During his time at Oklahoma's oil and gas regulator, Danny Ray worked to contain pollution events known as purges. He left the agency after three years, fed up with what he described as regulators' inability to stop these floods of toxic wastewater. Abigail Harrison

Toxic Pressure

# Toxic Wastewater From Oil Fields Keeps Pouring Out of the Ground. Oklahoma Regulators Failed to Stop It.

by **Nick Bowlin**, **The Frontier**

Co-published with The Frontier

October 29, 2025, 5:30 am

*This article was produced for ProPublica's Local Reporting Network in partnership with The Frontier. This story is co-published with Grist, which contributed to its development. Sign up for Dispatches to get stories like this one as soon as they are published.*

*Join The Frontier in Oklahoma City on Nov. 18 to discuss how oil and gas extraction is contaminating Oklahoma's groundwater. Register now.*

### Reporting Highlights

- **Under Pressure:** Oil companies have polluted groundwater and the environment by injecting oil field waste deep into the earth at pressures high enough to violate Oklahoma law.
- **Warnings From Within:** For years, people working for the state agency charged with regulating Oklahoma's oil and gas industry have warned about the dangers of high-pressure injection.

In January 2020, Danny Ray started a complicated job with the Oklahoma agency that regulates oil and gas. The petroleum engineer who'd spent more than 40 years in the oil fields had been hired to help address a spreading problem, one that state regulators did not fully understand.

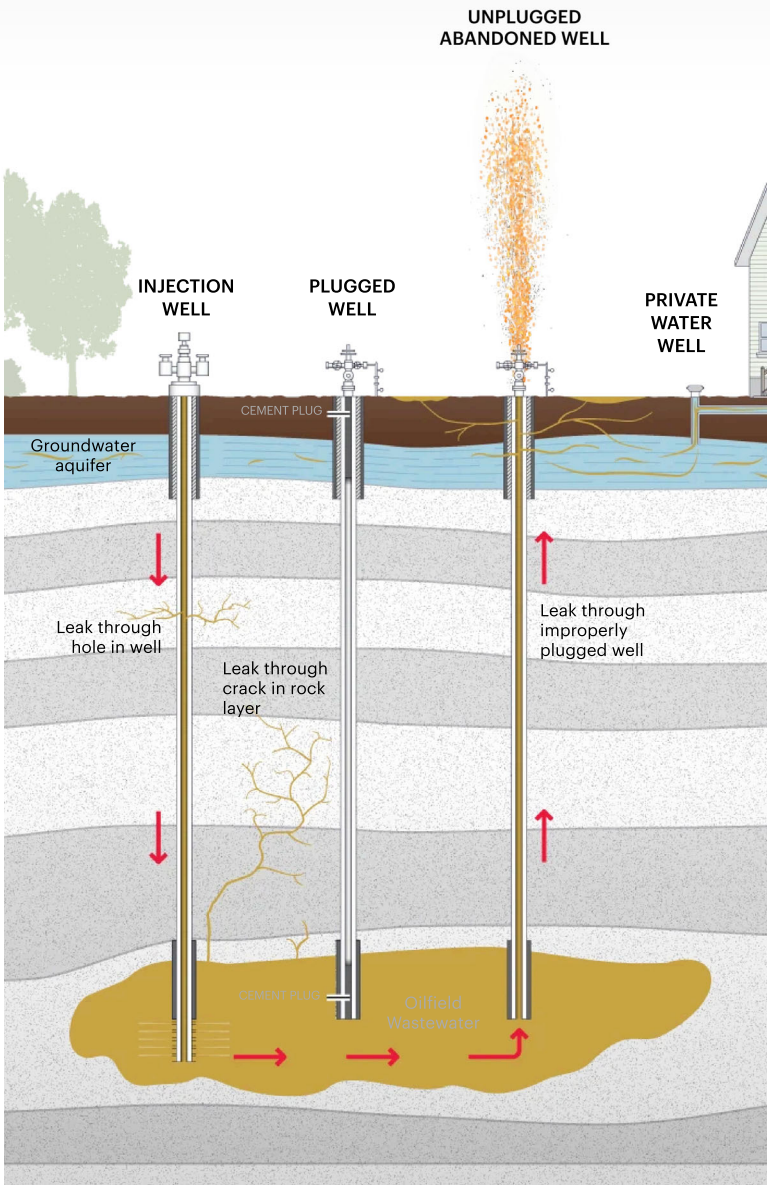
The year prior, toxic water had poured out of the ground — thousands of gallons per day — for months near the small town of Kingfisher, spreading across acres of farmland, killing crops and trees.

