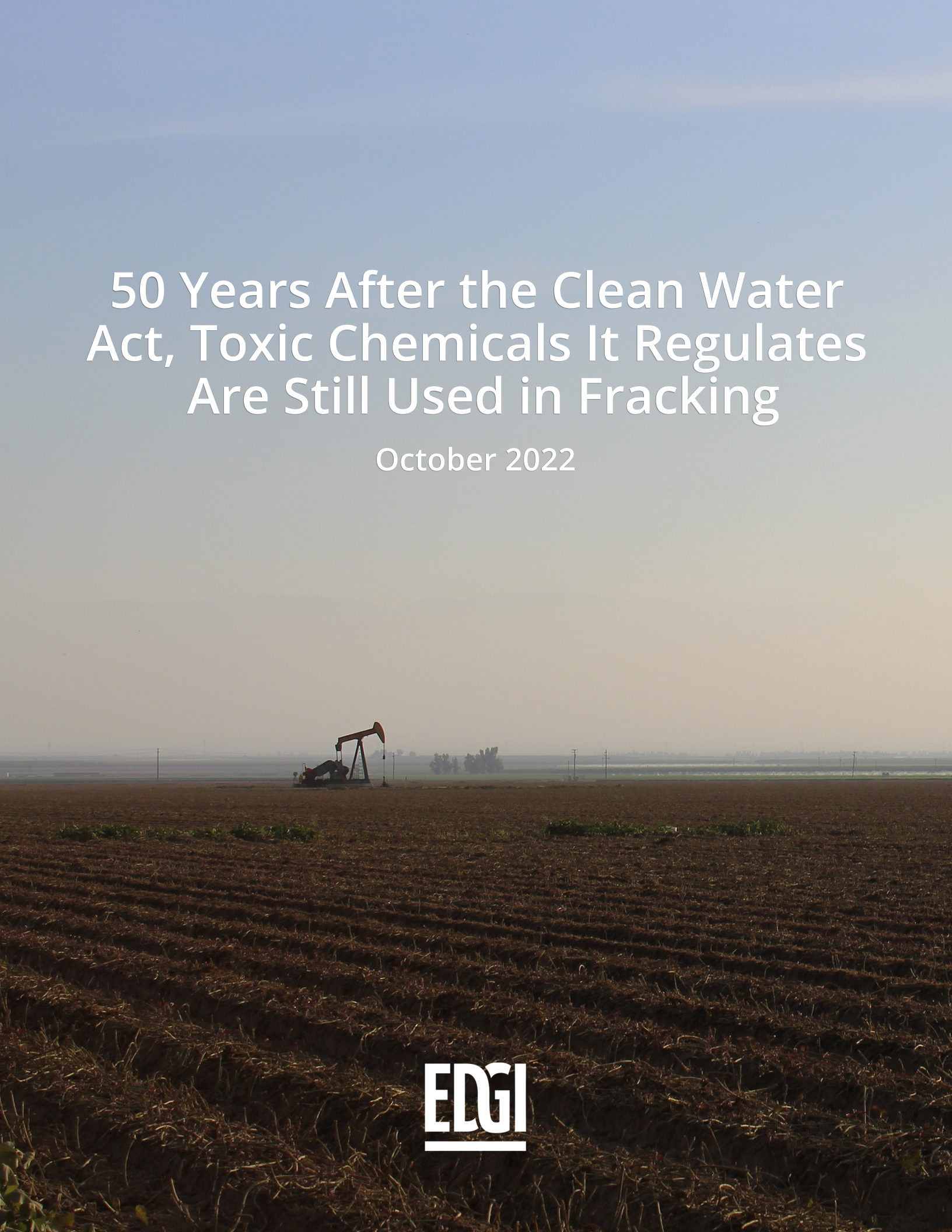
50 Years After the Clean Water Act, Toxic Chemicals It Regulates Are Still Used in Fracking

October 2022



EDGI

50 Years After the Clean Water Act, Toxic Chemicals It Regulates are Still Used in Fracking

October 2022

Vivian Underhill, Lourdes Vera, Eric Nost, Kelly Wilkins,
Madison Sonnenday, Sara Wylie, and EDGI

Cover photo: Oil drilling among agricultural fields, Kern County, CA. Vivian Underhill.

The Environmental Data & Governance Initiative (EDGI) is a North American network with members from numerous academic institutions and nonprofit or grassroots organizations, as well as caring and committed volunteers and employees who come from a broad spectrum of work and life backgrounds. EDGI promotes open and accessible government data and information along with evidence-based policymaking.

