the well's operator. The EPA did not make Weller available to comment for this article.

When EPA inspectors kept digging, they found the buried devices on 10 more wells.

The case stunned regulators. Weller had been inspecting the site's injection wells, which were used to enhance the recovery of oil, for the better part of a decade, certifying them as safe. After the EPA's discoveries, workers at the company that operated the wells, Roseclare Oil, [accused its manager](#), Daniel Lewis, of having conspired to cheat the tests for much of that time.

In 2009, Lewis [was convicted](#) of a felony charge for gaming the safety tests on Roseclare's wells and was sentenced to 3 years probation and a \$5,000 fine. He maintains his innocence, saying the wells were rigged by his father, who ran the company's local operations until his death, but said such practices were typical in Kentucky's oil and gas industry. "I'd say it's pretty common," said Lewis, whose probation was commuted in 2011. "But it's not something people go around talking about either."

From Lewis' perspective, injection well operators sometimes have little choice but to try to fool

inspectors. Many wells are decades old and were drilled before the current regulations were written. Some are decrepit, their cement aging and cracked. They also can't be easily – or cheaply – repaired.

Lewis, who is now a part-owner of Roseclare and continues to run its operations, said that before wells were due for EPA inspections he would pretest them himself. If one failed, he'd enter problem-solving mode, prepping the site for the EPA's arrival. Two of his employees testified that he ordered them to fabricate and install the diverters.

"You go and work in it and try to get it to hold and it won't hold," Lewis said of the wells. "What are you going to do? It's kind of a 'Don't ask, don't tell.'"

Randy Ream, the Assistant U.S. Attorney for Kentucky's Western District who prosecuted the case against Lewis, called his scheme unusually elaborate but agreed that efforts to get around the rules for injection wells are common. Sometimes, he said, they result in the contamination of private drinking water wells.

"We have people who have constructed wells that are not certified injection wells, or we have people who will put their brine in a tank and carry it over and put it in somebody else's well," Ream said. "One guy, he's got oil coming out of his shower head."

"There is just so much brine," Ream added, "and you have to get rid of it."

So Many Wells, So Few Inspectors

One obstacle to more effective enforcement in Kentucky and elsewhere, Ream said, is that regulators cannot always keep up with well tests and inspections.

According to EPA records, Kentucky has 3,403 Class 2 wells, which are supposed to be tested for mechanical integrity once every five years. But since 2007, an average of just 253 wells a year have been tested, less than half as many as there should have been to remain on schedule.

A spokeswoman for the EPA's regional office in Atlanta said in an email that only half of Kentucky's injection wells are actively used and only active wells can be tested. She said mechanical integrity tests are performed on each well every 36 months, but did not address the discrepancy between this schedule and the number of tests reflected in EPA data.

The EPA employs just six people to check its wells across the southeast, not just in Kentucky, but in Tennessee and Florida, too. Those same people are also responsible for working with state inspection programs in North and South Carolina, Georgia, Alabama and Mississippi, which have their own inspection staffs.

Most states aim to visit injection sites at least once a year, and some meet or exceed that schedule, EPA records show. Ohio, for example, recently added staff dedicated exclusively to injection oversight and visits its active injection sites every 12 weeks. (Ohio also insists that Class 2 wells meet many of the more stringent testing and permitting regulations it uses for Class 1 hazardous waste wells.)

"Ohio's [rules] are based on what we felt we needed to develop to continue to alleviate any concerns," said Tomastik, of Ohio's Department of Natural Resources. "Obviously without regulatory presence in the field, the operator is not concerned about operating within the requirements."

But understaffing seems to be endemic across drilling states, especially where state regulatory agencies are responsible for checking both producing oil and gas wells and injection wells for waste or to enhance production.

In Montana, [EPA auditors](#) noted that inspectors are choosing which wells to inspect and have a “significant” workload. In North Dakota, EPA auditors [also noted](#) the pressures of “exponential” growth and an “increasing workload.”

To meet the goal of inspecting each well annually, Texas inspectors would have to visit eight wells a day, every day, including Sundays and Christmas. That’s after Texas’ Railroad Commission hired 65 staffers last year to help inspect the state’s 428,000 wells.

Nye, the commission’s spokeswoman, said the state had sufficient funding and inspected each of its commercial disposal wells twice last year.

“The Commission has a stringent and comprehensive review process for these wells,” Nye wrote in an email. “Railroad Commission staff work diligently to ensure saltwater disposal wells are not and will not be a problem.”

But inspectors don’t check on private disposal wells, which are far more numerous, with the same regularity. Nor do they keep a schedule for when officials should conduct such visits.