Such pollution events were not new, but they were occurring with increasing frequency across the state. By the time Ray joined the Oklahoma Corporation Commission, the incidents had grown common enough to earn a nickname — purges.



When oil and gas are pumped from the ground, they come up with briny fluid called "produced water," many times saltier than the sea and laden with chemicals, including some that cause cancer. Most of this toxic water is shot back underground using what are known as injection wells.

Wastewater injection had been happening in Oklahoma for 80 years, but something was driving the growing number of purges. Ray and his colleagues in the oil division set out to find the cause. As they scoured well records and years of data, they zeroed in on a significant clue: The purges were occurring near wells where companies were injecting oil field wastewater at excessively high pressure, high enough to crack rock deep underground and allow the waste to travel uncontrolled for miles.




Haisam Hussein for ProPublica

By November 2020, at least 10 sites were expelling polluted water, according to internal agency emails obtained through public records requests.

The number of purges has grown steadily since. A Frontier and ProPublica analysis of pollution complaints submitted to the agency found more than 150 reports of purges in the past five years. Throughout that time, state officials were aware of the environmental and public health crisis as Ray and others at the agency investigated the proliferating purges and uncovered a complex stew of causes.

Ray often likens his home state, where oil has been drilled for more than a century and is a major industry, to a block of Swiss cheese, punctured with the nation's second-highest number of "orphan" wells — inactive wells whose owners have abandoned them without properly plugging them with cement. The state has catalogued about 20,000 orphan wells, but federal researchers believe the true number may be over 300,000, based on historic industry data and airborne imaging techniques that identify old wells underground. These old wells provide easy pathways for the injected wastewater to zoom up thousands of feet to the surface, contaminating drinking water sources along the way.

Ray particularly worried about the volume of wastewater being crammed underground by high-pressure injection — tens of billions of gallons each year, enough to fill the Empire State Building over 300 times. Oklahoma's vast landscape of unplugged holes combined with its large number of injection wells operating at high pressures creates conditions ripe for purges.

**Number of Injection Wells in Top Oil-Producing States**

Oklahoma has the third-largest number of injection wells in the country, much more than other prolific oil states, because of its long history of oil and gas extraction and distinct

| State | ▼ Injection Wells | Oil Production Rank |
|---|---|---|
| Texas | 49,821 | 1 |
| California | 37,378 | 7 |
| Oklahoma | 10,407 | 6 |
| Wyoming | 4,756 | 8 |
| New Mexico | 3,790 | 2 |
| Ohio | 2,138 | 10 |
| Alaska | 1,639 | 5 |
| North Dakota | 1,357 | 3 |
| Colorado | 873 | 4 |
| Utah | 758 | 9 |

Sources: Environmental Protection Agency, Energy Information Administration

But Ray would come to learn that at the commission, identifying the causes of the purges was one thing. Stopping them — and preventing new ones — was a very different matter.

“I don’t know if we’re ever going to fix it or not,” said Ray, 72, who resigned in frustration three years later. “They don’t want to listen.”

A yearlong investigation by The Frontier and ProPublica reveals that the Oklahoma Corporation Commission did not mandate that responsible companies clean up the pollution belowground, as state law requires “when feasible.” Regulators say that once tainted by oil field brine, polluted groundwater is virtually impossible to treat. That makes preventing purges all the more critical — something the commission also failed to do, according to current and former employees. At times, records show, agency leadership sidelined employees who criticized the agency’s response.