Summary

This October marks the 50th anniversary of the Clean Water Act (CWA), the United States' primary federal legislation protecting water quality. The CWA is meant to minimize water pollution in rivers, lakes, and streams, protecting both public health and wildlife habitat. Fifty years later, and over seventy years after the onset of hydraulic fracturing (or fracking), federal loopholes and the structure of the CWA itself have left fracking largely unregulated. In this report, we share results from a novel analysis of fracking disclosure data showing that 85 chemicals regulated by the CWA have been used in fracking since 2014, totaling nine billion pounds over that time period.[1] We combine this with an analysis of EPA data on oil and gas facilities' effluent violations, inspections, and penalties that shows simultaneously increasing violation rates and decreasing inspections since 2001. Other key findings include:

- Nine billion pounds of chemicals regulated under the CWA have been reported in fracking operations over the past seven years - roughly the same weight as the water that 1,534 olympic-sized swimming pools can hold.
- The rate of effluent violations has increased since 2015, reaching as high as 80% in 2019. Meanwhile, the rate of facility inspections has shown a marked decrease, from 50-60% in 2001 and 2002 to about 12% in 2022. Only 1,017 facilities (less than half) have reported any inspections since 2001.
- Many fracks used chemicals in masses far greater than their Reportable Quantities (RQs), which are a benchmark for individual chemicals' relative toxicity by mass.[2] Benzene, which has an RQ of 10 pounds, was used in an average of 6,636 lbs per job. This amounts to an average use of benzene that is 663 times greater than its RQ.
- 17.5% of oil and gas facilities regulated under the CWA's National Pollutant Discharge Elimination System have reported at least one effluent violation since 2001.
- The two permits with the highest violations are responsible for 346 and 347 violations respectively - more than one a month.

[1] Hydraulic fracturing, a type of oil and gas extraction that has entered our common vocabulary as "fracking," uses high quantities of chemicals commonly regulated under the CWA that are scientifically proven to harm planetary and local health (learn more about how fracking works here).

[2] RQs are defined in both the CWA and the CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act). We use these thresholds as guidelines for what amounts of each chemical have been defined as potentially harmful by the federal government.

By combining these different data sources within an intentionally fragmented landscape of data on oil and gas extraction, processing, and transport, we are able to create a larger picture of the CWA's impact on oil and gas across the supply chain. Finally, we recommend changes to the CWA to make it more responsive over the next 50 years as the US deepens its investments in natural gas rather than truly renewable energies.

Introduction: the Clean Water Act and Fossil Fuels

In this report, we show how the structure of the CWA, and the loopholes it contains, limits our ability to reduce the contamination of our waterways. There are major exemptions in many federal environmental laws for oil and gas operations: the 2005 Energy Policy Act - spearheaded by former Vice President and former Halliburton CEO Dick Cheney and colloquially termed the "Halliburton Loophole" - exempted oil and gas from the stormwater permit requirement under the CWA and from the Underground Injection Control section of the Safe Drinking Water Act (SDWA). This dismantling of environmental governance has allowed significant unregulated emissions of otherwise regulated pollutants. In terms of fracking, it means that until contamination can be shown to have entered a waterway, there is no federal oversight of fracking activity. Therefore, this report explores the outcomes of the fossil fuel industry's CWA exemptions and their implications for human and environmental health.

Passed in 1972, the CWA was a landmark step forward that marked growing societal awareness of an industrial economy's impacts on lands and waters - concerns that couldn't be more urgent today. Though the CWA originally stated that "it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985," we clearly have not met that goal. Instead, the CWA has become a "permission to pollute" mechanism[3] - essentially a pollution pass given to industry through the permitting process. Half a century later, we face dwindling availability of clean groundwater and the long afterlives of toxic substances in surface waters that damage public and ecological health.

The oil and gas sector in particular has created a cycle in which its emissions lead to climate change, spurring disasters such as severe hurricanes and rising sea levels that cause massive releases of even more toxic pollutants. In the aftermath of Hurricane Ida in 2021, more than 2,300 spills were reported to the Coast Guard from drilling sites and

[3] The logic of "permission to pollute" regimes is discussed at length in Max Liboiron's recent book *Pollution is Colonialism.*

refineries. The damage was significant but still less than the 10.8 million barrels of oil spilled during Hurricanes Katrina and Rita in 2005. Now, reports are just beginning to be collected of similar spills from Hurricane Ian. This is a longstanding problem; when floodwaters rise in high-production regions like Texas or Louisiana, they also inundate oil and gas infrastructure and then carry its pollutants across wide swaths of land.

Smaller-scale spills from oil and gas sites are also a frequent occurrence, flooding or not. A recent study found that between 2-20% of unconventional oil wells report a spill every year.[4] In 2019, California's largest on-shore oil spill in a decade seeped from Chevron's Cymric oil field, filling a dry creek bed with 90,000 gallons of oil. Yet pollutants from the oil and gas industry are some of the chemicals we are least able to account for under the CWA. While oil spills are sometimes prosecuted under the CWA after the fact, the CWA has relatively little regulatory power until there is evidence of fracking chemicals in water. Given this reality, it is time to re-think the CWA and its approach to environmental governance as a whole.

Timely and appropriate enforcement of CWA permits also remains an issue. Therefore, we investigated the number of CWA violations, enforcements, and inspections of oil and gas facilities, using data reported by the EPA.[5] We find that oil and gas facilities' violations have increased significantly in the last seven years while EPA inspections of those facilities have decreased in the same time frame.

With this analysis, we analyze not only upstream issues (fracking, drilling and extraction), but the entire production chain, including "midstream" (transportation and storage) and "downstream" facilities (where further processing makes everyday products we depend on such as fuel and plastics). Regulations currently do not reflect this holistic view of oil and gas production, nor take into account the aggregate effects of oil and wastewater spills over time or space. Within this fragmented regulatory and monitoring landscape, we pieced together data from different sources and different legislation to more accurately analyze pollutant regulations in terms of chemical lifecycles.

