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TANKS FOR NOTHING

The Decades-long Failure to Protect the Public from Hazardous Chemical Spills

A National Report
and Case Study of Virginia

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Center for Progressive Reform | CPR

Tanks for Nothing: The Decades-long Failure to Protect the Public from Hazardous Chemical Spills, A National Report and Case Study of Virginia

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Executive Summary

Throughout most of the U.S., the public is not protected from spills and other disasters involving storage of hazardous chemicals — including toxic and flammable substances — in aboveground tanks. For decades, the U.S. Environmental Protection Agency (EPA) and most states have refused to act to protect the health and safety of workers and communities, as well as water and natural resources, from the threat of hazardous chemical tank fires, spills, and explosions.

The universe of these tanks — their quantity, location, contents, and conditions — and pollution involving these unregulated facilities are largely unknown to regulators and the public because most regulators do not even require registration. Our analysis demonstrates that federal and state regulators have significantly underestimated the threat of unregulated tanks, while federal and state policymakers have ignored the promised benefits of comprehensive protections, like those that have been in place for decades for oil and waste tanks. Furthermore, tank spills may exacerbate the cumulative effects of existing pollution and social stressors in communities near and downstream from these facilities.

Congress passed the Clean Water Act 50 years ago and mandated development of rules to prevent spills from aboveground chemical and oil storage tanks. EPA implemented national spill prevention and response rules for oil storage tanks, but it has to this day failed to issue the rules required by Congress for storage of hazardous substances. Lawsuits by environmental groups finally forced EPA to engage in overdue rulemakings in 2019, but the Trump administration issued no rule, leaving the public in harm's way.

In the absence of federal action, 10 states have established comprehensive programs that impose registration, inspection, and design and siting requirements to prevent releases from aboveground chemical storage facilities. Some of these state programs were enacted by lawmakers in response to catastrophic incidents, like a fatal explosion in Delaware or the Elk River leak in 2014 in West Virginia that contaminated drinking water for hundreds of thousands of residents. Several years ago, Virginia studied the issue of unregulated chemical storage and found that aboveground storage tanks pose a threat to the safety of Virginians and their drinking water. At that time, the Virginia Department of Environmental Quality (DEQ) recommended action, but policymakers chose instead to wait on an EPA rule that never came.

Key Findings

To date, neither the federal government nor Virginia state agencies have attempted to estimate the full extent of and incidents related to aboveground chemical storage tanks nationwide or in the Commonwealth.

- Using reports submitted by facilities regulated under the federal Emergency Planning and Community Right-to-Know Act, EPA estimates that there are roughly 2,000 facilities in Virginia that could have been subject to the spill prevention regulations that EPA ultimately refused to adopt. These facilities, however, only store large amounts of hazardous substances, and each facility may have multiple tanks.

- Our analysis found that the number of unregulated aboveground chemical storage tanks in the Commonwealth may fall between 2,720 and 5,405.

- Furthermore, our analysis of data from Virginia DEQ's Pollution Response Program found that between 2000 and 2020, there were more than 4,800 tank-related instances of spills, releases, improper storage, and illegal dumping, of which over 1,400 explicitly involved aboveground storage tanks. That amounts to an average of nearly 230 tank-related incidents in the Commonwealth each year. The number of reported incidents also appears to have increased over time, and the seven most impacted cities and counties are home to roughly a third of Virginians.

While these estimates paint a troubling picture, they are likely significant underestimates of the true extent of aboveground chemical storage tanks and associated spills in Virginia.

The public health impacts of aboveground chemical tank spills depend on a variety of factors —including the type of chemical spilled; the route, dose, and length of exposure; and the underlying health of those exposed. However, many past incidents have caused respiratory issues, dizziness, headaches, nausea, and other central nervous system problems in affected populations.

To add insult to injury, hazardous chemical facilities are disproportionately located in communities of color and low-income communities. Our analysis found that aboveground chemical tank spills in Virginia may be concentrated in these communities too. Spills do not happen in a vacuum, and the cumulative impacts of exposure to toxic chemicals on top of existing pollution sources and other social stressors can further harm the health and safety of communities living adjacent to and downstream from facilities with unregulated storage tanks.

Finally, worsening extreme weather events driven by climate change will only increase the frequency of spills. Our analysis found that the number of tank incidents increased between two- to eight-fold following hurricanes in Virginia. Given the inherent uncertainties of predicting the impacts of chemical releases, particularly those caused by hurricanes and other climate hazards, measures to prevent, prepare for, and respond to releases are the most effective way to safeguard public health.

Recommendations

Virginia government: Virginia policymakers have long recognized the threat that unregulated chemical storage poses in the Commonwealth.

- Like Delaware and West Virginia, Virginia should enact a comprehensive program that tracks tanks, prevents spills, and makes information available to emergency planners and the public.

- State and local policymakers should also enact reforms to fire and building codes to complement a comprehensive environmental regulatory program.

- To maximize protection from chemical disasters, policymakers should rely on lessons learned in other states and adopt measures to reduce reliance on the most toxic chemicals and put practices in place that effectively protect workers, communities, and natural resources.

Federal government: Enacting Clean Water Act rules for unregulated chemical storage facilities presents a significant opportunity to the Biden administration that will advance the president's priorities and initiatives on environmental justice, racial equity, climate, and regulatory reform.

- The Biden administration must reverse the Trump administration's refusal to issue a comprehensive spill prevention rule for storage of hazardous substances.

- Further, the Biden administration and EPA should prioritize development of comprehensive spill prevention and worst-case discharge planning rules required by Congress.

- The Biden administration should ensure equitable public participation by affected communities and those disproportionately affected by chemical storage and other chemical hazards, in accordance with the president's priorities on environmental justice, racial equity, and climate.

As several states have shown, protecting people and the environment from catastrophic chemical spills from aboveground storage tanks is possible. Virginia, 39 other states, and EPA can and should model their policies on what has already worked, and they must do so as soon as possible.

Introduction

Tucked away in industrial parks, towering along railways and waterfronts, and on pallets outside neighborhood home improvement and agricultural supply stores, tanks containing hazardous chemicals are seemingly everywhere in the landscape. When it comes to public protections for our health and safety, however, these unregulated chemical storage facilities are missing from public policy.

Decades ago, Congress passed legislation requiring a comprehensive and nationwide program to prevent and respond to spills from all kinds of chemical storage facilities.[1] Yet, 50 years later, the U.S. Environmental Protection Agency (EPA) has refused to issue rules to prevent spills of hazardous substances from aboveground storage facilities. EPA did, however, enact rules for facilities storing oil and petroleum products and hazardous waste, and these have successfully mitigated harms to the public and the environment.

The tanks that are the subject of this report vary greatly in function and dimensions, from pesticide totes containing 100 gallons or fewer to steel tanks storing millions of gallons of industrial chemicals. Collectively, these unregulated chemical storage facilities are often referred to as "aboveground storage tanks," or ASTs. Over the years, catastrophic incidents involving unregulated storage of toxic and flammable chemicals have driven states, including West Virginia and Delaware, to adopt rules for ASTs. However, without uniform action, the threat of an unknown universe of unregulated chemical facilities persists, along with untold stories of spills harming people's health and safety and the environment.

This report explores the law and policy landscape of hazardous chemical spills nationally; where states have taken action to prevent spills; and in Virginia, where the majority of aboveground chemical storage facilities are still totally unregulated. Indeed, the quantity, chemical contents, location, and conditions of these facilities are unknown to Virginia's regulators and the public. This report also presents new findings about what is known in Virginia, including the extent of these unregulated facilities, incidents of chemical spills, and their impact on Virginians. Lastly, the report charts a path forward, from long overdue EPA rulemakings to action by Virginia policymakers, local governments, and advocates to protect public health, safety, and the environment.

EPA Flouts Congressional Mandate to Prevent Hazardous Chemical Spills

In 2022, clean water advocates, policymakers, and all Americans will commemorate the 50th anniversary of the Clean Water Act (CWA), one of the most successful environmental regulatory laws ever enacted.[2] The year will also mark half a century since Congress first mandated safeguards against spills from tanks and other aboveground facilities containing oil or hazardous substances, which then-President Richard Nixon delegated to the fledgling EPA.[3] Another act of Congress followed in 1990, directing EPA to issue additional rules to respond to 'worst-case' spills of oil and hazardous substances.[4] In the intervening decades, Democratic and Republican administrations alike have neglected and outright refused to accede to Congress' mandate to protect Americans from chemical spills.

Hundreds of thousands of tanks and other facilities containing hazardous substances remain virtually unregulated.[5] The Clean Water Act-mandated rules call for preventing discharges of designated hazardous substances that "present an imminent and substantial danger to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, and beaches" when released to water in "any quantity."[6] To accomplish this purpose, EPA was required to establish a new regulatory program of "procedures, methods, and equipment and other requirements for equipment to prevent [and contain] discharges" from non-transportation-related onshore facilities. EPA was also required to revise the list of hazardous substances when appropriate to include chemicals that pose the specified risk to the environment and human health.[7] Congress' 1990 mandate directed EPA to make rules for the same facilities that, when storing certain quantities of hazardous substances posing threat of substantial harm, requires operators to develop and submit plans that "prevent, mitigate, and respond to worst-case spills."[8]

EPA did develop a list of CWA hazardous substances, but today it regulates these substances only when companies actually discharge them to water – not when storing the chemicals. Importantly, these regulated substances represented only a small fraction of the thousands of toxic and hazardous chemicals that are stored in unregulated aboveground facilities. The chart on the next page lists some of these substances.

Despite failing to issue spill prevention regulations for all hazardous substances, EPA has, in part, complied with Congress' mandate by issuing spill prevention and worst-case planning rules for tanks storing oil. Pursuant to the CWA, EPA created the Spill Prevention, Control, and Countermeasure (SPCC) regulatory program "to prevent discharges of oil [and oil mixed with other substances] from vessels and facilities and to contain such discharges."[9] The rules require facility operators to undertake spill prevention planning that includes "a facility diagram, oil discharge predictions, secondary containment or diversionary structures, overfill prevention, requirements for inspections, transfer procedures, personnel training, and a five-year plan

Examples from the Clean Water Act-designated hazardous substances list (330 total)

Arsenic pentoxide (highly toxic)
Benzene (highly flammable and toxic carcinogen)
Calcium cyanide (highly toxic)
Carbaryl (highly toxic pesticide)
Chlorobenzene (toxic and highly flammable)
Chloroform (toxic and carcinogenic)
Chlorpyrifos (neurotoxic pesticide)
Formaldehyde (highly flammable and toxic carcinogen)
Parathion methyl (toxic pesticide)
Nitrobenzene (highly toxic and flammable)
Phosgene (highly toxic and potentially lethal poison)
Potassium cyanide (highly toxic and potentially lethal poison)
Trichloroethylene (highly toxic and persistent contaminant in water)

Source: 40 CFR 116.4 and 40 CFR 117.3.

review."[10] After the 1990 amendments to the CWA, EPA then established the Facility Response Plan rules that require operators of oil facilities to develop and implement plans for spill detection, notification, response, containment, and disposal for various worst-case spill scenarios and hazards.[11]

The Trump administration's principal reason for not developing the required hazardous substance storage regulation was that other federal regulatory schemes adequately substitute for the dedicated hazardous substance spill prevention and worst-case response rules mandated by Congress.[12] However, other major federal regulatory regimes do not regulate the universe of facilities containing hazardous substances pursuant to the CWA, and they only variously address hazardous substances, in some instances at thresholds that are at orders of magnitude greater than what EPA has determined will harm water resources and human health.[13] For example:

- The Clean Air Act Chemical Disaster Rule ("Risk Management Program") regulates fewer than eight percent of hazardous substances and at thresholds that are at orders of magnitude greater than those established by CWA rules.[14]

- The Resource Conservation and Recovery Act (RCRA) regulates only some CWA hazardous substances but only when such materials are designated as "waste," not when the substances are being manufactured, stored, or used for commercial purposes.[15] Furthermore, the RCRA rules for underground storage tanks, dating to the mid-1980s, regulate just those tanks, not the aboveground tanks and facilities for which Congress mandated spill prevention and response rulemakings.[16]

- Clean Water Act pollution discharge permits do not impose programmatic requirements and standards to prevent and respond to spills of hazardous substances as called for by the CWA.[17]

- The Emergency Planning and Community Right-to-Know Act of 1986 merely requires reporting of chemical storage to certain regulators for local emergency planning, among other purposes, and the requirement applies to fewer than 20 percent of CWA hazardous substances and at substantially higher regulatory thresholds.[18] Reporting is no substitute for standards and other requirements that aim to prevent and contain hazardous substance spills where chemicals are stored.

Due to EPA's inaction, environmental groups sued in 2015 to compel the agency to issue the long overdue hazardous substances spill prevention regulations, resulting in a 2016 consent decree binding the agency to take action on new rules.[19] By 2019, however, the Trump EPA declined to issue regulations for hazardous substance storage facilities.[20] In doing so, EPA brazenly ignored Congress' original and legally unequivocal mandate that the president "shall issue" rules to prevent discharges of hazardous substances.[21]

In the 2019 (non)rulemaking, EPA admitted that it does not have information, or, even, reliable estimates, for the extent of facilities, the history of spills from these facilities, or the costs and benefits of compliance with the rules Congress demanded.[22] As such, the agency's refusal to issue regulations results in a perceived conundrum of its own making: If EPA were to issue the regulations, as required by statute, then the agency would have decades of data directly relevant to the design and implementation of these regulations.[23] Yet, EPA did not follow through on its own plan that it deemed necessary for acquiring data to adequately support the rulemaking.[24] Adding insult to injury, EPA did not consider the potential benefits to the environment, drinking water sources, or saved economic costs of major chemical storage incidents, like the one in West Virginia that cost the local economy more than $60 million in the first week after a tank was found leaking chemicals.[25]

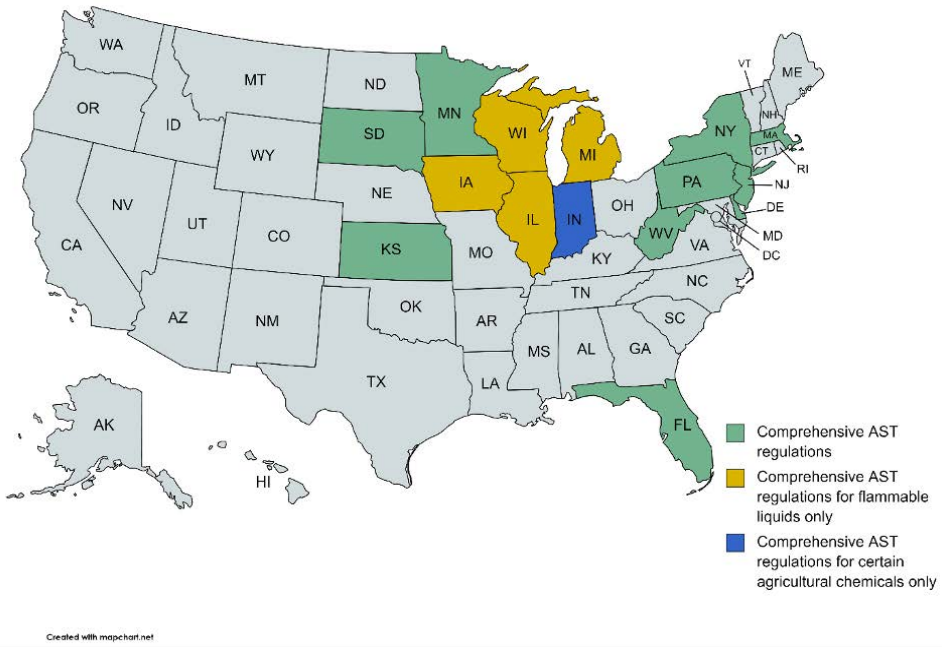
In 2019, environmental groups again sued EPA to compel the agency to issue worst-case discharge planning regulations in accordance with the 1990 CWA amendments. It is now almost 30 years after EPA was required to issue the spill response planning rules, ensuring that facilities storing hazardous chemicals in quantities large enough to cause harm to people and communities prepare plans for worst-case discharges, including incidents during adverse weather.[26] In 2020, EPA entered into a consent decree binding the agency to finally publish draft rules, no later than March 2022, and adopt final rules within the following two and half years.[27]

States Act to Prevent Hazardous Chemical Spills

Without federal action on aboveground chemical storage facilities, some states have enacted regulatory programs to prevent and respond to spills. Ten states — Delaware, Florida, Kansas, Massachusetts, Minnesota, New Jersey, New York, Pennsylvania, South Dakota, and West Virginia — have comprehensive regulatory programs for ASTs. The earliest of these programs were implemented in the early 1980s, while the most recent program was implemented by West Virginia in 2014.[28] Furthermore, Illinois, Iowa, Michigan, and Wisconsin have adopted regulations for facilities storing flammable liquids only. Lastly, Indiana regulates fertilizer, pesticide, and herbicide storage.