Field reports from agency staff referred to individual incidents as “a threat to the environment and the safety of persons” or “a hazard to the ground water.” These notes describe orphan wells spewing toxic water near homes or into streams, leaving scars of salt residue. A homeowner reported that his grandchildren often play near a purging well. Ranchers have lost calves, which, drawn to the salty water, died after drinking it. But the full scale of Oklahoma’s purge problem — and state regulators’ awareness of it — has never previously been reported.

Officials with the agency’s oil division acknowledged in an interview with The Frontier and ProPublica that overpressurized wells are contributing to the purges. They say some of these incidents are a result of historic pollution in a state where oil and gas was extracted long before modern regulations, beginning in the 1960s, required companies to protect the environment and plug inactive wells with cement. They noted that the state has taken steps to reduce injection pressures on new wells in recent years and is committed to “doing the right thing, holding operators accountable, protecting Oklahoma and its resources, and providing fair and balanced regulation.”

“I am also confident that every employee and every view is heard and considered,” said Brandy Wreath, who as director of administration for the commission is responsible for the agency’s operations, in a follow-up statement. “We will continue to be committed to protecting Oklahoma and supporting the state’s largest industry to perform its role in a safe and economic manner. These goals are not mutually exclusive.”

Purges often occur at abandoned, unplugged oil wells as a result of high-pressure injection. Obtained by ProPublica and The Frontier

To Ray, those efforts were not enough in the face of a much bigger problem. If thousands of gallons of water was reaching the surface, he reasoned, that meant an incalculably greater amount was dispersing below ground. The thought scared him. Oklahoma relies on groundwater for over half of its annual water use.

“We have so much damage underground that we don’t even know about,” Ray said.

## State Regulatory Failures

State regulators have direct authority over the pressure at which companies inject oil field wastewater.

But while investigating purges over the last five years, oil division employees have found hundreds of wells that were injecting more fluid than their permits allowed or at pressures above the legal limit, as indicated by the pressure gauge on each well and regular reports from companies to the state. During his tenure, Ray and others also discovered purges caused by wells operating within the pressure boundaries noted on the well permits. Oklahoma’s rules, they concluded, were part of the problem.

In a November 2020 email to a handful of employees, Mike McGinnis, deputy director of the oil division, described an abundance of overpressurized wells near a purge as “self-inflicted.”

“It looks like some of the approved injection pressures were set high in the permit,” he wrote. “May be hard to put that genie back in the bottle.”

Reducing permitted injection pressures was exactly the solution Ray felt was necessary.

The state approves the pressure at which companies can inject oil field wastewater based on whether injection would fracture a hard layer of rock meant to contain the fluid. Ray believed purges could be prevented by lowering pressure limits to the point where injection would not crack the softer sandy layers where most oil and gas is found.



Soon after starting his job, Ray began distributing long memos and dizzying equations calculating the pressure at which different rock formations break.

Ray’s efforts helped yield some short-term success. As new purges emerged and existing ones continued to flow, oil division officials in 2020 lowered injection pressures on a case-by-case basis. Regulators added layers of scrutiny for proposed injection wells and more frequently asked for maps showing wells that the pressurized water might collide with as well as data on the pressure at which rocks crack, according to agency officials.

Oil field wastewater flows up from the ground on a farm near Enid, Oklahoma. Abigail Harrison

As 2020 came to a close, several purges in oil fields roughly 2 miles outside the small town of Velma in southwestern Oklahoma made the pressure problem impossible to ignore. Old wells were regularly expelling toxic salt water, one at a rate of 12,600 gallons per day, roughly enough to fill a backyard swimming pool.

Ray and other members of the oil division discovered that some nearby wells had been injecting at pressures that were too high or were shooting more wastewater into the earth than legally allowed, according to agency emails.

The owner of the injection wells, Citation Oil and Gas Corp., one of the largest operators in Oklahoma, agreed to plug some of the purging wells. Ray likened this approach to "Whac-A-Mole": With so much injected water underground, plugging a few old wells wouldn't reduce the likelihood of purges; the water would simply find a new outlet.

Citation did not answer questions about the Velma purge.