Other states are struggling under similar burdens. In Wyoming, inspectors would also have to check eight wells a day for each well to be checked once a year – a pace possible if wells are clustered together, experts said, but otherwise difficult to achieve. In West Virginia and Kansas, inspectors would have to check seven wells per day.

Visiting injection wells often ranks low among inspectors’ priorities unless there is an accident or spill, according to a 2007 [Texas auditor’s report](#). The most urgent responsibility for regulators, beyond responding to emergencies, is typically overseeing the development of new oil and gas wells. The result is that several years can pass between inspections of many injection well sites. In 2010, state regulators visited less than half of the Class 2 sites that a federal well inventory shows they were responsible for monitoring, ProPublica’s analysis showed. EPA inspectors checked on such wells even less frequently, visiting less than one-quarter of the sites under their jurisdiction in 2010.

“I don’t give a darn whether you have federal regulations, or a squeaky clean permitting system,” said Bill Bryson, a member of the Kansas Geological Survey and the former head of Kansas’ oil and gas commission. “If you don’t have somebody going out and looking at the wells it doesn’t do any good, and if you don’t have the right people looking ... it doesn’t do any good either.”

Much of the problem with oversight comes down to money, critics say. In some states, budgets and staff for oil and gas agencies have dropped relative to the number of new wells being drilled over the last nine years.

Kansas employs about the same number of inspectors as it did in 2003, even though it drills four times as many new wells. New drilling has nearly doubled in Louisiana over the same period, but the state’s enforcement staff has remained static and its oil and gas budget has increased modestly. In Illinois, drilling has nearly doubled, while the number of enforcement staff has been reduced.

Since the Underground Injection Control program is run under a federal mandate, states rely partly on money from the EPA to fund oversight and enforcement. Federal dollars make up 20 percent of Texas’ budget, for example. But in the last 22 years, the EPA’s annual operating budget for injection has remained about the same: \$10 million. Taking inflation into account, funding has dropped at least 40 percent from 1990 to 2012, though the regulations for all well classes have only grown more complex.

“The UIC program has been flat funded for years,” said Dan Jarvis, the field operations manager for Utah’s Division of Oil, Gas and Mining. “With more manpower, obviously you put them on the ground and you’re going to have better compliance. Our field people are some of the greatest guys going, but they are overworked.”

The EPA declined to disclose the operating budget for regional offices that monitor waste wells under federal jurisdiction or oversee state injection programs. [Documents show](#), however, that in 2011 the agency suspended its travel budget for visits to some of the states that have the largest injection programs, including Louisiana, Texas and Oklahoma.

“Do you think we are doing more now than we were doing 30 years ago? No, there is no money,” said Salazar, the former EPA injection expert. “There are not enough people to know what is going on. It is the ideal storm for industry. Less and less people, more and more things that the EPA has to do.”

Ultimately, much of the responsibility for meeting EPA standards falls to companies themselves. Some operators routinely exceed the minimum requirements of injection regulations, says Hughbert Collier, who runs a Texas environmental engineering firm that consults with injection well operators. They conduct their own integrity tests every year and make sure employees visit well sites once a month.

But operators inclined to cut corners have little to hold them back.

“What most people would be surprised about is that regulators don’t have real good control over everything that goes on in the regulated community,” said Miller, the former EPA criminal investigator in Texas. “Most of our environmental law requires self-reporting and that requires honest people.”

When violations are identified – such as the 140 times waste was illegally injected and noted in the regulatory reports – the consequences can be minimal, and only in rare cases do transgressions rise to the level of criminal prosecution. In the three years of national data reviewed by ProPublica, which included more than 24,000 formal notices of violations, only one case was referred to criminal investigators.

Usually, violations result in citations or informal warnings. If operators do not address violations, then modest fines may be levied; in some cases, wells are temporarily shut down. There is no central source of information on the size of fines, but an audit of [Louisiana’s injection program](#) provides a glimpse: In 2011, the state collected an average of \$158 for each violation.

After three deaths, two federal worker safety investigations and a criminal prosecution, few injection sites nationwide received as much regulatory scrutiny as those in Rosharon, Texas. Yet, despite all the attention, the wells there later failed on the most basic level.

On Feb. 17, 2010, thousands of gallons of waste that had been deposited into these wells [gurgled to the surface](#) in what the Railroad Commission described as a “breakout.” Materials injected far below the earth had managed to migrate back up to the surface, perhaps through an old well missed by regulators.

As of this June, investigators were still analyzing whether the chemicals injected underneath the site had reached water supplies.

Jesse Nankin contributed research for this report.