---

[4] Lauren A. Patterson, Katherine E. Konschnik, Hannah Wiseman, Joseph Fargione, Kelly O. Maloney, Joseph Kiesecker, Jean-Philippe Nicot, Sharon Baruch-Mordo, Sally Entrekin, Anne Trainor, James E. Saiers (2017). "Unconventional oil and gas spills: risks, mitigation priorities, and state reporting requirements". *Environmental Science & Technology*, 51(5), 2563-2573.

[5] EDGI's Environmental Enforcement Watch (EEW) uses data from the EPA's Environmental Compliance and History Online (ECHO) dataset and co-created a series of Jupyter notebooks that make this ECHO data transparent through publicly available visualization and manipulation interfaces.

Even with clean energy transitions, fracking will still play a major part in US domestic energy budgets. The Inflation Reduction Act, lauded as a major step forward for climate change action, still depends on liquid natural gas (LNG) production - which requires fracking. This forces the question: what future are we building toward? Further, what lessons can we learn from the CWA's first 50 years about the updates it needs to achieve healthy and safe waterways?

The Fracking Loophole Landscape

In spite of its issues, the CWA has been effective in many ways, and is considered one of the 1970s' major environmental achievements.[6] The CWA focuses on limiting point-source pollution from regulated facilities. To do so, it developed the National Pollutant Discharge Elimination System (NPDES) permit program and prohibits the discharge of any pollutant from a point source without a permit.

Most oil drilling, including fracking, relies on two main forms of wastewater disposal: injecting it into the ground, or storing it in temporary surface pits. Because this does not entail the deliberate discharge of wastewater into streams, lakes, or rivers, drilling sites generally do not come under the CWA's regulatory jurisdiction. The only aspect of the CWA that could regulate fracking activity is the stormwater permit system, which is designed to prevent contaminated stormwater runoff from entering waterways. However, the Halliburton Loophole exempts fracking operations from stormwater permitting requirements under the CWA.[7] As one review article described it, "there is no federal oversight of fracturing activities until there is proof of fracturing contaminants in surface waters."[8]

The fact that fracking companies don't plan to discharge to surface waters doesn't prevent accidents, spills, and other improper disposal techniques: as discussed above, between 2-20% of oil wells report spills each year. A 2014 EPA study of the Clean Water Act and oil and gas pads in Denton, TX, reported that gas fracking wells can create just as

[6] Hines, N. (2013). "History of the 1972 clean water act: the story behind how the 1972 act became the capstone on a decade of extraordinary environmental reform." *George Washington Journal of Energy and Environmental Law*, 4(2), 80-106. P 80.

[7] The complicated history of stormwater permit regulation dates back to 1987, when the Water Quality Act began the process of prohibiting the EPA from requiring stormwater permits for the oil and gas industry. For further detail see https://www.epa.gov/npdes/oil-and-gas-stormwater-permitting.

[8] Hatzenbuhler and Centner, 2012. "Regulation of Water Pollution from Hydraulic Fracturing in Horizontally-Drilled Wells in the Marcellus Shale Region, USA." *Water* 4(4): 983-994.

much, if not more, pollution than other sites requiring stormwater permits: wells can negatively impact surface waters through increased sedimentation rates or increased metals in stormwater, while spills and leaks can also cause high concentrations of petroleum hydrocarbons, including hexane and benzene. In fact, legal and permitted unlined wastewater disposal ponds in California's San Joaquin Valley were recently found to have contaminated nearby groundwater that is used for irrigation.

Legal scholars have proposed a number of revisions to the Clean Water Act, including extending the NPDES permit program to "temporary holding pits," the current category for fracturing wells. Another clear option is to revoke the stormwater permit exemption. For facilities that are regulated by the CWA, others point out that NPDES permit compliance remains inconsistent, with too many discharging facilities failing to meet pretreatment standards. Beyond these revisions and improvements in the law's administration, we suggest new additions to tackle non-point-source pollution: while the CWA primarily focuses on pollution coming from specific facilities (point source), non-point-source pollution includes contamination not only from fracking wells, but also from sources like fields, roads, clear cuts, and construction sites.[9]

Masses and Reportable Quantities of CWA Chemicals

Using data from Open-FracFocus, an open-source database of fracking disclosures, we calculated the total amount of CWA-regulated chemicals reported since 2014 to be 8,935,217,672 (8.9 billion) pounds, which is roughly the same weight as the water that 1,534 olympic-sized swimming pools can hold.[10]

Interestingly, while 85 chemicals regulated by the CWA were disclosed in fracking events, 1,240 chemicals have been reported in FracFocus as a whole. However, this shouldn't be taken as a sign that fracking operations are using relatively benign chemicals,

[9] Hatzenbuhler and Centner, 2012. "Regulation of Water Pollution from Hydraulic Fracturing in Horizontally-Drilled Wells in the Marcellus Shale Region, USA." *Water* 4(4): 983-994. Andreen, 2003. "Water Quality Today - Has the Clean Water Act Been a Success?" *Alabama Law Review* 55: 537-593.