The agency reduced injection pressures for some of Citation's wells and temporarily shut down others, but Ray believed that to permanently stop the purge, all injection near Velma needed to be halted indefinitely so the amount of fluid and pressure that had built up underground could be lowered over time. But he said his bosses didn't agree and, in the Velma case and subsequent purges, allowed companies to continue injecting — or to restart after a short pause — at times near active purges.

"They would say things in our meetings, like, 'Well, the operators might not go for that,'" Ray said.

"Hell, you're supposed to be regulators."

Wreath denied that the agency was overly lenient with oil companies and said that Ray advocated for changes that the oil division could not implement on its own.

"Danny may not have gotten things as fast as he wanted to, but he was heard," Wreath said. "People were working on it and doing what they needed to do to do it properly and legally. We just don't have the big stick of government to walk out and say, 'Boom, you've got to start doing this.'"

Charles Teacle III, regulatory affairs chairman for the Oklahoma Energy Producers Alliance, an industry group, said most purges "tend to occur in areas that have a very long history of historical practices that do not represent how the industry operates today." He did not specify which practices companies no

Several of the recent purges threatened to violate federal clean water laws, according to Environmental Protection Agency reports, so federal officials began conducting field inspections alongside state oil division employees. The EPA regional office in Dallas noted in a 2020 review of Oklahoma's injection regulations that "inappropriate" injection appeared to add "pressure to an already over-pressurized system."

The following year, Ray took his complaints about his agency's injection pressure regulations to the EPA.

"I have been trying for more than a year to convince everyone that this is a major problem in Oklahoma," he wrote in a memo to the head of the EPA's regional office.

The EPA did not respond to questions.

In August 2022, the Velma purge exploded to the surface again, more than a year after the agency's initial investigation began. Thousands of gallons of oil field wastewater poured down a forested hillside, forming a "field" of water and flowing into a creek, according to an email from an agency employee. The agency discovered the fluid was 56 times more concentrated with salts and chemicals than the EPA's standard for drinking water.

Contaminated water erupts from the ground during a purge in Velma, Oklahoma, in 2022. Oklahoma Corporation Commission, obtained by ProPublica and The Frontier

This time, oil division officials shut down all nearby injection. But a week later, wastewater flowed out of the ground at an even faster rate, a result of the pressure that had built up over time. A week after that, a mile away, another purge began.

As before, Ray chafed at what he saw as the agency's reactive stance.

If an across-the-board pressure reduction was impossible, Ray hoped that the oil division would wield one of its available tools: legal action against companies creating the pollution. The oil division could take companies to the Oklahoma Corporation Commission's administrative law courts, where judges could issue rulings that fine companies or enforce cleanups, as long as the three elected commissioners approved.

Agency leadership appeared to support this strategy. In an October 2022 email, field operations manager Brad Ice wrote that if pollution were found, the agency would order the company to halt injection and take steps to clean the area. And if the company disagreed or pollution continued, the agency would "file contempt for failure to prevent pollution" against the company.

But no contempt cases have been filed for purges in the last five years, according to commission spokesperson Trey Davis. Nor has the agency fined any companies for purges during that time, he said.

Davis identified two cases in administrative law court during that time in which the agency formally ordered companies to stop injection after a purge and to clean up the pollution — though he said the commission prefers "to lead with a handshake instead of a hammer."

Despite creating purges, companies did not face punishment if they subsequently complied with agency requests to shut down injection wells, pump wastewater off the surface and restore the landscape, Davis and other agency officials said.

"We're not a fine-driven agency," said Wreath, adding that extended injection well shutdowns cut into oil company profits, making additional fines unnecessary. He noted that pursuing enforcement can take longer and cost taxpayers more than getting companies to cooperate voluntarily.

That cooperation, however, almost never involves cleanup of water resources tainted by purges. Oil division officials were able to identify just one time since 2020 that their agency approved a plan to clean up groundwater pollution caused by a purge. Removing pollution from underground water sources is incredibly difficult and very expensive, McGinnis, the agency's deputy director, said.