Most states also regulate aboveground oil tanks through a combination of federal and state laws. In states that do not have a regulatory program for aboveground chemical storage, tanks are subject to a web of laws derived from state and local fire codes and federal environmental laws. Applying these scattered and overly narrow regulations is an additional barrier to compliance and enforcement. Enacting a single program that comprehensively tracks ASTs, imposes construction and operation standards, creates spill response measures, and provides information to the public and state regulators would more effectively reduce the potential dangers posed by these tanks.

Figure 1: Map of States with Regulatory Programs for Non-Petroleum ASTs

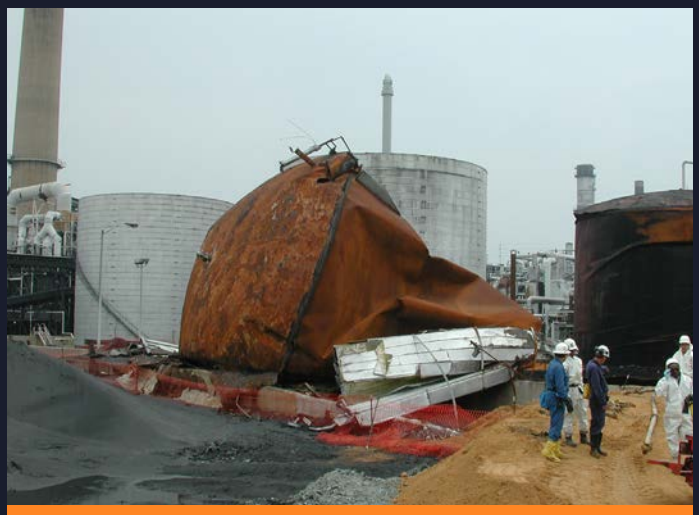


The 2001 Motiva Tank Explosion in Delaware

On July 17, 2001, the contents of Tank 393 at the Motiva Enterprises Delaware City Refinery ignited and exploded. The tank had been constructed in 1979 to store fresh sulfuric acid.[29] However, in the decades since, Motiva had used it to store flammable spent sulfuric acid with minimal engineering conversion.[30] Instead, the company hastily dropped a rubber hose through a hole in the tank roof to redirect carbon dioxide from a nearby tank's inerting system.[31]

A leak requiring major repairs occurred as early as 1994, and other leaks were reported in 1998, 1999, 2000, and 2001.[32] No repairs were made in response to the 2001 leak. Motiva's inspectors recommended an immediate assessment of the tank's internal integrity based on extensive corrosion observed in preceding years, but the company made no such assessment. Each inspection stated that patches made to the tank were only temporary measures, yet Motiva insisted that the tank could continue to operate safely.[33] On June 27, 2001, an operator submitted an unsafe condition report regarding the corrosion and leakage of the tank, suspending hot work on the tank.[34] Motiva investigated the report but took no further action.[35] Instead, Motiva acquired a permit allowing welding and other modifications on the tank's catwalk.[36] Contract workers were not alerted to the previous hazard reports regarding the tank.[37]

During work, a spark from the welding equipment entered a hole in the tank and ignited the highly flammable spent acid, causing the tank to detonate and instantaneously release the 264,000 gallons stored within.[38] Damage to adjacent tanks resulted in a total leakage of 1.1 million gallons of sulfuric acid, with an estimated 99,000 gallons flowing directly into the Delaware River.[39] Nine workers were on the catwalk at the time of the explosion. One worker, Jeffrey Davis, was fatally injured, while the remaining eight suffered acid burns and internal injuries.[40] The Occupational Safety and Health Administration (OSHA) declined to cite Motiva for violations of Process Safety Management Standards, holding that sulfuric acid processes were categorically exempt from the rules.[41]



Collapsed tank from the Motiva Enterprises explosion.

Source: U.S. Chemical Safety Board

Existing State AST Laws

Comprehensive state AST programs share several common features. First, AST programs collect and track critical information about regulated tanks. Registering tank location, ownership, contents, and other information is a common feature of almost all programs. Second, programs impose measures to prevent spills. These provisions typically include design criteria, secondary containment measures, and inspection requirements. Compliance with these standards is often a prerequisite to obtaining an operating permit. Third, an AST program often requires spill planning and response measures, such as response plans and demonstrating financial capability to cover the costs of response to a chemical leak and its impacts. Finally, AST programs often function to inform the public, state regulators, drinking water utilities, emergency planners, and first responders. For example, many state programs consolidate registration or permitting information in a publicly accessible database or require signage to be posted on tanks. A table presenting the major features of states' regulatory programs for chemical ASTs can be found in Appendix A.

Absent comprehensive AST regulation, most states instead impose rules on certain hazardous chemical storage tanks through a combination of fire codes and federal regulations. Dozens of states have adopted provisions from the National Fire Protection Association Code 30 and the International Fire Code.[42] These model codes typically include construction design standards, with criteria related to secondary containment, prevention of corrosion, and leak detection. However, the codes do not require tank registration, spill prevention planning and response, or monitoring and compliance. Most states are delegated authority to implement RCRA rules for storage of hazardous wastes, including enforcement of federal rules for secondary containment and inspections, for example, as well as guidelines for tank design.[43] Lastly, states are delegated Clean Air Act permitting authority to implement federal rules for monitoring and technological controls for storage tanks containing certain volatile organic liquids.[44]

Elk River Disaster: The 2014 Freedom Industries Chemical Spill in West Virginia

On the morning of January 9, 2014, residents of Charleston, West Virginia, noticed an unusual licorice-like odor in their tap water. The cause was methylcyclohexane methanol (MHCM), a chemical used in industrial coal processing. An estimated 11,000 gallons of the substance[45] had leaked from a severely corroded storage tank located 1.5 miles north of the city's municipal water intake on the banks of the Elk River, contaminating the water supply of nine counties.[46] A federal state of emergency was declared as approximately 300,000 West Virginia residents were advised to avoid contact with their tap water, forcing

those affected to rely on bottled water until the water supply was restored over one week later — though the chemical continued to be detected in water supplies months after the spill.[47] The region's economy was brought to an abrupt halt, and nearly 400 people sought emergency room care with symptoms of nausea, headaches, and vomiting.[48]

In the aftermath of the spill, many West Virginia residents wondered how such a disaster could have struck with so little warning, while fenceline communities in Chemical Valley were left waiting for the next disaster. Freedom Industries had operated the damaged tank at its facility, which was covered by a stormwater permit issued by state regulators in 2009.[49] State inspections had been conducted at least as far back as 2007.[50] Inspectors who arrived at the facility noted that workers had attempted to block the leak with a 50-pound bag of absorbent material, but the company had not reported the spill to the Department of Environmental Protection or the municipal water utility until after the inspectors' arrival.[51]

The Freedom Industries spill prompted West Virginia residents to demand more rigorous inspection and oversight of chemical storage tanks, leading to the passage of the West Virginia Aboveground Storage Tank Act in 2014. As significant as the damage caused by the spill was, the distinctive odor of MHCM made the problem immediately obvious in the affected area and spurred a rapid state response.[52] An odorless chemical likely would not have been detected so quickly.

Notable State AST Laws

West Virginia

West Virginia lawmakers enacted the West Virginia Aboveground Storage Tank Act in 2014 in the wake of the Elk River disaster that contaminated the water supply of approximately 300,000 state residents. The act imposes measures to prevent future spills from ASTs that contain at least 1,320 gallons of fluid.[53] Broad exemptions remove certain vessels from regulation, such as flow-through process tanks that are common in the chemical industry.[54] Notably, the statute specifies different regulations based on the proximity of a tank to a drinking water source.[55]

West Virginia's law is among the most vulnerable in the country. State legislators have continuously attempted to reduce the scope of the act, first limiting inspection requirements to only certain categories of large tanks or tanks near water intakes in 2015.[56] Later, smaller tanks used in fossil fuel production located far from water intakes were exempted.[57] As a result of these rollbacks, fewer than 4,500 tanks are currently subject to the full scope of protections originally

provided by the act, out of roughly 42,000 registered tanks.[58] The House of Delegates also passed a bill that would exempt tanks containing less than 8,820 gallons of fluid used in fossil fuel production from regulation, regardless of location.[59] As of this writing, the bill was awaiting a vote in the Senate, over opposition from state environmental officials.[60]

Where still applicable, the act imposes several requirements for AST operation. Each owner or operator of an AST must disclose the ownership of the tank, its location, the date of installation, its capacity, and the materials stored within.[61] New and existing tanks must be inspected, and the results submitted to state regulators.[62] The state may direct inspections of registered tanks, request the owner to monitor the tank or furnish information, or enter a facility to perform testing or take corrective action.[63] Tank owners must submit and periodically update a spill prevention and response plan,[64] and owners must demonstrate that they are financially able to respond to a release.[65] General information about tank facilities is made publicly available, but specific details regarding site layout and materials stored are not.[66]

Delaware

Delaware first enacted the Jeffrey Davis Aboveground Storage Tank Act in 2002. The statute is notable for its thoroughness, covering all of the major areas of AST regulation for a wide range of tanks. The law defines an AST as "a single aboveground containment vessel having a capacity of greater than 250 gallons and currently or previously having contained regulated substances."[67] "Regulated substances" are defined as either petroleum products, liquids containing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous substances, or any other substances identified as hazardous by Delaware's environmental regulators.[68] Certain vessels, such as process tanks or tanks regulated under other laws, are categorically exempted.[69]

All ASTs subject to regulation under the law must be registered with the state. The registration must disclose the "date of installation, location, type of construction, type of substance to be stored, the size of the tank, the material of construction and the owner and operator's name."[70] Tanks must comply with performance and design standards, including that they be equipped with a leak detection system.[71] Inspectors may enter a facility to perform testing or inspection at any reasonable time and may do so unannounced.[72] Additionally, tank owners are required to perform regular inspections and must perform an inspection upon emptying a tank.[73]

Delaware requires tank owners to develop release response plans and take corrective action in the event of a spill.[74] Tank owners must demonstrate that they are able to assume financial liability for an accidental release.[75] Regardless of whether corrective action is taken by the tank owner or the state, the owner remains liable for response costs.[76]

Florida

First enacted in 1983, Florida's Storage Tank Compliance program is among the oldest AST regulatory programs in the country. Uniquely, Florida's statute explicitly identifies the threat

posed to the state's coastlines and wetlands by chemical storage facilities and declares that any potential burden imposed by regulation is outweighed by the benefits to public health and the environment derived from increased oversight.[77] The statute defines an "aboveground hazardous substance tank" as "any stationary aboveground storage tank . . . that contains hazardous substances which are liquid at standard temperature and pressure and has an individual storage capacity greater than 110 gallons."[78] However, Florida' regulations provide extensive categorical exemptions, such as certain pesticide and biofuel facilities, that limit the law's scope.[79]

Florida's statute directs the Department of Environmental Protection to enact certain regulations, including construction and maintenance standards,[80] registration requirements,[81] discharge response plan requirements,[82] and inspection schedules.[83] It also directs the agency to enforce violations of these standards.[84] The agency otherwise has broad discretion to implement the statute and impose additional requirements.

Kansas

The Kansas Storage Tank Act of 1989 imposes regulations on any AST with a capacity greater than 660 gallons with at least 90 percent of its volume above the ground.[85] Notably, the law provides exemptions for storage tanks at agricultural facilities, which are separately regulated by the Department of Agriculture.[86] Certain other categories of containers are also exempt, such as wastewater treatment vessels or flow-through process tanks.[87]

Under the law, tank owners must notify state regulators of their tank's existence.[88] Any construction or modification of a tank must be permitted by the state and must meet design and performance standards.[89] These include construction and repair standards, spill detection and reporting requirements, siting criteria, testing and inspection methods, cleanup criteria in the event of a release, removal and disposal procedures, retrofitting schedules, fee schedules, and requirements for demonstrating ongoing financial responsibility.[90] Performance standards may not exceed federal requirements, but local jurisdictions are permitted to adopt more stringent regulations than the state.[91] Enforcement provisions in Kansas' act are less stringent than in other jurisdictions, only requiring monitoring upon request and inspections at reasonable times.[92]

New York

New York's AST regulatory program is among the most broadly inclusive of any state's. All tanks containing hazardous materials with a capacity greater than 185 gallons are included within the program.[93] Apart from categorical exemptions for closed process systems, wastewater treatment systems, transformers, and tanks used for agricultural purposes on a farm,[94] all tanks above the capacity threshold are subject to the program unless they are separately regulated comprehensively by a different state program.[95] Temporary tank systems are only granted a 90-day exemption from regulation,[96] affording even less leeway than Delaware's six-month exemption.[97] New York's program may be considered a benchmark for regulatory inclusivity.

Regulated tank facilities are subject to extensive requirements. All facilities must be registered with the state prior to the first receipt of a hazardous substance.[98] AST owners must also comply with regulations governing design, secondary containment, monitoring, and modifications.[99] All tanks must be visually inspected daily by the tank owner, and certain technical inspections must be conducted annually or every five years, depending upon the type of inspection, with larger tanks requiring five-year inspections by a professional engineer.[100] All facilities must prepare a spill response plan, which must be provided to the state upon request.[101]

Some states have adopted comprehensive regulatory programs to fill the gap in public protections that has resulted from EPA's failure to issue rules for unregulated chemical storage. Critical features of such laws include registration requirements, inspection and monitoring standards, requirements for the preparation of emergency preparedness and response plans, and the creation of a centralized registration database for operational ASTs.

Currently, Virginia is one of 40 states that have not adopted comprehensive laws and regulations to protect the public from unregulated chemical storage tanks. While this is admittedly still the majority approach, it is also the case that many states that have enacted AST laws did so after workers, residents, and communities suffered the disastrous consequences of a chemical release or other tank failure. There is no reason for Virginia to ignore the lessons learned by other states and continue to delay regulation until after an accident results in irreparable harm to human health or the environment.

Aboveground storage tanks at a chemical manufacturing plant in the city of Salem, Virginia.

Source: David Flores, Center for Progressive Reform

Virginia's Stalled Efforts to Prevent Hazardous Chemical Spills

Virginia policymakers have studied aboveground chemical storage and found that existing federal and state programs do not prevent and respond to the threat of releases from unregulated aboveground chemical storage tanks in the Commonwealth. The General Assembly has yet to pass proposed legislation that would close this significant gap in public protections.