[10] Open-FracFocus (Open-FF) significantly improves the accessibility and accuracy of fracking disclosure data shared through FracFocus, a database run by the Groundwater Protection Council and the Interstate Oil and Gas Compact Commission. Importantly, only twenty-three states mandate disclosure through FracFocus; in the other oil- and gas-producing states, it remains voluntary. Therefore, FracFocus isn't an exhaustive database, but it is one of the most complete data sources we currently have on chemical use in fracking. While FracFocus data extends back to 2011, we begin our analysis in 2014 because data quality is significantly better from 2014 onward. See Underhill et al (forthcoming in *Environmental Pollution*) for more.

but rather as a sign of the CWA's inadequacies and specifically the slow and often political process of studying chemicals and putting them on formal regulation lists.

The three chemicals reported as being used in the highest amounts (by mass) were hydrochloric acid at 6,875,124 (6.9 million) lbs, hydrofluoric acid at 1,653,160 (1.7 million) lbs, and acetic acid at 918,500 (919 thousand) lbs. These are all acids that are used in "acid fracturing", a type of hydraulic fracturing that requires a high volume of acids to penetrate carbonate reservoirs more easily. All of these acids will change the pH (acidity/alkalinity) of water, harming flora and fauna. All three are also commonly used in chemistry labs and can cause skin or eye irritation, damage to organs if ingested, and burns.

While the aggregate masses of each compound are important, analyzing aggregate mass alone does not take into account the fact that chemicals have different properties such as density, pH, and concentrations at which they start to react with living or non-living things, including each other. Because each chemical begins to have health impacts at different levels, one way of understanding the meaning of their masses is with reportable quantities (RQs).[11] RQs, defined under the CWA as the quantity of a chemical that must be reported to emergency-management authorities if accidentally released, are one benchmark for each chemical's relative toxicity. Any amounts under that RQ are not required to be reported, allowing the facilities "permission to pollute." This itself is a problematic logic, because for many of these chemicals, there is no amount at which exposure is safe. However, RQs allow us to take individual chemicals' properties and relative toxicity into account in analyzing their relative masses. Therefore, we also analyze the ratio between the mass of each regulated chemical used in a fracking job and their RQ as defined under the CWA.

The RQ for benzene - a carcinogenic, volatile organic compound - is 10 lbs. Chronic exposure to benzene causes cancer; short term exposure causes a host of symptoms such as unconsciousness, drowsiness, dizziness or headaches, and irritation of the skin, eyes, nose, and throat. Frack jobs that used benzene used an average of 6,636 lbs per job. The frack job using the most benzene used 143,556 lbs of the compound. This means that frack jobs, on average, used 663 times more benzene than its RQ. Other notable compounds include the volatile organic compound xylene, with an RQ of 100 lbs. The maximum mass of xylene used in a frack job was 99,259 lbs, and average xylene use was 10.8 times greater than its RQ (about 1,080 lbs). Xylene causes symptoms comparable to the non-carcinogenic

[11] See the full list of CWA RQs here:
https://www.ecfr.gov/current/title-40/chapter-I/subchapter-D/part-117/subpart-A/section-117.3

health effects of benzene, including death at high exposure. Naphthalene use, which causes similar symptoms in addition to liver and neurological damage, was found to exceed its RQ of 100 lbs by six times on average, with a maximum use of 54,484 lbs in one frack job. Formaldehyde, commonly known as a carcinogen, has an RQ of 100 lbs but was reported to have a maximum use of 53,908 lbs.

CWA Violations, Enforcements, and Inspections

While individual oil and gas wells are not regulated by the CWA, facilities such as refineries, natural gas processing plants, and wastewater disposal sites are. Therefore, another way of understanding the CWA's impact on fracking is by tracing facility violations, inspections, and federal enforcements pursuant to the CWA.[12] We do so by using data from the US EPA's Enforcement and Compliance History Online (ECHO) database.

The CWA NPDES system requires facilities to monitor and report the water quality of their effluent; violations include discharging a pollutant without a permit or discharging a pollutant in higher levels than a permit allows. Under the CWA, state and federal EPAs have the authority and mandate to inspect any permitted facility to evaluate compliance with their permits, and the authority and mandate to enforce the CWA when they find permit violations. Enforcement actions can range in type and severity, including fines or non-monetary actions like requiring specific remediation tasks. Enforcement actions can also include what are called Administrative Orders, which come with no fines but can mandate cleanup activities.

For about 1,600 oil and gas facilities regulated under the Clean Water Act's NPDES system, we found 2,283 permits (approximately 1.5 permits per facility on average) in operation for at least part of the time period spanning from 2001 to 2022. One facility can hold multiple permits for different aspects of its operation, and individual permits can cover multiple pollutants. While the number of active permits peaked in 2014 with slightly over 1,000 permits that year, they have since steadily decreased (see Figure 1 for more detail).

[12] We used the North American Industry Classification System (NAICS) codes for oil and gas activity (2111* , 213111, and 213112) and searched the ECHO database for all facilities listed with at least one of those codes. The * represents a wildcard where any two digits could follow 2111 (namely, 211120 and 211130 - crude petroleum extraction and natural gas extraction, respectively. See: https://www.naics.com/naics-code-description/?code=2111).