"I believe it is unconscionably reckless on our part as a regulatory agency not to act swiftly, while knowingly and willingly allowing the continued operation of activities under our jurisdictional control that are contaminating groundwater and presenting a potential endangerment to the health and safety of persons and the environment," wrote Everett Plummer, at the time a supervisor at the agency's oil division, in an October 2022 email to another supervisor that was forwarded to Ray and agency leaders, including Strickland.

"We are not addressing the root cause of the problem," Plummer went on in the same email. "That root cause is overpressure."

Less than a year later, Plummer sent another email, this time to Ray and another colleague, lamenting that Strickland and other agency leaders "won't offer any help or technical input or solutions."

Neither Strickland nor an agency spokesperson responded to requests for comment on Plummer's email. Plummer declined to be interviewed for this story.

Some oil and gas companies know when their injection wells are operating at excess pressure and fracturing rock, allowing toxic water to disperse below ground, in violation of state standards, according to a hydrogeologist who worked in saltwater disposal for a large Oklahoma oil company. He pointed to wells he had worked on that were injecting 10,000 barrels of wastewater a day — more than the rock layer should be able to absorb. "You're thinking, 'Damn, where is it all going?'" he said.

The hydrogeologist, who spoke on the condition of anonymity because he still works in the industry and fears repercussions, said he worries the result is pollution the state doesn't know about — until it breaks the surface.

"It was so disheartening to me," he said, "because you should be able to go to OCC to actually address this stuff."



## Toxic Drinking Water

As Ray pushed his agency to respond more urgently to the purges, oil field wastewater was seeping into aquifers and drinking water sources scattered across the state.

In 2021, John Roberts, who works as an oil field pump truck driver, and his wife, Misty, asked the state to test their water. They live near the 500-person town of Cement in southwestern Oklahoma, where a series of purges encircled the town for nearly four years. One gushed a few hundred feet from the high school, just beyond the softball diamond.

For residents whose private water wells pulled from the local groundwater, these purges posed severe health risks in addition to killing grass and other vegetation on their land. When the state tested water from the Roberts' well, samples showed levels of salts well above the EPA's recommended maximum. Their well water also contained benzene, a notorious carcinogen linked to leukemia and other blood cell cancers, at six times the EPA's limit for drinking water.



In these images taken by staff of the Oklahoma Corporation Commission, salt residue covers the ground after a purge. Oklahoma Corporation Commission, obtained by ProPublica and The Frontier

Subsequent agency investigations near Cement found a tangle of problems. Several wells were injecting at pressures far beyond the fracture point of the rock. A study commissioned by the state found that, within a few square miles, 22 of 28 injection wells were operating at pressures outside legal limits, were injecting into the wrong geologic formation and potentially causing cracks, or had an incomplete permit.

These wells were also injecting near more than 100 old wells that had been plugged with mud. Unlike a proper cement plug, mud is not strong enough to prevent the pressurized fluid from bursting out of the well.

Many of the injection wells were again owned by Citation, whose high-pressure injection had been shut down by the agency near the Velma purge about 60 miles away. Company representatives downplayed the number of purges, referring to them as "alleged" in emails to the agency. They maintained that the pollution was a remnant of historic oil and gas activity. But agency engineers pulled well records and field staff tracked oil field wastewater flowing less than a half mile from a church and a Dollar General on the edge of town. The state report analyzed water samples and injection data and found that the cause was overpressurized injection.

In 2023, the Robertses sued Citation in federal district court, alleging that the company's injection was causing "new pollution and contamination on a daily basis." Citation denied the allegations and argued that the case ought to first be decided by the commission's administrative law court. The federal lawsuit is on hold until the administrative case with the Oklahoma Corporation Commission concludes.

Misty Roberts told The Frontier and ProPublica that the couple has installed filtration systems, which require upkeep to keep toxic chemicals out of their drinking water. "It's a headache just knowing that if our filters get bad, it could come through if we don't get them changed in time," she said.

She said that Citation recommended that they pay to hook up to city water, but their neighbor refused to offer them an easement to dig a water line.