Spurred by the 2014 Freedom Industries spill in West Virginia, the Virginia General Assembly unanimously passed a bill in 2015 requiring a study of "existing statutory and regulatory tools for ensuring that chemical storage in the Commonwealth is conducted in a manner that is protective of human health, public safety, drinking water resources, and the environment of the Commonwealth."[102] The bill defined chemicals as those designated pursuant to the reporting requirements of the Superfund Amendments and Reauthorization Act and the Emergency Planning and Community Right-To-Know Act.[103] Chemicals stored in quantities less than 10,000 gallons and those designated as hazardous substances pursuant to the CWA, for example, were not included. The General Assembly directed the Virginia departments of Environmental Quality, Health, and Emergency Management to conduct the evaluation of regulatory gaps and provide recommendations to the General Assembly to "address protection of human health, public safety, drinking water resources, the environment, and the economy of the Commonwealth."[104]

Published the following year, the *Chemical Storage in the Commonwealth* report highlights the gaps in knowledge and regulation of aboveground chemical storage tanks in Virginia.[105] State regulators found that EPA delegates broad authority to Virginia to implement federal programs for environmental regulation and that the Commonwealth has in some instances built upon federal programs to enhance protection of human health and the environment.[106]

Recognizing that underground storage tanks and aboveground oil storage tanks are extensively regulated, the Virginia regulators note that there are few state or federal requirements that pertain to aboveground chemical storage tanks.[107] Responding to the mandate to investigate certain designated chemicals and their impact on drinking water resources, the report's authors conclude that there are no regulations that "govern storage of these chemicals" and that there is "a general lack of siting requirements for chemical storage tanks in near proximity to source water areas" in Virginia.[108]

As part of their evaluation, Virginia regulators surveyed 11 other states that implement their own hazardous chemical storage regulatory programs and concluded, where EPA has failed to make rules, that "states have the predominant role in regulating ASTs that contain chemicals."[109] The report summarizes the evaluation of the state AST programs, finding that most rely on a combination of state statutes and regulations and local fire code programs to comprehensively

address hazardous chemical storage with requirements for registration, notification, design and construction standards, periodic inspections, release detection and spill prevention practices, financial responsibility, spill response planning, and cleanup of contamination.[110] Recognizing the then-pending EPA regulations on hazardous substance spill prevention, the report recommends that Virginia policymakers consider delaying action until after promulgation of federal regulations, but the authors also urged the Commonwealth to establish an inventory and registration program for aboveground chemical storage tanks to support subsequent regulatory actions. Neither the EPA rules on hazardous substance spill prevention, nor a Virginia inventory and registration program for chemical storage, were enacted.[111]

After several additional years without progress, Virginia legislators introduced a new bill during the 2020 Session of the General Assembly to establish regulatory controls for chemical storage tanks modeled after existing comprehensive regulatory programs for oil storage and underground storage of hazardous chemicals.[112] The proposed legislation would direct the State Water Control Board and the Department of Environmental Quality (DEQ) to design and promulgate regulations for a statewide program imposing requirements for registration, reporting, spill planning, prevention, response, and cleanup. Unlike Virginia's oil tank regulations or other states' chemical storage tank programs, the proposed regulatory program would also impose additional spill prevention requirements for facilities in areas within federally designated floodplains or exposed to hurricane storm surge, owing to the worsening impacts of climate in Virginia and the growing risk of chemical disasters. Due to industry opposition, the sponsors of the proposed legislation were forced to continue the bill to the following legislative session.

Virginia has implemented comprehensive programs to regulate storage tanks containing oil, hazardous wastes, and underground storage tanks for hazardous substances. The DEQ and the State Water Control Board implement federal and state water pollution laws, including regulations for oil storage facilities.[113] Virginia's regulators also implement Articles 9 and 10 of the State Water Control Law, which establish a comprehensive program to regulate underground storage tanks containing CERCLA hazardous substances, liquid petroleum products, and other substances designated as hazardous.[114] The regulations require, in part, performance and mechanical standards, secondary containment measures, inspections and training, spill response measures, and tank opening or change-in-service procedures.[115] In 2016, only 22 of some 18,000 regulated underground storage tanks in Virginia contained nonpetroleum substances.[116] Finally, Virginia environmental regulators implement federal RCRA and state hazardous and solid waste regulations, applicable to tanks storing regulated wastes only.[117]

The Virginia legislature has also adopted a form of governance (the Dillon Rule) that preempts most local governments from exercising regulatory authority except where the General Assembly explicitly delegates those powers to counties and independent cities. Conversely, local governments may further legislate in regulatory matters delegated by the General Assembly, except where expressly preempted.[118] Therefore, there are ways for local governments to tackle the problem of unregulated chemical storage facilities through regulation of land use, fire codes, and building codes.

The General Assembly has delegated broad zoning authorities to counties and cities, inclusive of the power to restrict and prohibit commercial and industrial land use (the kinds of land use where unregulated chemical storage facilities are likely to be found) and to enact other zoning ordinances that impose conditions on certain uses.[119] The delegation of land use regulatory authorities to local governments also includes various broad mandates of purpose, including the "general purpose of promoting the health, safety or general welfare" and protection of natural resources and water quality.[120]

Virginia's Statewide Fire Prevention Code and Uniform Statewide Building Code impose standards on certain chemical storage facilities but are inadequate for safeguarding the public and the environment. The codes adopt provisions from international and national model fire codes, and both are primarily enforced by local governments.[121]

The fire code primarily provides construction standards for storage tanks containing flammable and other hazardous materials.[122] However, these regulations are not a substitute for a comprehensive program, as the code does not require registration of tanks and measures for emergency preparedness and monitoring are lacking. Although the code includes a model emergency response plan, its guidelines are sparse and there is no requirement that the plan be submitted for outside review.[123] Finally, the code does not provide for adequate and regular inspection. Inspections by fire code officials are only required when "deemed necessary" and tank owners are merely directed to conduct visual monitoring.[124]

Likewise, Virginia's building code also imposes standards for leak detection and containment, as well as standards for certain liquid fertilizer storage facilities.[125] Local governments are permitted to impose more stringent regulations than those contained in the code so long as they do not affect the manner of construction or materials used contrary to the state building code; a local jurisdiction therefore may not categorically prohibit all ASTs.[126]

While the building and fire codes' design criteria provide a starting point for a comprehensive regulatory program, they are insufficient without further requirements for registration, prevention, planning, response, and oversight.

Agencies Underestimate the Extent of Unregulated Aboveground Chemical Storage in Virginia

Neither EPA nor Virginia DEQ have attempted to assess the total number of aboveground storage tanks nationwide or in the Commonwealth. The closest proxy for this information is an estimate of the universe of non-transportation-related onshore chemical storage facilities that would be covered by EPA's 2018 CWA hazardous substances spill prevention rulemaking, which ultimately resulted in no final rule.

EPA estimated that there are 2,037 facilities that would subject to these regulations in Virginia. However, that analysis relied on so-called Tier II reports filed under the Emergency Planning and Community Right-to-Know Act (EPCRA), which are only submitted by facilities storing a relatively large amount of hazardous substances.[127] As a result, estimates of aboveground chemical storage that rely solely on these reports are likely a significant underestimate.

To estimate the number of chemical ASTs in Virginia, we compared EPA's findings to states that have AST registration programs. Using this method, we found that the number of aboveground chemical storage tanks in Virginia may fall within a range of 2,720 and 5,405.

Estimating Aboveground Chemical Storage with EPCRA Tier II Reports

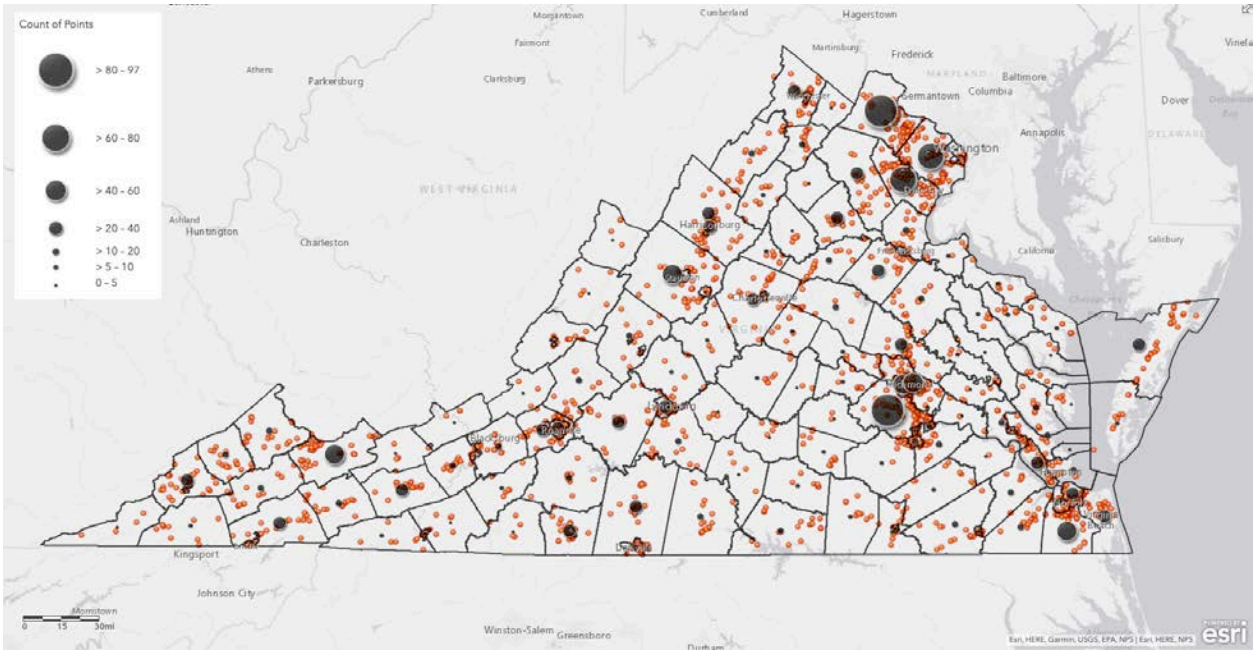
EPA's estimates of the universe of facilities that may be subject to hazardous substances spill prevention regulations were based on the agency's review of EPCRA Tier II reports (submitted in 2014 or 2015) from facilities in 16 states.[128] Virginia was one of these states. EPA used these reports to determine the number of facilities that store CWA hazardous substances.[129] The agency then extrapolated its findings to the entire United States using National American Industry Classification System codes from 2015 County Business Patterns data.[130] EPA estimated that 107,735 facilities in the United States would be subject to the hazardous substances spill prevention regulations.[131] In Virginia, it estimated that 2,037 facilities would be subject to the regulations.[132]

To estimate the universe of facilities with ASTs in Virginia, we analyzed EPCRA Tier II reports from 2018. We first identified facilities that list "tanks" (excluding underground storage tanks when explicitly stated) as a storage method and eliminated those that listed petroleum and

oil substances.[133] We found that some 2,011 facilities in the Commonwealth store hazardous substances in tanks, a result similar to EPA's findings. These facilities stored a maximum of 3.6 billion pounds of hazardous substances per day. Eighty-seven percent of the reports were for liquid hazardous substances, and 19 percent included gases. The ten most frequently stored substances were, respectively: propane, sodium hydroxide/caustic soda, nitrogen, asphalt, sulfuric acid, ammonia, calcium chloride/chlorate, oxygen, sodium hypochlorite, and carbon dioxide. Nearly 60 percent of the reported substances were listed as contributing to skin corrosion and/or serious eye damage, 30 percent were flammable, and a quarter could cause respiratory effects.

Figure 2 demonstrates the location of facilities in Virginia that submitted Tier II reports in 2018, as well as the number of facilities by city or county. These facilities together submitted more than 6,100 reports; therefore, each point on the map may correspond to a facility with multiple ASTs. Tier II facilities are concentrated in the more densely populated areas of northern Virginia and in and around the city of Richmond. They are also prevalent throughout the Hampton Roads region and the western part of the state.

Figure 2: Map of Virginia Facilities with "Tanks" that Submitted EPCRA Tier II Reports in 2018



The orange points show the locations of individual facilities and black circles correspond to the total number of facilities by city or county. Each facility may be the location of multiple tanks.

Our analysis, as well as EPA's, are likely significant underestimates — a limitation that EPA affirmed in the 2018 rulemaking.[134] Tier II reports are required only from facilities that store a large amount of hazardous substances — specifically, facilities with 500 pounds or more of

"extremely hazardous substances" and 10,000 pounds or more of other hazardous substances.[135] Therefore, facilities that possess hazardous substances below threshold amounts or non-reportable substances are not captured. EPA's own analysis reveals the flawed methodology — out of nearly 200,000 relevant industrial establishments in Virginia, roughly one percent were estimated to be subject to spill prevention regulations. Furthermore, this method does not estimate the number of chemical storage *tanks* — only the number of *facilities* that store hazardous chemicals. An analysis of storage tank registration data from states like Florida and New York — which regulate storage tanks that contain just a few hundred gallons of hazardous substances — would have provided EPA with a more accurate estimate of the chemical storage universe than an analysis based on Tier II reports.

Comparing EPA's Analysis to States with AST Registration Programs

One approach for estimating the number of ASTs in Virginia is to compare EPA's analysis of Tier II reports to data from states that register aboveground chemical storage tanks. For our analysis, we selected Florida and Minnesota, because they were among the 16 states included in EPA's analysis and also have public databases for storage tank registration. Furthermore, according to the 2016 American Manufacturer's Survey, the number of employees in the manufacturing industry (which, according to EPA's analysis, would be significantly impacted by hazardous substances spill prevention regulations) are similar across the three states: 222,824 in Virginia, 270,180 in Florida, and 297,770 in Minnesota.[136]

EPA's 2018 analysis estimated that there were 5,372 CWA hazardous substances facilities in Florida that would be subject to spill prevention regulations. Similar to Virginia, EPA's estimate of facilities storing hazardous substances in Florida represents roughly one percent of relevant industrial establishments in the state.

As mentioned previously, Florida's statute uses a broad definition for "aboveground hazardous substance tank," and as a result, the Florida Department of Environmental Protection's (DEP) database is likely one of the most comprehensive estimates of the universe of ASTs in any state nationwide.[137]

According to DEP's database, there are 54,985 active ASTs in Florida,[138] and at least 7,174 of them contain non-petroleum products.[139] While EPA's and our analyses were of facilities and not individual tanks, this comparison further demonstrates that EPCRA Tier II reports encompass only some of the facilities that should be subject to spill prevention regulations. Based on these findings, where the number of aboveground chemical storage *tanks* in Florida is roughly a third greater than EPA's estimate of *facilities* storing hazardous substances, the number of unregulated ASTs in Virginia may be closer to some 2,720.

EPA's 2018 analysis also estimated that there were 3,349 CWA hazardous substances facilities in Minnesota. These represented roughly two percent of the relevant industrial establishments in the state.

According to the Minnesota Pollution Control Agency's storage tanks database, there are 26,771 active ASTs in Minnesota, and roughly 8,887 of them contain non-petroleum products.[140] Based on these findings, where the number of aboveground chemical storage *tanks* in Minnesota is more than two and a half times greater than EPA's estimate of facilities storing hazardous substances, the number of unregulated ASTs in Virginia may be closer to 5,405.

While extrapolating from other states is an imperfect approach, it likely provides a more accurate range for the extent of chemical storage in Virginia than an analysis based solely on Tier II reports. Furthermore, the fact that there are 11,088 active petroleum ASTs in Virginia[141] (fewer than Florida and Minnesota), supports the likelihood that the number of hazardous substances ASTs in Virginia falls somewhere in the range of 2,720 and 5,405 (also fewer than Florida and Minnesota).

Derelict chemical storage tanks at a former agricultural supply depot in Savage Town, Accomack County, Virginia.

Source: David Flores, Center for Progressive Reform

EPA Significantly Underestimates Aboveground Hazardous Substance Spills in Virginia

While there are few studies of the prevalence of chemical AST spills in the United States, federal and state pollution incident databases may include information that can help regulators, advocates, and the public assess the source of releases. These databases typically cover chemical and oil spills from all sources, including ASTs, underground tanks, trucks, and rail cars. Our analysis of incidents reported to Virginia DEQ's Pollution Response Program found that, between 2000 and 2020, there were some 4,850 tank-related pollution incidents, of which 1,484 explicitly involved ASTs. That amounts to an average of nearly 230 tank-related incidents in the Commonwealth each year. The number of reported AST incidents also appears to have increased over time, and the seven most impacted cities and counties are home to roughly a third of Virginians.

While these findings are alarming, they are likely a significant underestimate, as databases that rely on voluntary self-reporting from citizens and regulated entities do not capture the full extent of pollution incidents, and operators are not required to conduct spill investigations.