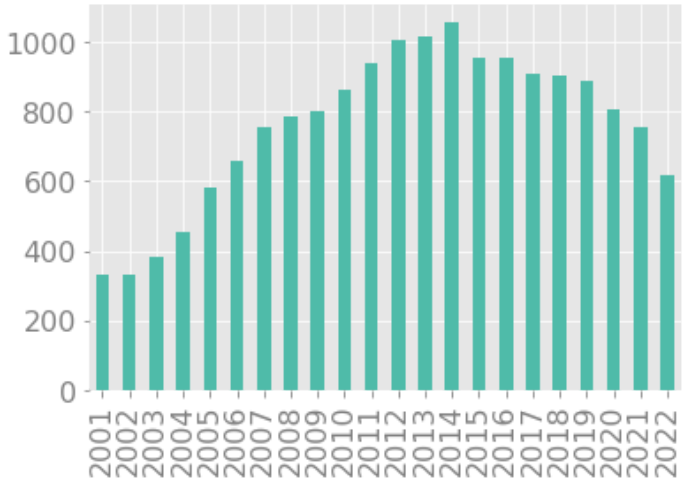


Figure 1. Total number of NPDES permits active for at least part of the preceding year for oil and gas facilities from 2001-2022.

Out of those 2,283 permits, about 400 - or 17.5% - have reported at least one effluent violation since 2001. Importantly, the rate of effluent violations has increased since 2015, reaching as high as 80 for every 100 permits in 2019 (see Figure 2). Many of these permits have multiple violations: the two permits with the most violations are responsible for 346 and 347 violations respectively, or more than one violation a month for the last twenty years. The third highest-violation permit is responsible for 294 total violations.

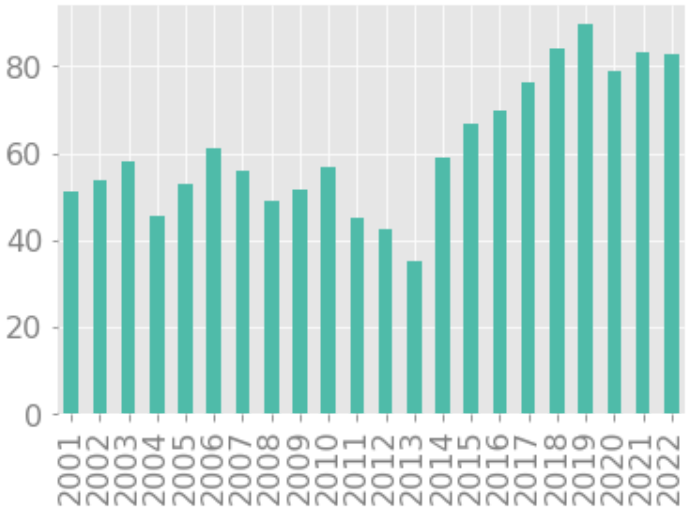


Figure 2. Yearly total rate of effluent violations per 100 permits (calculated as total effluent violations from any oil and gas permit, divided by the total number of oil and gas permits active for at least part of the preceding year, multiplied by 100).

While the rate of effluent violations has increased since 2015, the rate of inspections has shown a marked decrease, from 50-60 per 100 permits in 2001 and 2002 to about 12 per 100 permits in 2022. (See Figure 3 for the rate of inspections from 2001-2022). The median number of inspections reported for a permit is one, and the average is 3.29 - but only 1,017 permits (less than half) have been inspected by regulators since 2001.

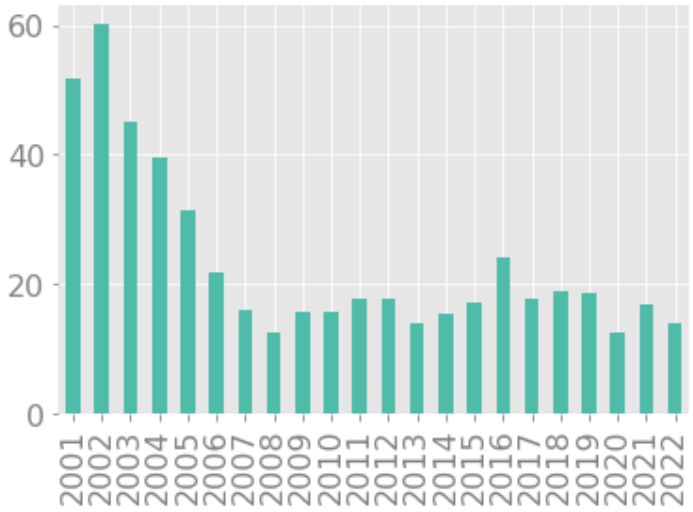


Figure 3. Yearly rate of inspections per 100 permits (calculated as total inspections for any oil and gas permit, divided by the total number of oil and gas permits active for at least part of the preceding year, multiplied by 100).

Overall, while the rate of violations has increased significantly since 2001, both inspections and enforcements have decreased. Only 60 permits have been fined since 2001, with a monetary amount of only $27,350 on average. An additional 225 permits have faced formal enforcement actions but no monetary penalties. Meanwhile, for general context, the largest oil and gas producers made close to $100 billion in the first quarter of 2022 alone.

The significant increase in violations over the past six to seven years in particular mirrors the findings in EDGI's 2020 Democratizing Data report, which analyzes data on compliance and enforcement of not only the CWA but also the Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA). This analysis found that, in 14 of the 20 states which have Senators on the Senate committee overseeing the EPA, CWA violations have increased since Trump's inauguration compared to the previous 16 years. Further, the median increase in the number of CWA violations was 98% in congressional districts and 60% in states. At the same time, inspections decreased in 13 out of 20 states. Finally, in 18 out of 20 states, there was a decline in the total number of enforcement actions taken

under the CAA, CWA, and RCRA. This is also in line with one Harvard Law School study which summarizes research showing that over 25% of all regulated facilities regularly violate their permits, while rates of significant violations of 50-70% are not unusual. This means that the overall trends we see in relation to oil and gas facilities are mirrored for all NPDES-regulated facilities.