The company did not answer questions about the lawsuit.

"Citation Oil & Gas Corp. continues to work cooperatively with the OCC to further investigate the sources and causes of these alleged purges," Bob Redweik, the company's vice president of environmental health and safety and regulatory affairs, said in a statement.

The 67-year-old spent decades as a coal miner. The oil industry's pollution angers him. Regulators' failure to prevent that pollution angers him even more. He described the state as "so slow at doing anything."

"My biggest beef," he said, "is why did you let them get away with it to begin with?"

Tim Ramsey's ranch land is littered with orphan oil and gas wells. September Dawn Bottoms for ProPublica

Similar disappointment ate at Ray in his final months at the Oklahoma Corporation Commission. Despite his urging, the oil division did not pursue court cases against companies, even as the crisis seemed to be worsening. In spring 2023, he said he reviewed an internal spreadsheet identifying 42 purges, most of which were still actively flowing.

Around the time of Ray's departure from the agency, the oil division hired a prominent environmental consulting firm, Halff, to help settle disputes among its employees on how the state should respond to the purges.

The Frontier and ProPublica reviewed reports prepared by the firm about major purges. In each one, they had drawn the same conclusion as Ray: Overpressurized injection wells were causing purges, a dynamic intensified by the number of orphan wells and years of lax regulation, according to the reports.

But tensions remained. Shawn Coslett, manager of the pollution abatement division, became increasingly vocal about what he called a "culture problem" within the commission when it came to holding companies accountable for pollution, according to emails he sent to his managers and other colleagues.

Since 2023, Coslett had been pushing the agency to pursue Citation in court for its role in a major purge outside Ardmore that gushed wastewater on and off for years. In May 2024, Citation's vice president of environmental health and safety emailed his team to let them know that Ice, the agency's field operations director, agreed to hold a meeting between the company and the agency's oil division with "limited attendance."

"Shawn Coslett and his team would not be invited," Redweik wrote.

The role of Coslett's team in the purge investigation was subsequently reduced, according to internal documents. The agency marked the purge as "resolved" in April 2025.

Coslett declined to be interviewed for this story. Neither Ice nor Redweik responded to questions about Coslett's work on the Ardmore purge.

Last December, Coslett also urged the agency in several emails to take action on a purge expelling 1,300 gallons of salt water daily on Choctaw Nation land in southeastern Oklahoma. It had been flowing intermittently for four years.



Coslett wanted the agency to create a sampling plan for barium, which had been found in the purging water at high levels, as well as other metals. In a December email to an oil division manager, he wrote that runoff from the site could eventually make its way into the headwaters of Lake Wister, a public water supply that serves tens of thousands of people.

The oil division did attempt to make some changes. In closed meetings with industry representatives last year, agency officials suggested requiring companies to test the fracture point for each injection well — exactly what Ray had recommended years before. But industry groups vigorously opposed the idea, agency officials told The Frontier and ProPublica, and it was not included in the formal proposal to change state rules for injection pressure that the agency submitted to the commissioners last September.

Wastewater from an orphan well shoots into the air. Obtained by ProPublica and The Frontier

In January, the commission ultimately approved a revised formula to calculate maximum injection pressures. But the new rules, effective this month, only apply to new wells. Retroactively reducing pressures would require action by the state Legislature. The higher pressures for Oklahoma's more than 10,400 existing injection wells remain unchanged, allowing the problem that Ray identified to persist.

Coslett left the agency in March. Two weeks later, a new director arrived to lead the oil division: Jeremy Hodges, a former financial analyst and project manager for Continental Resources, the Oklahoma City-based oil and gas giant. He replaced Strickland, who recently took a job as chief projects officer for the Interstate Oil and Gas Compact Commission, a quasi-governmental organization that often advocates for industry interests.

In the weeks immediately before and after Hodges took over the oil division, the agency marked nearly 20 purge cases as "resolved," including some of the most damaging and persistent pollution events, according to the agency's database of pollution complaints.

In a September public meeting, Hodges sought to reassure the agency's commissioners: Purges were under control, he said.