Analysis of AST and other Tank-Related Incidents in Virginia

To date, no entity has comprehensively assessed hazardous spills attributed to unregulated aboveground storage tanks in the United States, and analyses of spills often rely on data that significantly underestimate the actual number of incidents. EPA's 2018 analysis of the "frequency and impacts of reported Clean Water Act hazardous substances discharges" uses self-reported National Response Center (NRC) data, which EPA itself claimed are "preliminary and incomplete"[142] and "greatly underestimate the actual number of spills because of significant underreporting."[143] Their analysis found that from 2007 to 2016, there were 2,491 spills nationwide of CWA hazardous substances that "potentially reached water from a non-transportation-related source."[144] Of these, only 63 spills occurred in Virginia, and 12 of those were attributed to storage tanks.[145]

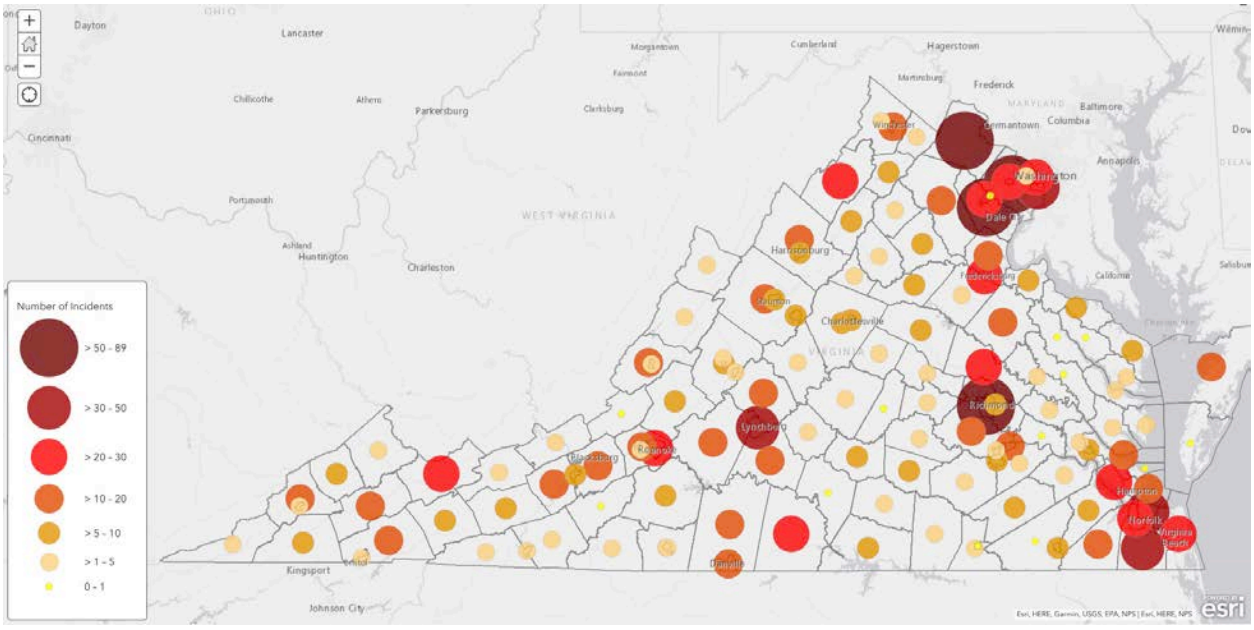
To estimate the extent of AST spills and incidents in Virginia, we analyzed pollution reports collected by DEQ's Pollution Response Program (PREP).[146] PREP responds to pollution incidents and maintains a database of reports submitted by regulators, citizens, and regulated

entities. Our analysis of pollution incidents found that, in Virginia alone, there were 1,484 instances of spills, releases, improper storage, and illegal dumping involving ASTs between January 1, 2000, and December 31, 2020. From 2007 to 2016 — the timeframe of EPA's analysis — there were 793 AST-related incidents, which is more than 66 times greater than EPA's estimate of "storage tank" spills in Virginia.

The number of AST incidents per year ranged between 27 (in 2000) to 90 (in 2010 and 2013), with an average of 70 incidents per year. The number of incidents appears to have increased over time — between 2015 and 2020, there were an average of 77 AST incidents per year. Of the reports that identified the materials released (85 percent), three-quarters involved petroleum and oil substances.[147] Unidentified chemicals (4 percent), propane (3 percent), and sewage (2 percent) were the next most common substances, with the remaining incidents involving other hazardous chemicals, substances, and waste. Due to an error in DEQ's database, we were unable to assess the volume of materials released. Consequently, we have an incomplete picture of the impacts of these releases to public health and the environment.

Figure 3 demonstrates the number of pollution incidents involving ASTs between January 1, 2000, and December 31, 2020, by city or county. Our analysis shows that AST incidents occurred most frequently in the northern, Tidewater (specifically Hampton Roads), and Blue Ridge regions of the state, as well as the city of Richmond. The seven most impacted cities and counties (each had 40 or more AST incidents) are home to roughly a third of Virginians. There was an average of 11 incidents per city or county, and every jurisdiction except Charles City and King and Queen County had at least one AST incident between 2000 and 2020. In general, AST incidents appeared to be more frequent in cities and counties with a higher concentration of facilities that file hazardous substance reports under the Emergency Planning and Community Right-to-Know Act, known as Tier II reports.

Figure 3: Map of Pollution Incidents Involving ASTs between January 1, 2000, and December 31, 2020, in Virginia, by city or county



In addition to the 1,484 AST-related reports, the PREP database included 3,370 reports of spills and incidents involving "tanks" (excluding underground storage tanks when explicitly stated) during the same time period. Unfortunately, these reports did not specify what types of storage tanks they were, further illustrating the uncertainty regarding AST incidents in the state. Altogether, this amounts to some 4,850 tank-related incidents in Virginia between 2000 and 2020.

While our analysis illustrates a troubling picture of AST and tank-related incidents in Virginia, these findings are likely an underestimate of the number of these incidents in the state. Similar to NRC reports, DEQ's pollution response database is largely populated by voluntary reports submitted by the public, regulated entities, and environmental regulators. Even when incidents involving storage tanks are reported, information about the incident and its impacts may be scarce because state and federal regulations do not require operators to conduct spill investigations and reporting of the findings from those investigations.

For example, a fire at a Petersburg, Virginia metal galvanizing facility in 2013 contributed to tank spills of at least 257,782 pounds of iron chloride, 32,595 pounds of ammonium chloride, and 73,754 pounds of hydrochloric acid, of which some quantity reached local waterways.[148] Yet, today, any additional information beyond brief media mentions about the incident, including any investigation, impacts, and clean-up of the spill, is not readily available in either Virginia or federal spill reporting and response records.[149]

Finally, another limitation of self-reported data is that there is a significant amount of missing or inconsistent information, further inhibiting the public's ability to fully understand the environmental and public health impacts of AST spills in the Commonwealth.

Unregulated Chemical Storage Endangers Environmental Health in Virginia and Beyond

Without comprehensive data on the number of ASTs and associated incidents, it is difficult to assess their implications for public health. However, research shows that storage tank releases tend to yield the largest spills by volume, and climate change is increasing the risk of storage tank and other chemical spills. Virginia is particularly prone to hurricane-related releases, and our analysis found that tank-related incidents increased between two- to eight-fold following hurricanes.

Furthermore, because hazardous chemical facilities are disproportionately located near communities of color and low-income communities, the effects of unregulated AST spills may be primarily borne by historically disenfranchised communities and those who live downstream from these facilities. Some of the state's most notable storage tank spills — in Chesapeake, Petersburg, and Cloverdale — occurred in or near some of the most overburdened communities in the state. The cumulative effects of toxic chemical spills in communities that already grapple with the exposure to many other pollution sources and fewer resources to recover from these effects may widen existing health disparities.

ASTs Pose Inherent Risks to Public Health

By their nature, aboveground storage tanks — containers that hold often large amounts of hazardous substances, many of which are volatile, reactive, and/or flammable — pose inherent risks to public health and the environment. While there are few nationwide studies on the public health impacts of AST releases in the United States, some federal incident databases provide a snapshot.

For example, in 2010, the Agency for Toxic Substances and Disease Registry launched the National Toxic Substance Incidents Program (NTSIP), a chemical incident surveillance program that aims to "protect populations from harm caused by acute toxic substance releases."[150] NTSIP's last biennial report, published in 2014, included chemical incident data from eight states. Between 2013 and 2014, there were 2,575 chemical incidents attributed to a fixed facility, and of those that reported the source of the spill, nearly 13 percent occurred in a "storage area above the ground."[151] The most commonly reported health effects among all reported incidents were, respectively, respiratory system problems, burns, dizziness or other central nervous system problems, and trauma.[152]

The public health effects of storage tank and other chemical releases depend on a variety of factors, including but not limited to, the type of chemical released; the conditions in which it is released; whether the chemical mixes or reacts with other substances; the route, dose, and length of exposure; and the underlying health of the people exposed. For example, propane — which was identified as a commonly released substance in both our analysis of AST incidents in Virginia and NTSIP's report — can cause headaches, dizziness, and asphyxiation when inhaled as a gas.[153] Contact with liquified propane, however, can cause frostbite. Propane is also highly flammable, and if it is exposed to fire or heat, it can expand, causing the container it is stored in to burst. Given the inherent uncertainties of predicting the impacts of chemical releases, measures to prevent, prepare for, and respond to releases are the most effective way to safeguard public health.

Climate Change Heightens the Threat of AST Spills

As the effects of climate change intensify, so too will the risk of storage tank releases. Hurricanes and extreme weather, for example, can cause severe damage to tanks or facilities storing hazardous chemicals, and floodwaters can carry dislodged or damaged tanks and released materials into communities and waterways.[154]

For example, in 2005, an aboveground storage tank at the Murphy Oil refinery in Meraux, St. Bernard Parish, Louisiana, was dislodged and damaged in flooding caused by Hurricane Katrina. The damaged tank released more than one million gallons of crude oil, contaminating approximately 1,800 homes in the surrounding residential community.[155] Hazardous levels of polycyclic aromatic hydrocarbons (PAHs) — a likely carcinogen — and other organic chemicals commonly found in crude oil were detected in sediment samples in the affected area.[156]

Crude oil deposits in and around homes following the Murphy Oil Spill in St. Bernard Parish, Louisiana.

Source: Agency for Toxic Substances and Disease Registry. (2005). Health Consultation 2: Murphy Oil Spill. U.S. Department of Health and Human Services.

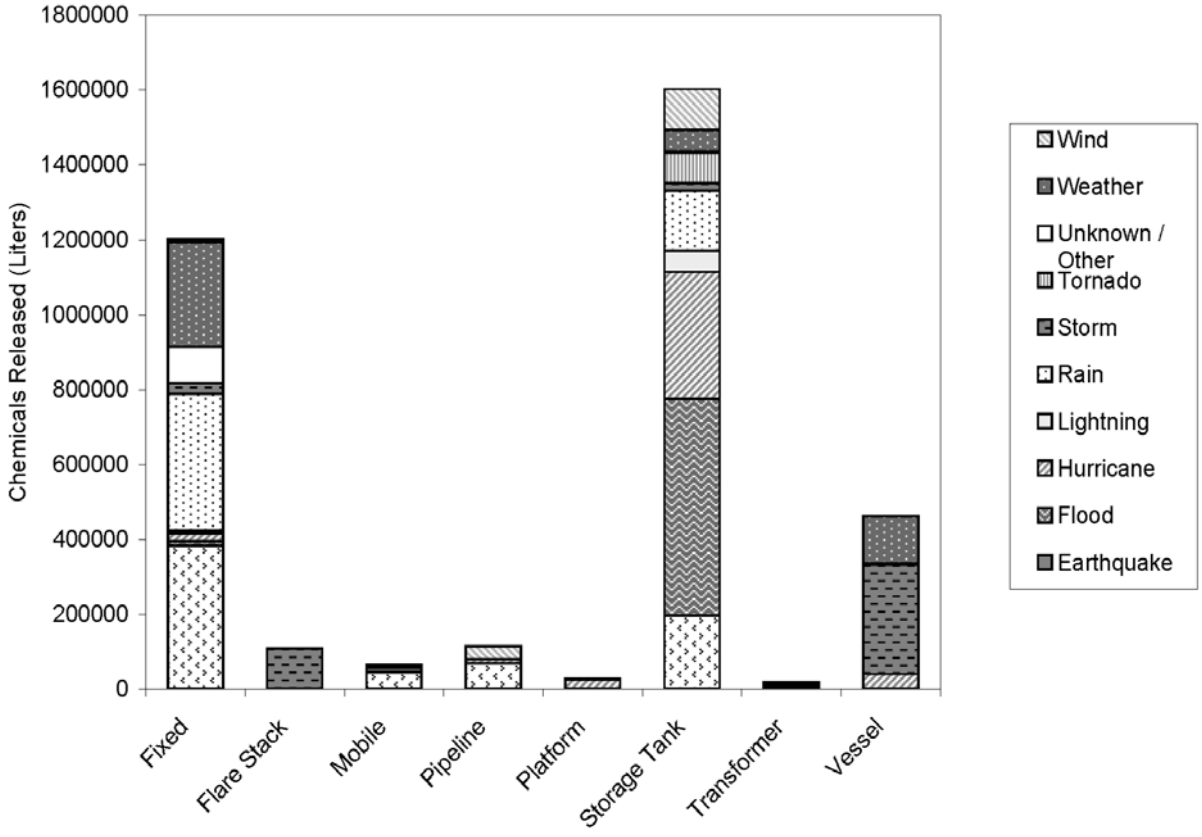
One 2012 study of hazardous materials releases due to natural hazards (such as hurricanes, floods, tornados, earthquakes, etc.) found that storage tanks were the source of 11 percent of spills reported to the National Response Center between 1990 and 2008.[157] Storage tank releases were most often attributed to rain, hurricanes, and floods, and 30 percent of these releases resulted in evacuations. The two most common causes of hurricane- and flood-induced releases were flotation of storage tanks, causing a rupture of the tank or associated piping, and overflow of containment.

The study found that Virginia was one of the three U.S. states, alongside Louisiana and Mississippi, with the highest rate of hazardous materials releases due to hurricanes. Our analysis of AST- and tank-related spills in Virginia supports these findings. In the 10 days following Hurricanes Isabel (2003), Irene (2011), and Matthew (2016) making landfall, the number of tank-related incident reports in Virginia increased roughly eight-, five-, and two-fold, respectively, compared to the 10 days prior.

One 2018 incident report in Charlotte County, for example, describes a 275-gallon tank that was washed away due to flooding from Hurricane Michael. The tank leaked an unknown amount of heating oil into groundwater and a tributary of the Staunton River, yielding strong petroleum odors in the surrounding area.

The 2012 study also found that among all facility types and equipment, storage tanks are the most likely to release large volumes of hazardous substances due to natural hazards. As shown in Figure 4 (next page), storage tanks contributed to roughly 1,600,000 liters of chemicals released during natural hazard events (primarily floods and hurricanes) reported to the National Response Center between 1990 and 2008. The study concluded that, in light of the fact that hurricane-related releases increased fifteen-fold between 2005 and 2008, the "security of storage tanks (against hurricane damage) is an important area for improvement."

Figure 4: Volume of Chemical Releases Induced by Natural Hazards between 1990 and 2008



Source: Sengul, H., et. al (2012). Analysis of Hazardous Material Releases Due to Natural Hazards in the United States. Disasters, 36(4),723-743.