High-Violation Permits Along the Production Chain

Investigating the specific highest-violation permits shows the regularity of CWA violations across the supply chain - from extraction, to transport, to use in chemical production. In fact, the top three highest violating permits almost serve as a summary of the oil and gas supply chain.

The second-highest violating permit we found in our analysis, with 346 CWA violations, belongs to Fairmont Brine Processing in West Virginia, which had a permit to discharge to the Monongahela River. Previously called AOP Clearwater, they specialized in handling and treating wastewater from fracking in the Marcellus shale formation. Wastewater is one of the most likely routes of water contamination from fracking activity. For every gallon of oil produced, up to 17 gallons of water are produced at the same time. Therefore, wastewater treatment and disposal is a major part of what is called the oil field services industry.

Fairmont has been in noncompliance for every quarter of the last three years, but all of their violations for those three years are for the same reason: they simply failed to report any data. However, they reported 91 violations of effluent discharge limits in 2010, 62 in 2014, and 104 in 2015. They were put on a corrective action plan in 2016 and then 2018, but continue to fail to report and no penalties have been assessed. They were also involved in a major hazardous-waste scandal: they contracted with a Kentucky man to transport and dispose of fracking wastewater and sludge in 2015 and 2016. This sludge, which contained low levels of radioactivity and other toxic chemicals concentrated by treating wastewater fluid, was illegally buried in the Blue Ridge landfill. Fairmont Brine eventually settled with the state of Kentucky for $168,000. Their CWA permit expired in 2020, and they seem to now be out of business, but the EPA lists them as still “active” and they continue to be listed as “in significant noncompliance.”

The third-highest violator, with 294 CWA violations, is Aux Sable, the largest natural-gas processing plant in the United States. Located in Channahon, Illinois, just southwest of Chicago, Aux Sable receives and processes natural gas delivered from Canadian shale sands through the Alliance Pipeline. Owned by Enbridge (best known for its role in the Dakota Access Pipeline, routed through the Standing Rock Sioux's lands), Pembina, and Williams Partners, Aux Sable specializes in extracting natural gas liquids from natural gas - which makes it easier to transport and ship. This means they handle natural gas-based products like ethane, propane, butane, isobutane, and natural gasoline. In addition to the facility itself, they have three pipelines connecting to nearby chemical manufacturers and the nearby Kinder Morgan transfer facility and refineries. They have a consistent record of effluent violations, with a total of 46 effluent violations in 2011 and 20 in 2010. In addition to their CWA violations, they also are a major violator of the Clean Air Act. In 2018 they agreed to pay a $2.7 million civil penalty for CAA violations and spend at least $4.5 million in improvements to air pollution controls.

Finally, the highest-violation permit, with 347 violations, belongs to Cytec Industries in West Virginia. Cytec, a subsidiary of the conglomerate Solvay Industries, focuses on chemical production, which is a major endpoint for natural gas. Cytec violated its effluent guidelines in 11 out of the 13 most recent quarterly reporting periods. Their violations include fecal coliform in their effluent discharge that is 9,582% over its limit and discharging water with a chemical oxygen demand 100% over its permitted limit. Almost a quarter of the time it exceeded the effluent limit for toluene, a carcinogenic chemical - and not in small amounts either: by 186%, 1,970%, 959%, and 9,404% in four quarters across 2019, 2020, and 2021. Cytec's site is currently part of a hazardous waste cleanup led by the EPA under RCRA for contaminated groundwater, including lead, benzene and solvents such as methanol and toluene. The EPA has also levied two administrative enforcement actions against them (in 2017 and 2019) but neither came with any monetary penalty. However, the site continues to be in active use, and its CWA permit is still active.

Most Impacted Watersheds

Finally, we analyzed the watersheds where oil and gas effluent violations and penalties are highest (see Figures 4 and 5). The highest numbers of CWA violations are along the Gulf of Mexico in Texas and Louisiana, where there is a high density of oil and gas sites. There are also concentrations in West Virginia and Pennsylvania, along the cities of

the East Coast (Washington, DC, Baltimore, Philadelphia, New York, and Boston), in Utah and Wyoming's fracking country, and the oil regions of North Dakota and Montana.

The comparison between effluent violations and monetary penalties is striking. Of the regions including violations, reflected in Figure 4, only a few watersheds have monetary enforcements recorded. This includes one swath across the Kansas-Oklahoma border, a few in Wyoming, a few in Texas and along the Gulf of Mexico, and one near Boston.