But interviews with current and former agency staff and oil and gas officials suggest that Oklahoma is still dealing with dozens of purges. One of these incidents killed about two dozen cattle in September after toxic salt water filled a creek leading to Fort Cobb Lake, a public water supply. That month, the state increased testing at the lake and said the public supply has not been impacted. Nevertheless, in October Gov. Kevin Stitt declared a state of emergency and called it "a serious threat to public health and safety" as thousands of gallons of wastewater continued to flow each day.

Toxic water from a purge killed about two dozen cattle on a ranch near Fort Cobb Lake in September. Screenshot of News9.com by ProPublica

Agency officials said field staff periodically check for signs of new activity at purge sites that they considered resolved. They did not comment on the purges near Lake Wister or Fort Cobb Lake. Hodges, who participated in an interview with The Frontier and ProPublica, did not provide comment beyond what other agency officials said.

In late August, Ray, who has returned to consulting for oil and gas companies, took a reporter to visit a purge site on a ranch in southern Oklahoma where the agency had closed a pollution complaint around the time Hodges took office.

That afternoon, in an otherwise dry streambed flanked by steep red-dirt walls, puddles sat baking in the sun, though it hadn't rained in weeks. A film of oil shone on the water's surface, bands of green mixed with purple and bright blue. On the banks, white salt scars showed the outline of old wastewater spills.

"It is hard to believe that anyone would turn their back on this problem and just pretend it simply does not exist," Ray said as he surveyed the scene.

Farther up the gulch, the water formed a pool, which gave off a rank chemical smell. The oily surface appeared calm at first glance. But on closer inspection, bubbles were breaking the surface in several places. The water was coming up from beneath the ground.

The Frontier and ProPublica reviewed thousands of documents, obtained through public records requests, that include communications about the purges from the regulatory agency's oil division leadership, elected commissioners, state legislators and the Environmental Protection Agency. The news organizations interviewed more than 30 people, including current and former state employees, Oklahoma oil and gas industry employees, and citizens whose water and land was damaged by injected oil field waste.

### Help Us Report on the Impact of Oil Field Waste in Oklahoma

Toxic wastewater from oil fields keeps pouring out of the ground in Oklahoma. For years, residents have filed complaints and struggled to find solutions. We need your help to understand the full scale of the problem.

Share Your Experience

*Reporting grants from the Fund for Investigative Journalism and the Institute for Journalism & Natural Resources helped fund this reporting. This work was supported by pro bono legal assistance from the Reporters Committee for Freedom of the Press.*

*To contact the reporter with tips, you can fill out the form linked above or email nick@readfrontier.com.*

Mark Olalde of ProPublica contributed reporting.

### What We're Watching

During Donald Trump's second presidency, ProPublica will focus on the areas most in need of scrutiny. Here are some of the issues our reporters will be watching — and how to get in touch with them securely.

**Learn more about our reporting team.** We will continue to share our areas of interest as the news develops.

**Sharon Lerner**

I cover health and the environment and the agencies that govern them, including the Environmental Protection Agency.

Contact me

**Andy Kroll**

I cover justice and the rule of law, including the Justice Department, U.S. attorneys and the courts.

Contact me

**Jesse Coburn**

I cover housing and transportation, including the companies working in those fields and the regulators overseeing them.

Contact me


If you don't have a specific tip or story in mind, we could still use your help. Sign up to be a member of our **federal worker source network** to stay in touch.

## Journalism That Holds Power to Account

Sign up for ProPublica's Big Story newsletter and get our latest stories delivered straight to your inbox.

1 **The Trump Administration Aims to Penalize Disabled Adults Who Live With Their Families**


2 **Unfounded Health Concerns Are Powering a Solar Backlash**

3 **Meet the Mayor of a Tiny Texas Town Who Wants to Limit How Cities Can Govern**

4 **He Died in a Florida Jail. The Company in Charge Should Have Sent Him to the Hospital, Experts Say.**

5 **Some Connecticut Towing Companies Are Ignoring New Law Aimed at Helping Low-Income Residents**