Storage Tank Releases Disproportionately Harm Overburdened Communities

The dual burden of exposure to toxic chemicals from storage tank spills and worsening risks due to climate change is primarily borne by low-income communities of color. This is in large part due to redlining and other discriminatory finance and housing policies.[158] According to a 2016 report by the Center for Effective Government, people of color are nearly twice as likely as white populations to live within one mile of a hazardous chemical facility.[159] The proportion is even greater for people of color, especially children, living in poverty. The report also found that communities of color have almost twice the rate of chemical incidents compared to predominantly white neighborhoods.[160]

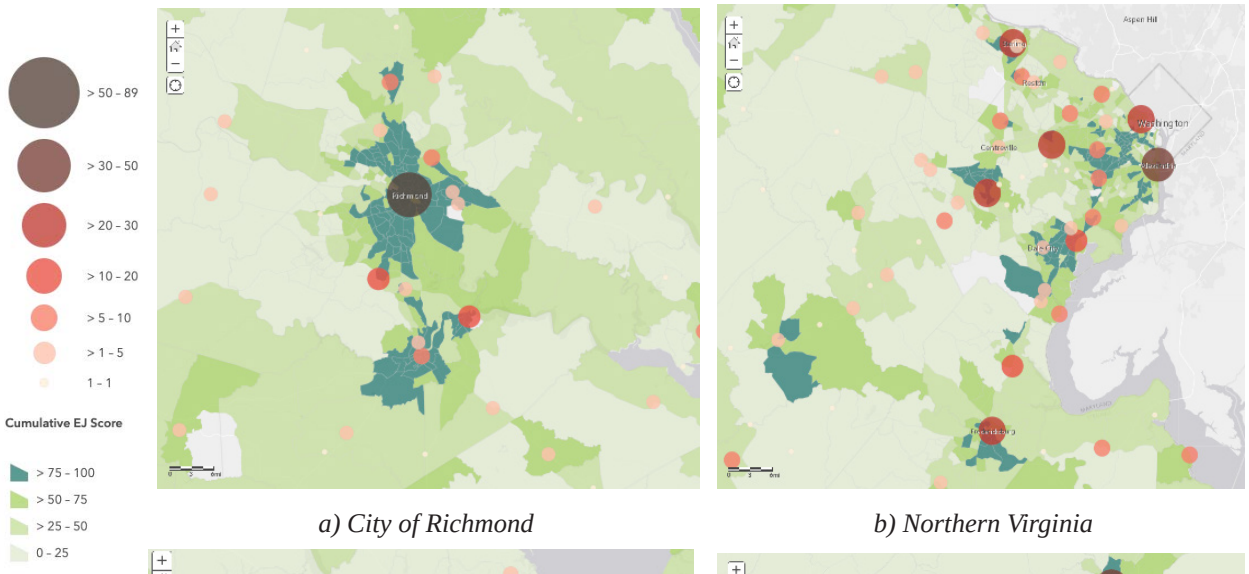
Data suggest this is also the case with AST spills. According to the 2018 lawsuit filed by the Environmental Justice Health Alliance and Natural Resources Defense Council, "U.S. Coast Guard data indicate that [...] hazardous-substance spills from above-ground storage tanks are more likely to occur in majority non-white counties than majority white counties."[161] In addition, a 2013 study found that leaking *underground* storage tanks in South Carolina were more likely to be in close proximity to communities with a higher proportion of Black and impoverished residents.[162]

A wealth of research has shown that communities of color and low-income communities in the United States face a disproportionate burden of exposure to climate hazards and pollution, poorer quality resources like health care and healthy food options, and inadequate access to financial services and political power.[163] A failure to comprehensively regulate chemical storage tanks, which are prone to releasing a large amount of hazardous chemicals at once, effectively ensures the continued harm and oppression of marginalized communities.

These disproportionate harms also persist in Virginia. To assess whether AST releases and spills disproportionately affect marginalized communities in Virginia, we added data on AST incidents reported to DEQ's Pollution Response Program (PREP) to an environmental justice screening map for Virginia created by researchers at the University of California, Berkeley.[164] The map shows a "cumulative environmental justice (EJ) score" for all census tracts in Virginia. Communities that score high for specific pollution burden and population characteristics indicators will have a higher cumulative EJ score. Below, we refer to these communities as "overburdened," meaning that people in these communities are likely exposed to more environmental pollution and social stressors compared to all census tracts in the state.[165]

As shown in Figures 5a-5d (next page), AST incidents that occurred between 2000 and 2020 appear to have been in or near the state's most overburdened communities. In general, the state's urban population centers are also among the most overburdened, which may in part be driven by concentrated emissions and higher-quality pollution data in these areas. However, small cities and towns (populations less than 50,000) such as Danville, Franklin, Fredericksburg, Hopewell, Manassas, and Petersburg contain some of the most overburdened census tracts in the state and all had at least ten AST incidents between 2000 and 2020. This analysis is also limited by spatial scale, where AST incidents are shown by city, town, or census-designated place, and the cumulative environmental justice burden is shown by census tract.

Figures 5a-5d: Maps of AST Incidents in Four Virginia Regions with Overburdened Census Tracts



a) City of Richmond

b) Northern Virginia

c) Hampton Roads

d) Blue Ridge/Southwest

In Virginia, some of the most notable unregulated AST spills and incidents have occurred in the communities most overburdened by environmental and social stressors. Below are examples of three releases and their effects on communities.

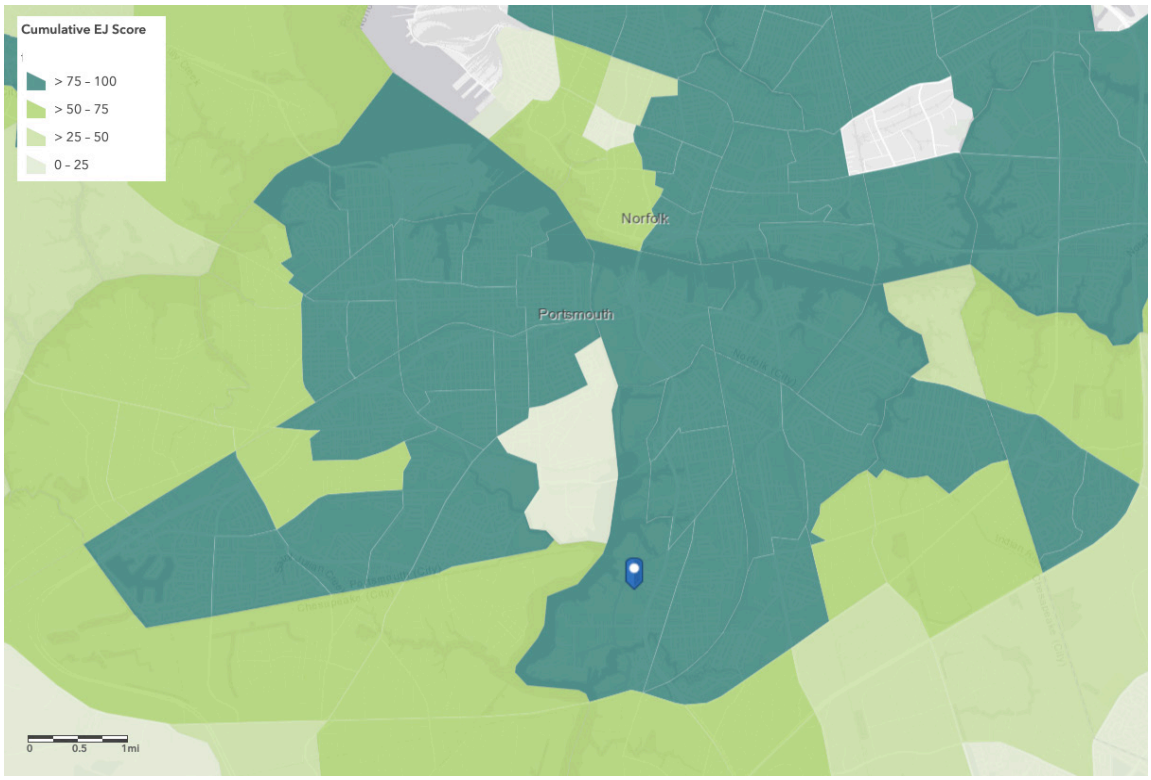
Chesapeake, Virginia

In 2008, a catastrophic failure of a liquid fertilizer tank at the Allied Terminals facility in Chesapeake critically injured workers and citizens, damaged homes and business, and harmed the environment. The tank collapsed while it was being filled, instantly releasing 2.1 million gallons of liquid urea and ammonium nitrate fertilizer, which flooded the adjoining residential South Hill neighborhood and entered the Elizabeth River.[166] At least four people were injured

and hundreds of workers in area businesses and members of 43 households were evacuated and unable to return for days and weeks. The U.S. Chemical and Safety Hazard Investigation Board found that the facility operator did not ensure that the tank met industry mechanical standards, did not adequately inspect the tank, and did not establish safety procedures for the work being performed on the tank when the spill occurred.[167]

As shown in Figure 6, the Allied Terminals facility is located in one of the most overburdened census tracts in the state, with a cumulative environmental justice (EJ) score greater than 89 percent of all tracts. The community falls in the top 15th percentile for several population characteristics indicators, including population of color and linguistic isolation, and notably, ranks in the top five percent of census tracts in the state for the concentration of hazardous waste facilities, high-risk chemical facilities, and federal cleanup sites.

Figure 6: Location of the Allied Terminals tank spill in Chesapeake, Virginia



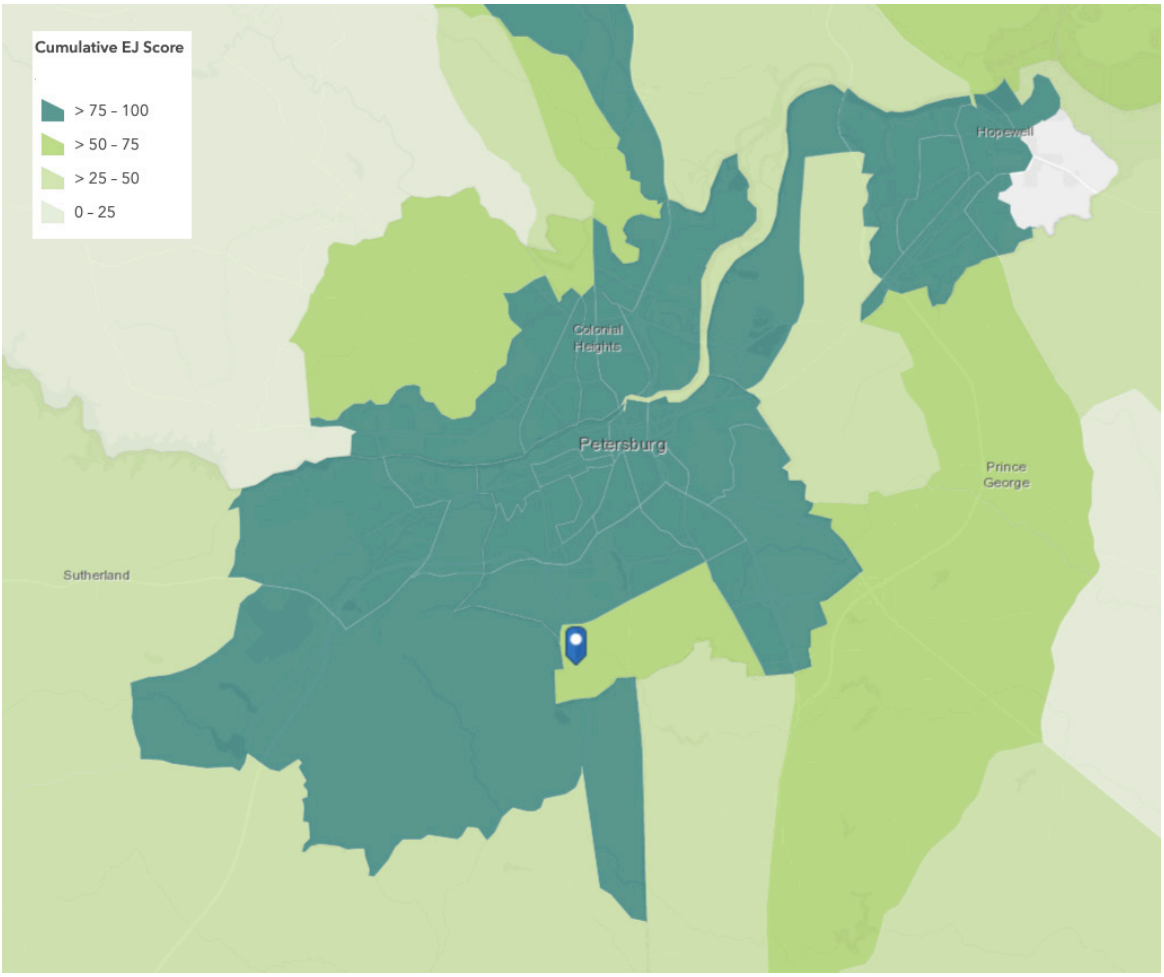
This spill is just one example of many pollution hazards faced by residents of Chesapeake and the neighboring cities of Portsmouth and Norfolk, where a significant number of the state's hazardous industrial facilities are concentrated. This spill was not even the first tank spill in the community, as another fertilizer tank in Chesapeake collapsed years earlier, spilling hundreds of thousands of gallons into the Elizabeth River.[168] Later in 2016, roughly 75,000 gallons of jet fuel leaked from a storage tank, once again in the South Hill neighborhood, prompting evacuation of 70 homes.[169]

Petersburg, Virginia

As mentioned previously, in 2013, a fire at the Industrial Galvanizers America plant in Petersburg caused tanks to spill more than 360,000 pounds of iron chloride, ammonium chloride, and hydrochloric acid.[170] The large volume of water mixed with the chemicals, forming a hazardous runoff, and at least one firefighter was hospitalized.[171] Inhalation of any of these three chemicals can cause respiratory system irritation and difficulty breathing, and both iron chloride and hydrochloric acid are corrosive and can burn the eyes and skin upon contact.[172]

As shown in Figure 7, the facility was located in a census tract that is nearly in the top 25th percentile for overburdened communities in the state and is surrounded by those that are. Among all tracts in Virginia, this one falls in the top 15th percentile for population of color (roughly 77 percent of Petersburg's population is Black[173]) and concentration of hazardous waste and high-risk chemical facilities.

Figure 7: Location of the Industrial Galvanizers America tank spill in Petersburg, Virginia

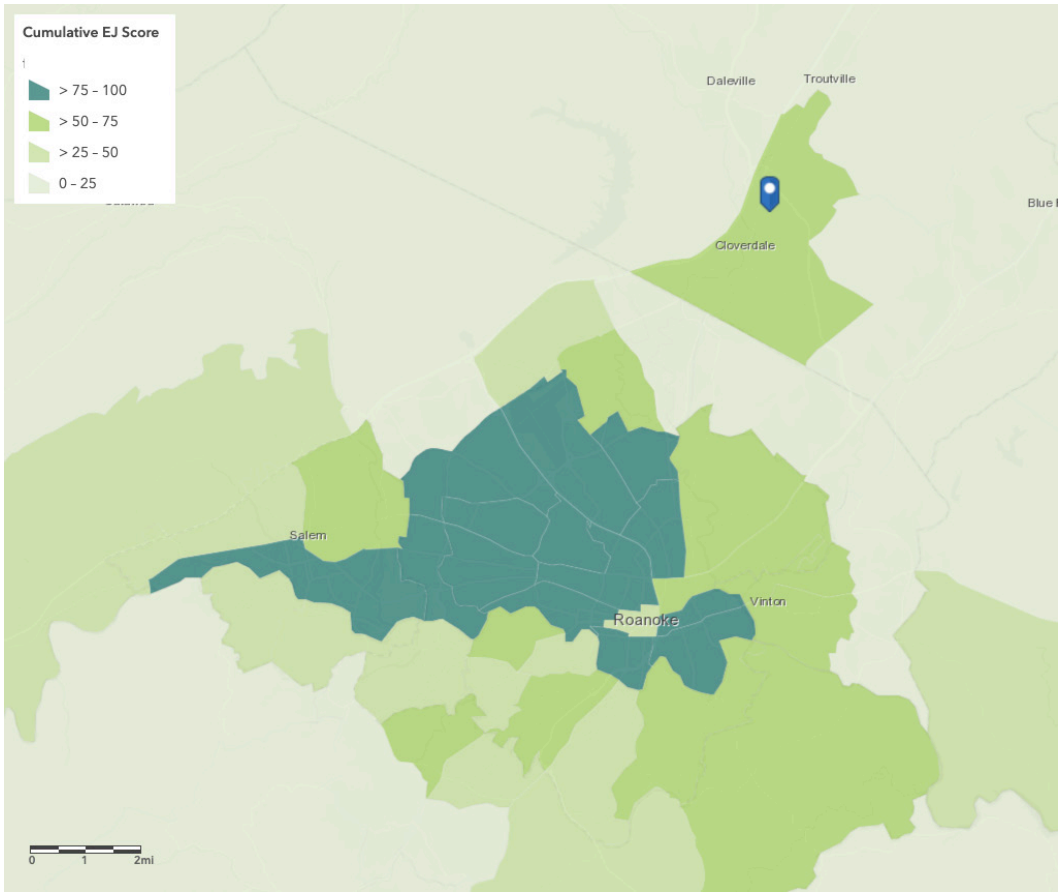


Cloverdale, Virginia

In 2017, Termix 5301 — a chemical that is added to herbicides and pesticides before they are applied to crops — leaked from a 250-gallon tank with a puncture hole at the Crop Production Services facility in Cloverdale, running into a drainage creek that flows into the Tinker Creek.[174] The leak impacted an 11-mile stretch of the creek and killed more than 51,000 fish — one of the largest fish kills in Virginia history, according to DEQ.[175] According to the product's Safety Data Sheet, Termix 5301 is "very toxic to aquatic organisms [and] may cause long-term adverse effects in the aquatic environment."[176] Residents were advised not to recreate in the affected area of the creek for two weeks following the spill.[177] The impacts on drinking water wells near Tinker Creek are unknown, but water samples collected from the creek a week after the spill did not detect the chemical.[178]

As shown in Figure 8, the Crop Production Services facility is in a census tract with a cumulative EJ score greater than more than half of tracts in the state and ranks in the top 25th percentile for concentration of hazardous waste facilities and wastewater releases. Furthermore, the effects of the spill were felt by communities downstream of Tinker Creek — specifically those in Roanoke that rank among the most overburdened in the state.