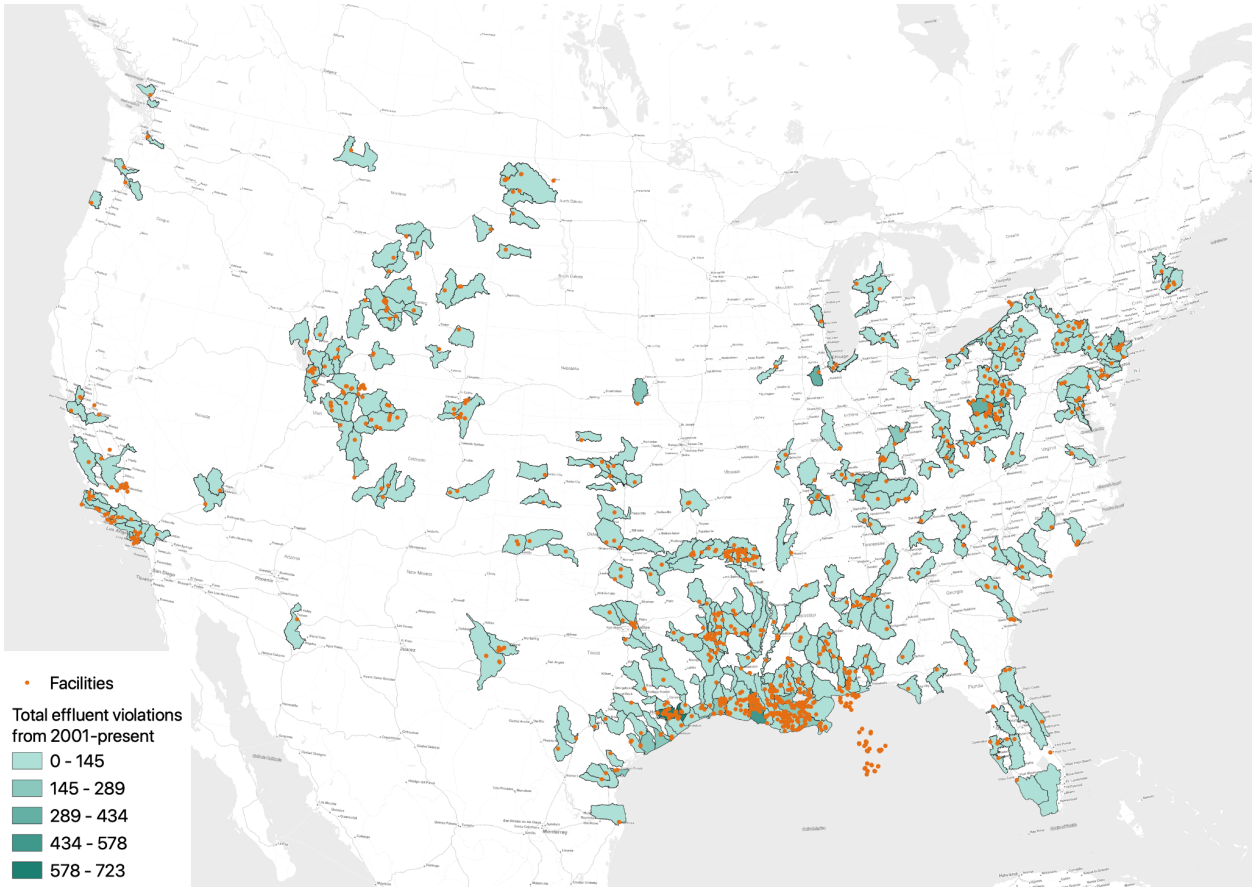


Figure 4. Map of effluent violations per watershed from 2001-present. Darker green represents higher total violations. Orange dots represent oil and gas facilities.