Figure 8: Location of the Crop Productions Services tank spill in Clovedale, Virginia



As shown in the examples above, AST incidents are not equally distributed across the state, nor do they occur in a vacuum. Much of the time, they happen in communities that already have a high concentration of industrial facilities, and the effects compound the everyday pollution exposures and other stressors felt by nearby communities. While regulating aboveground chemical storage tanks alone will not redress the disproportionate harm of toxic chemical releases, it is a necessary step to addressing environmental racism.

The Allied Terminals tank failure flooded the adjacent South Hill neighborhood and roadways with liquid fertilizer.

Source: City of Chesapeake Fire Marshal; U.S. Chemical Safety Board

Recommendations: Virginia Must Act to Prevent Harm from Hazardous Chemical Spills

Virginia policymakers must act to prevent the harm that spills of hazardous chemicals pose to the health and safety of Virginians and to the environment and economy of the Commonwealth. State and federal agencies fail to even track, let alone impose, standards to prevent harm from unregulated aboveground storage of chemicals outside of certain petroleum products or hazardous wastes. Comprehensive action at the state level, as well as additional action by cities and counties, is necessary to prevent harm to Virginia's communities and environmental resources. Virginians and the Commonwealth's environmental and public interest advocates have an important role to play in both providing momentum for state action, as well as ensuring that the resulting regulations adequately protect Virginians.

Virginia should establish a comprehensive program for unregulated chemical storage.

A comprehensive regulatory program focused on the prevention and response to spills and other failures of unregulated chemical storage facilities is long overdue.

- A uniform, statewide aboveground chemical storage tank program modeled after Virginia's existing oil tank and underground storage tank regulations should require, minimally, universal registration and reporting, construction and maintenance standards, spill detection and containment, third-party inspections, and spill prevention and response planning and training.

- Provisions should govern changes in operations, ensuring different materials are compatible with tank design, as well as decommissioning tanks from use.

- A comprehensive chemical storage program should regulate the storage of all state and federally designated hazardous chemicals, for which spill prevention and response standards are not currently imposed, as any EPA rulemaking would be limited to only several hundred CWA hazardous substances.[179]

- The authority to promulgate rules and enforce a comprehensive aboveground chemical storage program should be properly delegated to the Department of Environmental

Quality and State Water Control Board, but given the human health and chemical disaster considerations, the Virginia Department of Health and Department of Emergency Management should be required to participate in the rulemaking process.

With tank registrations, state regulators can improve chemical storage and spill reporting and tracking.

Robust and accessible reporting and tracking of chemical storage and spills should be achieved through enforceable registration, inspection, reporting, and spill notification and investigation requirements as part of a statewide comprehensive regulatory program.

- Regulators should be able to track how many storage tanks contribute to releases to better account for environmental harms and identify when stronger regulations are needed.

- Emergency planners need reliable data to mitigate and address chemical disaster hazards, and advocates and community members need accessible, easy-to-understand data to understand threats to their communities and push for stronger protections.

- While DEQ's Pollution Response Program database makes pollution incident reports available to the public, missing data and inconsistent reporting and tracking inhibits the ability of stakeholders to protect public health and the environment.[180] DEQ should adapt existing pollution reports to a standardized template, ensure that data are reported in the appropriate fields, add more fields such as "storage type" and "incident cause" to allow for easier analysis, and update reports when corrective action is taken.

State policymakers should reform Virginia building and fire codes to align with a comprehensive environmental regulatory program for chemical storage tanks.

Virginia has adopted and delegated enforcement to local governments certain model fire and building codes that include standards for facilities storing flammable liquids and liquid fertilizer. However, there remains a lack of comprehensive standards for all categories of stored materials in Virginia's building and fire codes.

- The Virginia legislature could amend the existing model codes with best practices for hazardous chemical storage, analogously to how the state's building code was amended to regulate liquid fertilizer storage following the 2008 Allied Chemical spill.[181]

- Outside state action, cities and counties could exercise their authority to enact more stringent fire codes to impose such regulations within their jurisdictions. Critically, more rigorous enforcement of existing and future reformed code provisions is required; local jurisdictions

already bear the regulatory burden of enforcing the codes and may achieve inadequate compliance due to a simple lack of resources or information.

- Integration of fire and building code inspections, along with a comprehensive state chemical storage program that provides a centralized registration database, could facilitate effective implementation.

State policymakers should encourage use of safer chemicals.

Encouraging the use of safer chemicals and chemical processes can lead to reductions in hazardous chemical storage (and fewer chemical discharges) in Virginia.

- The Commonwealth should enact new rules that require certain regulated facilities, such as chemical manufacturers and refineries, to undertake chemical process assessments to identify and adopt inherently safer technologies, including, for example, reductions in the use of hazardous chemicals or adoption of safer alternatives.[182]

- State programs to support industry's voluntary use of less-toxic chemicals have produced substantial environmental outcomes without sacrificing economic output. In the first ten years of Massachusetts' implementation of the Toxic Use Reduction Act, voluntary use of toxic chemicals declined by 40 percent and environmental releases of toxics declined by some 90 percent, all while industry reported a 45 percent increase in production.[183]

Local governments should reform land use controls to guard against chemical disasters.

Virginia's cities and counties have broad authority to regulate local land use for the protection of human health and the environment.

- In the absence of state and federal safeguards against chemical disasters for aboveground storage of hazardous chemicals, local governments should prioritize reforms of land use controls to ensure that unregulated hazardous chemical storage facilities are not sited or operated near sensitive resources, including drinking water sources, and sensitive or overburdened populations, such as schools and low-income communities, that are especially vulnerable to harm from chemical disasters.

- Localities should also ensure that industrial and commercial land use regulations account for growing flood risks, moving chemical storage and use away from rising sea levels and extreme weather threats.

State policymakers, public interest advocates, and the public should engage nationally in efforts related to regulation of chemical storage.

The Biden administration and EPA are undertaking rulemakings to establish worst-case discharge planning for hazardous substance storage facilities and reviewing chemical disaster prevention rules for major industrial facilities.[184] To be effective, these rules must be informed by state and local stakeholders, especially the communities that are directly and routinely impacted by chemical disaster threats.

- Virginia environmental advocates and communities, along with state and local regulators and policymakers, should provide input to and comment on EPA's draft rules designed to prevent harm from chemical disasters.

- Virginia's environmental regulators should also engage directly with other states on the issue of unregulated chemical storage, through, for example, membership in the National Association of State AST Programs, in order to inform the design and implementation of Virginia's own regulations, while also coordinating with other states on efforts to support future federal rulemakings.

Recommendations: The Federal Government Must Issue Strong Rules to Prevent Spills of Hazardous Substances

EPA must engage in proactive rulemaking to address aboveground chemical storage facilities.

EPA should not merely enact worst-case planning rules for hazardous substance storage, in accordance with the 2020 consent decree, but should also begin development of hazardous substance spill prevention regulations.[185] Moreover, EPA should promptly implement a plan to acquire facility data in accordance with the agency's original plan established before the 2019 no-rule rulemaking.[186]

- Taken together, EPA should adopt comprehensive Clean Water Act regulations as soon as possible for aboveground hazardous substance storage facilities. Spills of hazardous chemicals disproportionately harm marginalized and sensitive populations and communities of color that are also burdened by multiple, cumulative chemical hazards and pollution impacts. The prevention of hazardous substance spills, therefore, aligns with the Biden administration's prioritization for environmental justice, racial justice, and investments in infrastructure and climate resilience.[187]

- Americans broadly support swift action by the administration to enact new environmental rules that curtail climate risks and industrial pollution to protect human health.[188] EPA should also develop comprehensive hazardous substances rules that include broad eligibility, reporting, and public notification requirements; comprehensive spill prevention standards and required practices; thorough spill investigations and corrective action; regular inspections; and requirements that are responsive to growing climate risks and natural disasters.

EPA should establish broad new requirements for aboveground chemical storage facilities, owners, and operators.

EPA should rely on its impact assessments of hazardous substances by establishing broad eligibility requirements for new regulations of hazardous substance storage facilities.[189]

- EPA should impose spill prevention and worst-case discharge planning requirements on all facilities that exceed regulatory thresholds already established in the CWA hazardous substances list and undertake a parallel effort to update the list.[190] The current hazardous substances list includes less than one percent of the tens of thousands of industrial chemicals in use nationwide and has not been updated since 1995.[191]

- Annual reporting requirements are important not only to ensure compliance with spill prevention and response regulations but also to provide access — preferably in a readily available online platform — to state and local government and emergency responders and the public at-large.

- EPA's regulations should include broad spill notification requirements, readily accessible to diverse populations, in languages that they speak and read, and dissemination through multiple media systems (e.g., phone, text message, etc.) designed to reach all community members.

EPA's aboveground chemical storage facility standards must be comprehensive and improve on existing practices and research.

Spill prevention and response standards and practices should be comprehensive and improve — but not be strictly predicated — on decades of industry and regulatory standards, study, and practice, as well as the design and implementation of oil facility regulations.[192]

- Rigorous prevention and spill response practices and planning are essential and should require hazard reviews and vulnerability assessments, inclusive of proximity to drinking water sources.

- Mechanical storage standards, including secondary containment and spill detection practices, for different kinds of facilities and hazardous substances should also be elaborated, and EPA should impose inherently safer design requirements for facilities.[193]

- Financial assurance should be required to cover the costs related to incident response and the potential impacts beyond the fenceline.

EPA should include rigorous requirements for inspections of aboveground chemical storage facilities.

Inspections are crucial for ensuring compliance and adapting spill prevention and response practices when operations or environmental conditions change.

- EPA should impose requirements for annual inspections and certifications of compliance by third-party certified engineers, with additional inspections and revisions to practices and plans required after significant changes in operations.

- EPA should also require semi-annual inspections to detect environmental contamination in nearby soils and groundwater and, during wet weather, in surface waters to ensure that practices are working as designed to prevent discharges of hazardous substances.

- When spills or discharges occur, facility operators should be required to make timely after-incident reports to EPA that include third-party inspections, root-cause analyses, and comprehensive assessment and reevaluation of required prevention and response plans, practices, and other management considerations. Operators should be required to identify corrective actions with proposed timelines, subject to EPA approval, for implementation.

EPA rules must account for climate change.

To mitigate the risks associated with worsening climate impacts and other natural disasters, the comprehensive regulations should explicitly impose assessment and design standards responsive to site-specific climate risks, supplemented by non-exhaustive guidance on climate adaptation assessments and practices for hazardous substance facilities.[194]

- Spill prevention and response practices should be imposed in accordance with "good engineering practices," which at least one federal court has found includes "consideration of foreseeable severe weather events, including any caused by climate change."[195]

- Congress' provision for addressing spills during "adverse weather" conditions in worst-case discharge planning rules also aligns with requirements for site-specific practices to ensure spill prevention and adequate spill response for flood and other extreme weather impacts.[196]

Federal rules for hazardous substance storage facilities are urgently needed to provide protection in the 40 states that do not currently comprehensively regulate such facilities, as well as uniformly rigorous and comprehensive rules for the several states that do. In accordance with the Biden administration's priorities for environmental justice, these rules should not only be designed to protect the marginalized communities and populations that face disproportionate risk of harm due to proximity to these facilities and downstream impacts, but should also account for their underlying socio-economic vulnerabilities to environmental disasters. These stakeholders must also be adequately engaged throughout the rulemaking process, including through early affirmative outreach and in basic agenda-setting, even before a formal rulemaking begins.[197]

Conclusion

Comprehensive public protections to prevent spills of aboveground chemical storage facilities are decades overdue. Federal rules for oil and hazardous waste tanks have been on the books for decades, providing a model for hazardous chemical tank regulations. During this period, only 10 states have adopted comprehensive programs in response to EPA's inaction. These states have demonstrated that such programs can protect public health and safety and the environment.

Virginia lawmakers know that there is a significant gap in public protections when it comes to hazardous chemical storage — and waiting on EPA to act has not worked out for the health and safety of Virginians. Our analysis demonstrates that the universe of unregulated chemical storage facilities, and releases and other incidents involving these facilities, is substantially greater than previously understood. Furthermore, the impacts of the spills are disproportionately borne by Virginia communities that already have a high concentration of polluting facilities. Still, the quantity, location, contents, and conditions of these tanks pose a looming and unknown threat to Virginians — one that health and environmental officials, absent new regulations, cannot do anything about until it is too late.

Now — not the day after the next disaster — is the time for the federal government and states to fulfill the decades-long promise to protect the public from hazardous chemical incidents. Models for effective policies exist, and Virginia and the federal EPA can and should use them to act now.

Appendices

Appendix A: Table of Major Features of States' Chemical AST Regulatory Programs

State	Applicability Threshold	Registration	Spill Prevention Standards	Spill Response Plans	Public Database	Codified At
Delaware (enacted 2001)	At least 250 gallons of a CERCLA-hazardous, carcinogenic, or otherwise designated substance	Y	Y	Y	Y	7 Del.C. Ch. 74A; 7 Del. Admin. Code Ch. 1352
Florida (enacted 1983)	550 gallons of any pollutant, now or previously; less stringent regulations apply for 110 gallons of CERCLA-hazardous substances, or at least 110 gallons of a mineral acid	Y	Y	N	Y	F.S.A. § 376.303; Fla. Admin. Code Ch. 62-762
Illinois (enacted 1985)	Flammable or combustible liquids	N	Y	N	N	41 Ill. Adm. Code Ch. I, Pt. 160
Indiana	Either 2,500 undivided gallons or 7,500 total gallons of regulated fertilizers, pesticides, or herbicides	N	Y	Y	N	327 IAC 2-10
Iowa (petroleum regulations enacted 1989, later expanded)	At least 1,100 gallons of a flammable or combustible liquid	Y	Y	N	Y	Iowa Admin. Code Agcy. 661, Ch. 224
Kansas (enacted 1989)	At least 660 gallons of a CERCLA-hazardous substance	Y	Y (only for flammable materials)	N	Y	K.S.A. 65-34, 100 et seq.; KAR 28-44
Massachusetts	At least 10,000 gallons of a fluid other than water	Y (only for flammable materials)	Y	N	N	CMR T. 502, Ch. 5.00
Michigan	Flammable or combustible liquids, now or previously	Y (if capacity greater than 1,100 gallons)	Y	N	Y	Mich. Admin. Code R 29.5601 et seq.
Minnesota	At least 500 gallons of a substance that is not solid or gaseous, generally (no specified minimum volume)	Y	Y	Y	N	M.S.A. § 116.46 et seq.; Minnesota Rules Ch. 7151
New Jersey (enacted 1996)	Facility storage capacity of at lease 20,000 gallons of a hazardous substance (regulations apply to all storage vessels therein)	N	Y	N	N	N.J.A.C. 7:1E Subch. 2
New York (enacted 1988)	At least 185 gallons of a hazardous substance	Y	Y	Y	Y	6 NYCRR Parts 596-599
Pennsylvania (enacted 1989)	At least 250 gallons of a CERCLA-hazardous substance or substance otherwise designated as hazardous, now or previously	Y	Y	Y	Y	35 P.S. § 6021.301 et seq.; 25 Pa. Code Ch. 245
South Dakota (enacted 1987)	Currently storing flammable or CERCLA-hazardous substances	Y	Y	Y	Y	SDCL T. 34, Ch. 34-38; ARSD Ch. 74:56:03
West Virginia (enacted 2014)	At least 1,320 gallons of liquid, including mobile devices remaining in one location for at least a year, that are near enough to a water intake to warrant "detailed scrutiny" (less stringent regulations may apply to tanks outside zones of critical concern)	Y	Y	Y	Y	W. Va. Code, § 22-30; W. Va. Code St. R. § 47-63
Wisconsin	Any accumulation of flammable liquids, although tanks containing certain less-flammable liquids must contain at least 1,100 gallons	Y	Y	N	Y	Wis. Adm. Code § ATCP 93, Subch. IV

Appendix B: Table of Pollution Incidents Involving ASTs between January 1, 2000, and December 31, 2020, in Virginia, by city or county

City or County Name	Number of Incidents
Richmond City	89
Fairfax County	75
Loudoun County	63
Prince William County	57
Lynchburg City	45
Norfolk City	43
Alexandria City	40
Chesapeake City	31
Fredericksburg City	29
Portsmouth City	29
Roanoke City	29
Virginia Beach City	28
Fairfax City	24
Newport News City	24
Manassas City	23
Tazewell County	23
Arlington County	22
Halifax County	22
Shenandoah County	21
Hanover County	21
Danville City	19
Winchester City	18

Wise County	18
Chesterfield County	18
Bedford County	17
Augusta County	17
Suffolk City	16
Russell County	15
Salem City	14
York County	14
Fauquier County	14
Accomack County	14
Pittsylvania County	14
Hampton City	13
Stafford County	13
Washington County	13
Pulaski County	12
Montgomery County	12
Alleghany County	12
Caroline County	12
Rockingham County	12
Hopewell City	11
Amherst County	11
Campbell County	11
Petersburg City	10
Wythe County	10
Botetourt County	10
Mecklenburg County	10

Warren County	9
King George County	9
Dickenson County	9
Page County	9
Smyth County	9
Sussex County	9
Orange County	9
Henrico County	9
Staunton City	8
Northumberland County	8
Westmoreland County	8
Scott County	8
Culpeper County	8
Franklin County	8
Williamsburg City	7
Harrisonburg City	7
Charlottesville City	7
Nottoway County	7
Prince Edward County	7
Albemarle County	7
Lexington City	6
Franklin City	6
Waynesboro City	6
Radford City	6
Louisa County	6
Isle of Wight County	6

Bristol City	5
Fluvanna County	5
Lancaster County	5
Gloucester County	5
Grayson County	5
Buckingham County	5
Lee County	5
Falls Church City	4
Covington City	4
Colonial Heights City	4
Galax City	4
Giles County	4
Lunenburg County	4
Dinwiddie County	4
Amelia County	4
Henry County	4
New Kent County	4
Greensville County	4
Frederick County	4
Rockbridge County	4
Buena Vista City	3
Martinsville City	3
Clarke County	3
Greene County	3
Appomattox County	3
Surry County	3

Middlesex County	3
Madison County	3
Prince George County	3
Brunswick County	3
Spotsylvania County	3
Roanoke County	3
Buchanan County	3
Norton City	2
Mathews County	2
Rappahannock County	2
Powhatan County	2
Goochland County	2
Highland County	2
James City County	2
Carroll County	2
Bland County	2
Bath County	2
Patrick County	2
Nelson County	2
King William County	2
Manassas Park City	1
Emporia City	1
Poquoson City	1
Richmond County	1
Cumberland County	1
Craig County	1

Essex County	1
Floyd County	1
Northampton County	1
Charlotte County	1
Southampton County	1

Appendix C: Methodology

Estimating Aboveground Chemical Storage with Tier II Reports

On July 6, 2021, in response to a Freedom of Information Act Request filed by Center for Progressive Reform researchers, the Virginia Department of Environmental Quality (DEQ) supplied us with a spreadsheet containing Tier II reports submitted in 2018 by Virginia hazardous facilities regulated under the federal Emergency Planning and Community-Right-to-Know Act. According to DEQ, 2018 was the latest available year of reports. The original file included 10,925 reports.

In 2018, Tier II reporters were required to include information about how hazardous substances are stored at the facility. This is a qualitative field; therefore, responses vary significantly between facilities. To determine which facilities have storage tanks, we used conditional formatting to highlight fields that had "tank," "AST," "tote," and "cylinder" in the Storage column. From this subset of reports, we highlighted the Storage fields that also included "underground," "under ground," "below ground," and "UST" and removed reports that exclusively refer to an underground storage tank. If a report referred to underground storage tanks AND other "tanks," "ASTs," "totes," and/or "cylinders," we did not remove it.

To estimate the facilities with *unregulated* tanks, we used filters in the Chemical Name column to remove reports specifically referring to oil and petroleum products. 9 VAC § 62.1-44.3:8 defines oil as "oil of any kind and in any form, including, but not limited to petroleum and petroleum by-products, fuel oil, lubricating oils, sludge, oil refuse, oil mixed with other wastes, crude oils and all other liquid hydrocarbons regardless of specific gravity." As a result, in our analysis, we categorized the following substances as "oil": oil, petroleum, sludge, gasoline, crude oil, waste oil, used oil, aviation/jet fuel, motor/engine oil, biodiesel, diesel, heating oil, fuel oil, hydraulic fluid, kerosene, lubricating oil, mineral oil, transmission oil, base oil, macron oil, petroleum asphalt, benzene, naphtha products, oily wastewater, RBOB, and denatured ethanol. According to 9 VAC 25-91-30, regulations do not apply to ASTs storing "propane gas, butane gas or other petroleum gases" and "nonpetroleum hydrocarbon-based animal and vegetable oils."[198] As a result, we did not remove reports that listed "propane," "liquefied petroleum gas," or "vegetable oil" in the Chemical Name column.

This methodology yielded 6,171 Tier II reports from hazardous facilities with non-petroleum tanks (those not explicitly 'underground'), ASTs, totes, and cylinders in Virginia in 2018. Since each regulated facility can submit more than one report, we also used conditional formatting to remove duplicates (by Facility ID) to determine that these reports were submitted by 2,011 facilities. Each facility that submitted more than one Tier II report may be the location of multiple storage tanks.

Tier II reports include coordinates for each facility, therefore we were able to map facility locations with relative accuracy, as shown in Figure 2. The map shows the points of individual

facilities (orange dots), as well as the total number of facilities in each city or county (black circles), with the size of the circle corresponding to the number of facilities.

While Tier II reports are some of the only sources of data regarding chemical storage in Virginia and nationwide, our findings are limited by the quality of reporting and DEQ's method of data storage. Responses in the "Storage" field varied significantly, with some reports providing much more detail than others. Therefore, our findings may not capture the complete breadth of Tier II facilities with storage tanks. Furthermore, while we attempted to remove all reports that exclusively list underground storage tanks, reports that refer to "tanks" only may be referring to USTs. Finally, chemical names varied significantly, with many reports including unidentifiable acronyms. As a result, it is possible that we did not eliminate all reports for petroleum-based substances.

Analysis of AST and other Tank-Related Incidents in Virginia

Virginia DEQ's Pollution Response Program (PREP) maintains a public database of Pollution Reports.[199] These reports are submitted by regulators, community members, and regulated entities and may include information such as the date, location, and description of the pollution incident, the materials released and how much, and whether and what corrective action was taken. The majority of the database is qualitative; therefore, the quality and consistency of the data vary greatly between reports.

On September 9, 2021, we exported pollution reports submitted between January 1, 2000, and December 31, 2020, from the database. The original file included 24,642 reports. We first used filters to remove reports for incidents that occurred before January 1, 2000, and after December 31, 2020. We then used conditional formatting to highlight fields across the entire dataset that included "aboveground storage tank," "above ground storage tank," "aboveground tank," "above ground tank," "AST," "tank," "tote," and "cylinder." We removed the fields that were not highlighted.

From this subset of reports, we used conditional formatting to highlight fields that included "underground," "under ground," "UST," and "below ground." We reviewed each of these fields and removed the reports that explicitly referred to only underground storage tanks. We did not remove reports that referred to underground storage tanks AND other tanks, ASTs, totes, and/or cylinders. We then used conditional formatting to highlight fields that referred to "rail," "train," "locomotive," "tanker," "saddle tank," "tractor trailer," "TT," "boat," "motor vehicle accident," "MVA," "bus," "truck," and "airplane." We reviewed each of these fields and removed reports for incidents from transportation-related and off-shore tanks. We also highlighted and removed reports that were listed as "drills" and therefore not actual incidents.

To identify pollution incidents specifically related to ASTs, we used conditional formatting to highlight fields that specifically include "AST," "aboveground storage tank," "aboveground tank," "above ground storage tank," "above ground tank," "AST," "tote," and "cylinder." This yielded 1,484 pollution reports regarding instances of spills, releases, improper storage, and

illegal dumping likely involving aboveground storage tanks between January 1, 2000, and December 31, 2020. The remaining 3,371 reports referenced "tanks" but did not specify the tank type, and therefore, these were not included in the count of AST incidents. That said, many of these tanks are likely also ASTs.

Since PREP reports are largely qualitative and can be submitted by any interested stakeholders, data on the location of incidents were at times inconsistent and unclear. As a result, the most specific location data we were able to include was the city, town, or census-designated place that the incident occurred. In Figure 3, we mapped AST incidents by city or county since local regulatory decision-making is made at this level in Virginia. In Figures 5a-5d, AST incidents are mapped by city, town, or census-designated place since the Virginia environmental justice map (described below) is shown at the census tract level. In these figures, the circles (varying by size and color) represent the number of AST incidents in the jurisdiction.

Analysis of Environmental Justice Impacts of ASTs

To identify "overburdened" communities, Center for Progressive Reform researchers used the Virginia environmental justice map developed by Mapping for Environmental Justice (MEJ) at the University of California, Berkeley.[200] The tool was developed in collaboration with the Virginia Environmental Justice Collaborative (VEJC) and uses data on 19 pollution and demographic indicators to calculate an overall "cumulative EJ impact score" for each census tract in the state. Census tracts with a higher score — which is expressed as a percentile — have a higher environmental justice burden. The indicators used in the tool were selected in collaboration with VEJC members, and the methodology for calculating the score is adapted from CalEnviroScreen, California's environmental justice screening tool.[201] The indicators use data from EPA EJ SCREEN, the 2014-2018 American Community Survey, Centers for Disease Control and Prevention, and the Virginia Department of Mines, Minerals, and Energy.

MEJ provided Center for Progressive Reform researchers with the Virginia environmental justice screening map dataset. For the purposes of our analysis, we considered any census tract that scored in the top 25th percentile as "overburdened." The top 25th percentile is a threshold used in several other environmental justice screening tools, such as CalEnviroScreen and Maryland EJSCREEN.[202] As a result, the "Cumulative EJ Score" shown in Figures 5a-5d is divided by quartiles — 0-25th percentile, 25-50th percentile, 50-75th percentile, and 75-100th percentile. Census tracts that fall within the 75-100th quartile are in the top 25th percentile.

While the Virginia environmental justice map provides important context, these tools are limited by the quality of the underlying data and are best utilized for screening purposes. Furthermore, MEJ's map shows the cumulative environmental justice burden at the census tract level, whereas our analysis of AST incidents is at the city and county level. The difference in spatial scale limits our ability to draw conclusions about the prevalence of AST incidents in overburdened communities in the state overall.

Endnotes

[1] The terms spill, discharge, leak, and release are used interchangeably throughout the report to refer to incidents involving contamination or other failures involving chemical storage facilities.

[2] Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500), Oct. 18, 1972, 86 Stat. 816; 33 U.S.C. 1251 et seq.; USEPA (2000a), A Benefits Assessment of Water Pollution Control Programs Since 1972: Part 1, The Benefits of Point Source Controls for Conventional Pollutants in Rivers and Streams: Final Report, USEPA; William L. Andreen. (2003). Water Quality Today - Has the Clean Water Act Been a Success Symposium: The Clean Water Act at Thirty: Progress, Problems, and Potential, 55 Ala. L. Rev. 537.

[3] Pub. L. No. 92-500, § 311(j)(1), 86 Stat. 816, 868 (1972) (codified at 33 U.S.C. § 1321(j)(1)(C)); Exec. Order No. 11,735 § 1(4), 38 Fed. Reg. 21,243, 21,243 (Aug. 7, 1973).

[4] Oil Pollution Act of 1990 – Public Law 101-380, 104 Stat. 484, 33 U.S.C. ch. 40 § 2701.

[5] 83 Fed. Reg. at 29,519 (EPA estimates based on available data that at least 108,000 tanks would be covered through a prospective CWA hazardous substance spill prevention rule, while acknowledging certain uncertainties in the data and rule that could result in far more covered facilities).

[6] 33 U.S.C. § 1321(b)(2)(A).

[7] 33 U.S.C. § 1321(j)(1)(C); 33 U.S.C. § 1321(b)(2).

[8] 33 U.S.C. § 1321(j)(5)(A)(i).

[9] Section 311(j)(1)(C) of the CWA, 33 U.S.C. 1251.

[10] 83 Fed. Reg. at 29,507; 40 C.F.R. § 112.2.

[11] Section 311(j)(5) of the Clean Water Act; 59 FR 34070 (July 1,1994) 40 CFR 112.20 -112.21.

[12] 83 Fed. Reg. at 29,505.

[13] Comment of Envtl. Justice Health All. For Chem. Policy Reform, et al., Comments on Docket ID No. EPA-HQ-OLEM-2018-0024-001, Clean Water Act Hazardous Substance Spill Prevention – Proposed Action, August 24, 2018, at 13. Hereinafter "2018 EJHA Comment Letter."

[14] 2018 EJHA Comment Letter at 16-17.

[15] 2018 EJHA Comment Letter at 19-20.

[16] 2018 EJHA Comment Letter at 20.

[17] 49 Fed. Reg. 37,998, 38,014 (Sept. 26, 1984) (Attachment 14); see also 44 Fed. Reg. 32,854, 32,896 (June 7, 1979) (Attachment 15) ("while both [best management practices under NPDES permits] and SPCC Plans have many common features, their emphasis is different."); also 2018 EJHA Comment Letter at 14-16.

[18] See 83 Fed. Reg. at 29,509; 40 C.F.R. part 355; 2018 EJHA Comment Letter at 20-21.

[19] See Compl., Envtl. Justice Health All. For Chem. Policy Reform v. EPA, 15-cv-5705, Dkt. No. 1 (S.D.N.Y. filed July 21, 2015), EPA-HQ-OLEM-2018-0024-0057; See Consent Decree, Envtl. Justice Health All. for Chem. Policy Reform v. EPA, 15-cv-5705, Dkt. No. 46 (S.D.N.Y. entered Feb. 6, 2016), EPA-HQ-OLEM-2018-0024-0058; CWA 311(j)(1)(C).

[20] 83 Fed. Reg. at 29,501.

[21] 33 U.S.C. § 1321(j)(1)(C); 2018 EJHA Comment Letter at 2-5.

[22] 84 Fed. Reg. 46100, 46106-46134; also 83 Fed. Reg. at 29,503, 29,519.

[23] 2018 EJHA Comment Letter at 5.

[24] 2018 EJHA Comment Letter at 10.

[25] 84 Fed. Reg. at 46133; also 2018 EJHA Comment Letter, FN 3 at 9.

[26] 33 U.S.C. § 1321(j)(5)(A)(i); Oil Pollution Act. Id. § 4202(b)(4)(A), 104 Stat. at 532. The Oil Pollution Act was enacted on August 18, 1990. Id. 104 Stat. at 484; Exec. Order No. 12,777 § 2(d)(1), 56 Fed. Reg. 54,757, 54,761 (Oct. 18, 1991).

[27] See Consent Decree, Envtl. Justice Health All. for Chem. Policy Reform, et al. v. EPA, 19-cv-2516, (S.D.N.Y. entered Mar. 12, 2020) at 3-4.

[28] State efforts began even earlier. Massachusetts imposed some standards following the Great Molasses Flood of 1919, which

caused 21 deaths and 150 injuries. Available at https://www.mass.gov/service-details/aboveground-storage-tanks-asts.