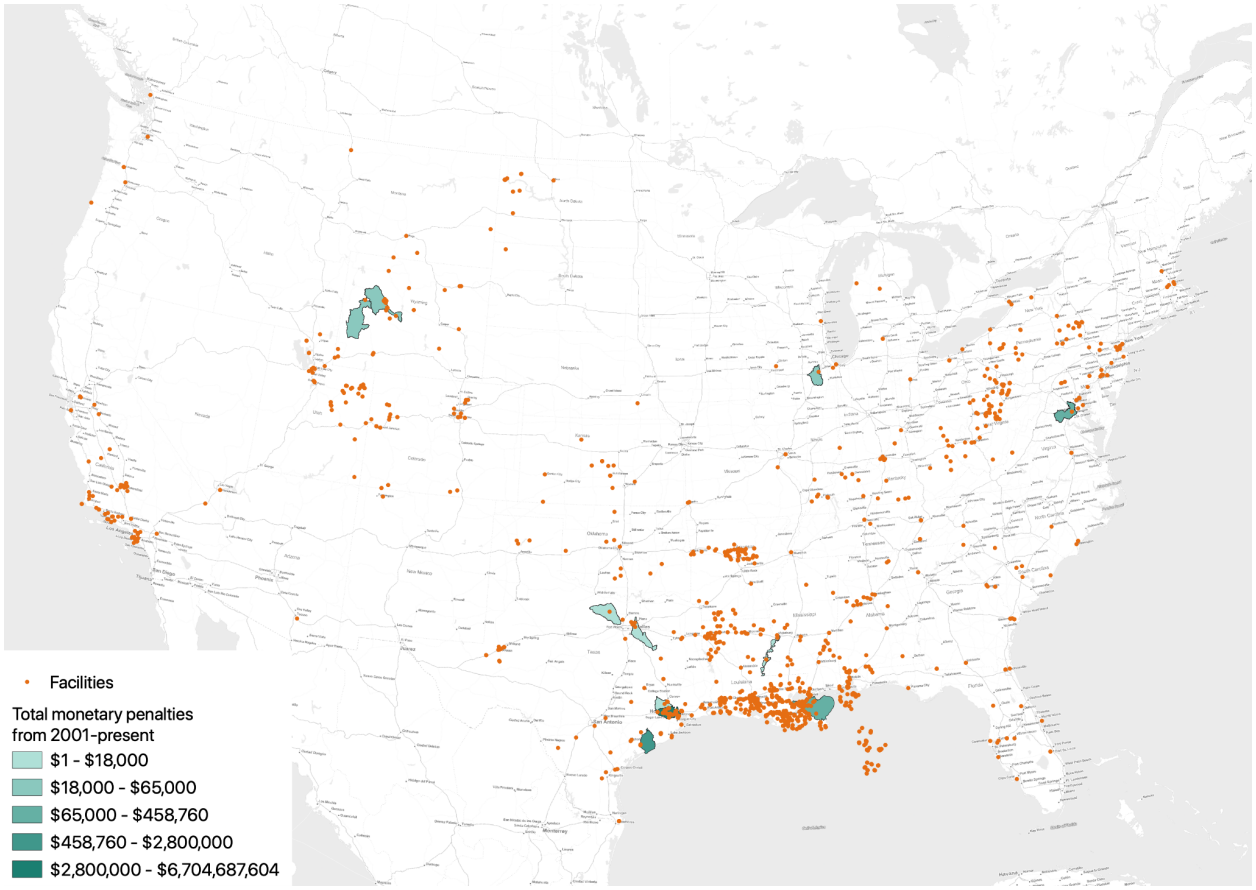


Figure 5. Map of total monetary penalties for enforcement actions per watershed from 2001-present. Darker green represents higher monetary values for enforcements. Orange dots represent oil and gas facilities.

The Future of the CWA

Looking ahead, fracking is likely to remain a core part of domestic energy production for at least the next 50 years. The Inflation Reduction Act (IRA), which will drive US energy policy for the next few decades, assumes the ongoing use of fracking to produce natural gas. The IRA also tie federal wind and solar development rights to oil and gas leases for ten years - one of its most damaging compromises.[13] Though natural gas is often touted as a necessary transition fuel from oil and coal to renewable energy, US natural gas

[13] In particular, the bill prohibits BLM from authorizing wind or solar development unless an onshore oil or gas lease sale has occurred within 120 days. These wind and solar rights of way will also require that BLM completes, in the year prior, oil and gas lease sales covering 2,000,000 acres or 50% of the acreage in which parties have expressed interest, whichever is lower. This is ostensibly for "energy security" - to make sure that there is a ready supply of energy even with the intermittent nature of wind and sun. However, linking wind and solar to natural gas works hand-in-glove with neoliberal financial and labor arrangements.

production already far exceeds domestic demand and is now exported around the globe. In fact, the US became the leading exporter of liquid natural gas (LNG) in 2022.

The recent increases in US LNG exports have been driven by the war in Ukraine; European countries have increasingly imported more LNG from the US to replace pipeline imports from Russia.[14] In March 2022, the EU signed an agreement with the United States to triple its natural gas imports from the US in order to diversify its energy supplies from "suppliers we trust," as European Commission President Ursula von der Leyen put it. This has driven a simultaneous resurgence in US fracking. But this increase in US LNG exports is likely to continue beyond the war, as we can infer from current increases in export capacity. There are currently seven LNG export terminals in the US, with a collective peak capacity of about 13.9 billion cubic feet per day (Bcf/d) estimated by the end of 2022. But there are another three under construction, and more already permitted but not yet under construction. The three under construction would add 5.7 Bcf/d of capacity - or an additional 41% - by 2025, according to data from the Department of Energy's Energy Information Administration.

The process of fracking uses a host of chemicals - 1,240 as reported to FracFocus.org - as surfactants, friction reducers, and for other purposes. Many of these chemicals are produced from natural gas. Ethylene glycol is one of the chemicals used in the highest mass in fracking fluids and is a direct product of the natural gas-derived chemical ethane. So, even beyond the impact of these additional LNG export facilities and increased demand for "clean" fossil fuels within the IRA, we should also analyze the chemical footprint of these chemicals, many of which come with their own carbon footprints throughout the supply chain.

In the face of US reinvestments in fracking technologies and natural gas processing and export, it is urgent to ask critical questions about what kinds of capacity we are building toward, and what futures we are preparing for. Part of this requires reinvesting in the Clean Water Act, revising it to make it truly responsive to the next fifty years of increased climate instability and pressure to use fracking and other unconventional methods to extract oil and gas. This includes, at a minimum, strengthening the enforcement and monitoring of CWA permits. It will also require repealing the stormwater permit exemption in the CWA, as well as the oil and gas industry's exemptions to other federal environmental legislation, such as the Safe Drinking Water Act's Underground

[14] According to the Energy Information Administration, LNG imports in the EU and UK increased during 2022 to average 14.8 Bcf/d.

Injection Control provisions. It will also require adding provisions to address non-point-source pollution under the CWA, and reclassifying wastewater pits and other “temporary” infrastructure as under the regulatory jurisdiction of the CWA. In 1972, we had a goal of eliminating pollutant discharge within ten years. Clearly this goal has passed - but perhaps we can aim to eliminate pollutant discharge within the next ten years. If so, re-regulating fracking and oil and gas processing is a necessary next step.