[29] U.S. Chemical Safety and Hazard Investigation Board. (Oct 2002). Investigation Report: Refinery Incident, at 11. Available at https://www.csb.gov/motiva-enterprises-sulfuric-acid-tank-explosion/.

[30] Id. at 12.

[31] Id. at 16.

[32] Id. at 14.

[33] Id.

[34] Id. at 17.

[35] Id.

[36] Id.

[37] Id.

[38] Id. at 12.

[39] Id. at 13.

[40] Id.

[41] Id. at 14.

[42] International Code Council, "Code Adoption Maps," available at https://www.iccsafe.org/wp-content/uploads/Code_Adoption_Maps.pdf; National Fire Protection Association, "About NPFA 30" available at https://www.nfpa.org/News-and-Research/Data-research-and-tools/Hazardous-Materials/The-fire-risk-of-Intermediate-Bulk-Containers/About-NFPA-30.

[43] 40 CFR Subpart J; 40 C.F.R. §§ 264.190-264.200; 40 C.F.R. §§ 264.192.

[44] 40 CFR 60 Subpart Kb; 40 CFR § 60.112b; 40 CFR §§ 60.113b, 115b-116b.

[45] U.S. Chemical Safety and Hazard Investigation Board. (Feb. 2017). Investigation Report: Chemical Spill Contaminations Public Water Supply in Charleston, West Virginia, at xi. Available at https://www.csb.gov/assets/1/20final_freedom_industries_investigation_report_(5-11-2017).pdf?15829. (Hereinafter "CSB Freedom Industries Report")

[46] Laurel Williamson. (May 29, 2014). Why We Should Remember The Elk River Spill, Center for Watershed Protection. Available at https://www.cwp.org/why-we-should-remember-the-elk-river-spill/.

[47] Id.; Rosen et al. (2014). WV TAP FINAL REPORT, Corona Environmental Consulting, LLC, 6 Old Country Way, Scituate, MA 02066. Available at https://emd.wv.gov/wvtap/testresults/Documents/WV%20TAP%20Final%20Report.pdf.

[48] CSB Freedom Industries Report at 11.

[49] Id. at 94.

[50] Id. at 82.

[51] Ken Ward. (Jan. 14, 2014). DEP inspectors describe early scene at Freedom leak site, Charleston Gazette-Mail online. Available at https://www.wvgazettemail.com/news/special_reports/dep-inspectors-describe-early-scene-at-freedom-leak-site/article_50247d9d-69f6-5533-9676-ff04532f6264.html.

[52] Infra Note 45.

[53] §22-30-3 (1).

[54] §22-30-3 (1)(A-N).

[55] §22-30-3(15).

[56] Glynis Board. (Feb. 26, 2015). W.Va. Legislators Working to Roll Back Aboveground Tank Regulations, West Virginia Public Radio. Available at https://www.downstreamstrategies.com/documents/Press/wvpubcast_w.va.-legislators-working-to-roll-back-ast-regs.pdf.

[57] Ward Jr., K. (2017, March 26). Tank safety roll back passes, water pollution and drilling bills to come. Charleston Gazette-Mail (WV), p. P1A. Available from NewsBank: Access World News: https://infoweb-newsbank-com.proxygt-law.wrlc.org/apps/news/document-view?p=AWNB&docref=news/16365CE52D9C77C8.

[58] Based on data available at https://apps.dep.wv.gov/tanks/public/Pages/ASTReports.aspx, counting Level 1 tanks against total registered tanks.

[59] Mike Tony. (Mar. 10, 2021). House approves rollback of state regulation of oil and gas tanks near water intakes, Charleston Gazette-Mail online. Available at https://www.wvgazettemail.com/news/energy_and_environment/house-approves-rollback-of-

state-regulation-of-oil-and-gas-tanks-near-water-intakes/article_1efb1c76-ee44-5a53-b01c-c49a3ec2812e.html.

[60] Steven Adams. (Feb. 24, 2021). Changes to aboveground storage tank law would exempt some tanks, The Weirton Daily Times. Available at https://www.weirtondailytimes.com/news/local-news/2021/02/changes-to-aboveground-storage-tank-law-would-exempt-some-tanks/.

[61] §22-30-4.

[62] §22-30-6.

[63] §22-30-15.

[64] §22-30-9.

[65] §22-30-7.

[66] §22-30-14(b).

[67] § 7402A(1).

[68] Id. at (21).

[69] § 7402A(1)(a-f).

[70] § 7405A.

[71] § 7407A(1).

[72] § 7408A.

[73] § 7407A(7).

[74] 7 DE ADC 1352-A-7.0

[75] § 7409A.

[76] Id.

[77] 376.30.

[78] 376.301(1).

[79] Fla. Admin. Code r. 62-762.301.

[80] 376.303(1)(a).C

[81] 376.303(1)(c).

[82] 376.303(1)(f).

[83] 376.303(1)(e).

[84] 376.303(1)(j).

[85] K.S.A. 65-34,102(a)(1).

[86] 65-34,103(h).

[87] 65-34,103.

[88] 65-34,104.

[89] K.S.A. 65-34,106.

[90] K.S.A. 65-34,105.

[91] Id.

[92] K.S.A. 65-34,108.

[93] 6 NYCRR 596.1(b)(1)(i).

[94] 6 NYCRR 596.1(c)(53).

[95] 6 NYCRR 596.1(b)(4).

[96] 6 NYCRR 596.1(c)(54).

[97] 7 Del.C. § 7404A(a)(5).

[98] 6 NYCRR 596.2(a).

[99] 6 NYCRR 599.7(a).

[100] 6 NYCRR 598.

[101] 6 NYCRR 598.1(k).

[102] Virginia Senate Bill 811 (2015, passed) "Chemical storage in the Commonwealth; protection of human health and the environment." Available at https://lis.virginia.gov/cgi-bin/legp604.exe?151+sum+SB811.

[103] Id.

[104] Id.

[105] Virginia Department of Environmental Quality, Department of Emergency Management, and Department of Health. (2016). Chemical Storage in the Commonwealth: An Evaluation of Existing Statutory and Regulatory Tools, (hereinafter "Chemical Storage in the Commonwealth").

[106] Chemical Storage in the Commonwealth at 7.

[107] Chemical Storage in the Commonwealth at 22.

[108] Chemical Storage in the Commonwealth at 26.

[109] Chemical Storage in the Commonwealth at 22.

[110] Chemical Storage in the Commonwealth at 23-24.

[111] Chemical Storage in the Commonwealth at 27.

[112] Virginia Senate Bill 626 (2020, continued) "SB 626 Hazardous Substance Aboveground Storage Tank Fund; created." Available at https://lis.virginia.gov/cgi-bin/legp604.exe?201+ful+SB626S1+pdf.

[113] 9VAC25-91; DEQ, Aboveground Storage Tanks, available at https://www.deq.virginia.gov/land-waste/petroleum-tanks/storage-tanks/aboveground-storage-tanks.

[114] Sections 62.1-44.34:8-12; 9VAC25-580 et seq.

[115] 9VAC25-580-50 through 320.

[116] Chemical Storage in the Commonwealth at 17.

[117] 9VAC20-60 et seq. and 9VAC20-81 et seq.; see also Chemical Storage in the Commonwealth at 15-17.

[118] Ticonderoga Farms, Inc. v. County of Loudoun, et al, 242 Va. 170 409 S.E. 2d 446 (1991); Resource Conservation Management, Inc., et al v. Board of Supervisors of Prince William County, et al, 238 Va. 15 380 S.E. 2d 879 (1989).

[119] Va. Code § 15.2-2280 et seq.

[120] Id. at § 15.2-2283; also e.g. 9VAC25-830-190.

[121] See 13 VAC 5-51-11; 13 VAC 5-51-31; 9 VAC 5-20-21.

[122] IFC 5001 et seq. Hazardous materials are defined as "those that pose an unreasonable risk to the health and safety of operating or emergency personnel, the public, and the environment if not properly controlled[.]" Specific categories of materials that are considered hazardous are described in IFC 5101-6701.

[123] IFC Appendix H.

[124] IFC 107.2; IFC 5004.2.2.5.

[125] 13 VAC 5-63, Docs. Inc. by Ref; IBC § 413-414; Aboveground Storage Tanks Containing Liquid Fertilizer: Recommended Mechanical Integrity Practices. The Fertilizer Institute, 2009; 13 VAC 5-63-40.

[126] See 13 VAC 5-51-11.

[127] Tier II reports are required under Section 312 of EPCRA to provide regulators and the public with information about the hazards and amounts of chemicals stored at regulated facilities.

[128] 83 Fed. Reg. at 29,499-29,520.

[129] Id.

[130] Id.

[131] 83 Fed. Reg. at 63,959.

[132] Id.

[133] The complete methodology for our analysis can be found in Appendix C.

[134] 83 Fed. Reg. at 29,499-29,520.

[135] 40 C.F.R. § 370.10(a)(1) and (a)(2)

[136] U.S. Census Bureau. (2016). Annual Survey of Manufacturers. https://www.census.gov/newsroom/press-releases/2017/cb17-tps86.html

[137] Florida Department of Environmental Protection. (n.d.) Facility Tank Locations. Retrieved October 7, 2021, from https://prodlamp.dep.state.fl.us/www_stcm/publicreports/FacilityLocTank

[138] Excludes underground storage tanks and facilities categorized as "closed" or "abandoned."

[139] "Non-petroleum products" were listed as ammonia compound, chlorine compound, hazardous substance, mineral acid, pesticide, unknown/not reported, and non-regulated.

[140] A database spreadsheet was emailed to CPR by Minnesota Pollution Control Agency. Retrieved October 28, 2021.

[141] Virginia Department of Environmental Quality (n.d.) Aboveground Storage Tanks. Retrieved October 28 2021, from https://www.deq.virginia.gov/land-waste/petroleum-tanks/storage-tanks/aboveground-storage-tanks.

[142] Office of Emergency Management. (2015). Oil Storage on U.S. Farms: Risk and Opportunities for Protecting Surface Waters. U.S. Environmental Protection Agency. https://www.epa.gov/sites/default/files/2016-02/documents/wrrda_farm_study_2015-06-30.pdf

[143] 62 Fed. Reg. at 54,508, 54,527.

[144] 83 Fed. Reg. at 494.

[145] Id.

[146] The complete methodology for our analysis can be found in Appendix C.

[147] 9 VAC § 62.1-44.3:8 defines oil as "oil of any kind and in any form, including, but not limited to petroleum and petroleum by-products, fuel oil, lubricating oils, sludge, oil refuse, oil mixed with other wastes, crude oils and all other liquid hydrocarbons regardless of specific gravity."

[148] Compl., Envtl. Justice Health All. For Chem. Policy Reform v. EPA, 15-cv-5705, Dkt. No. 1 (S.D.N.Y. filed July 21, 2015); Abt Associates, Inc., Analysis of Clean Water Act Hazardous Substances Spills 2007-2016, Prepared for U.S. Environmental Protection Agency, July 24, 2017, EPA-HQ-OLEM-2018-0024-0002.

[149] The authors examined Virginia Department of Environmental Quality Pollution Response Program data; EPA Onsite Response Coordinator Program data; and National Response Center Program data for the year 2013; Emily Satchell, et al. (Oct. 26, 2013). Firefighter injured at Petersburg steel plant fire, WTVR online, available at https://www.wtvr.com/2013/10/26/fire-at-petersburg-steel-plant; Geneva Smith. (Oct. 27, 2013). Update: Petersburg plant fire ruled an accident, NBC12 online, available at https://www.nbc12.com/story/23799874/two-injured-including-firefighter-in-petersburg/.

[150] Agency for Toxic Substances and Disease Registry. (n.d.) National Toxic Substance Incidents Program (NTSIP). Retrieved from https://www.atsdr.cdc.gov/ntsip/index.html

[151] Agency for Toxic Substances and Disease Registry. National Toxic Substance Incidents Program (NTSIP) Biennial Report 2013-2014. U.S. Department of Health and Human Services. https://www.atsdr.cdc.gov/ntsip/docs/NTSIP_2013-14_final_report_508.pdf

[152] Id.

[153] New Jersey Department of Health. (2015). Hazardous Substance Fact Sheet: Propane. https://nj.gov/health/eoh/rtkweb/documents/fs/1594.pdf

[154] Minovi, D. (2021). Toxic Floodwaters on the Gulf Coast and Beyond: Commentary on the Public Health Implications of Chemical Releases Triggered by Extreme Weather. Environmental Justice, 14(2).

[155] U.S. Environmental Protection Agency. (2006). Murphy Oil Spill Fact Sheet. http://www.columbia.edu/itc/journalism/cases/katrina/Federal%20Government/Environmental%20Protection%20Agency/Murphy%20Oil%20Spill%20Fact%20Sheet%20Feb%202006.pdf

[156] Id.

[157] Sengul, H., Santella, N., Steinberg, L. J., & Cruz, A. M. (2012). Analysis of Hazardous Material Releases Due to Natural Hazards in the United States. Disasters, 36(4),723-743.

[158] Lynch, E. E., Malcoe, L. H., Laurent, S. E., Richardson, J., Mitchell, B. C., & Meier, H. C. S. (2021). The Legacy of Structural Racism: Associations Between Historic Redlining, Current Mortgage Lending, and Health. SSM – Population Health, 14, 100793.

[159] Starbuck, A., & White, R. (2016). Living in the Shadow of Danger: Poverty, Race, and Unequal Chemical Facility Hazards. Center for Effective Government. https://www.foreffectivegov.org/sites/default/files/shadow-of-danger-highrespdf.pdf

[160] Id.

[161] See Consent Decree, Envtl. Justice Health All. for Chem. Policy Reform, et al. v. EPA, 19-cv-2516, (S.D.N.Y. entered Mar. 12, 2020) at 9.

[162] Wilson, S., Zang, H., Burwell, K., Samantapudi, A., Dalemarre, L., Jiang, C., Rice, L., Williams, E., & Naney, C. (2013). Leaking Underground Storage Tanks and Environmental Injustice: Is There a Hidden and Unequal Threat to Public Health in South Carolina?. Environmental Justice, 6(5), 175-182.

[163] U.S. Environmental Protection Agency. (2012). Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts. https://www.epa.gov/cira/social-vulnerability-report; Reskin, B. (2012). The Race Discrimination System. Annual Review of Sociology, 3, 17-35.; Khullar, D., & Chokshi, D. A. (2018). Health, Income, & Poverty: Where We Are & What Could Help. Health Affairs. https://www.healthaffairs.org/do/10.1377/hpb20180817.901935/full/.

[164] Mapping for Environmental Justice. (2021). Virginia. Retrieved from https://mappingforej.berkeley.edu/virginia/ Hereinafter "VA Mapping for EJ."

[165] To identify "overburdened" communities, we used the Virginia environmental justice screening map developed by Mapping for Environmental Justice at the University of California, Berkeley. The tool was developed in collaboration with the Virginia Environmental Justice Collaborative and integrates data on 19 pollution and demographic indicators to demonstrate which census tracts face the most significant environmental justice burden. For our analysis, we considered any census tract that scored in the top 25th percentile as "overburdened." The complete methodology for our analysis can be found in Appendix C.

[166] U.S. Chemical and Safety Hazard Investigation Board. (2009). Investigation Report: Allied Terminals, Inc. - Catastrophic Tank Collapse. 1-5. https://www.csb.gov/allied-terminals-fertilizer-tank-collapse/ Hereinafter "2009 Allied Chemicals CSB Report."

[167] Id.

[168] 2009 Allied Chemicals CSB Report at 28.

[169] Matray, M. (2016, January 16). About 75,000 Gallons of Jet Fuel Leaked in Chesapeake Tank Spill. The Virginian-Pilot. https://www.pilotonline.com/news/environment/article_975d4e04-9804-5d98-a92e-3969bd3bcc75.html

[170] Compl., Envtl. Justice Health All. For Chem. Policy Reform v. EPA, 15-cv-5705, Dkt. No. 1 (S.D.N.Y. filed July 21, 2015), citing National Response Center data; Abt Associates, Inc., Analysis of Clean Water Act Hazardous Substances Spills 2007-2016, Prepared for U.S. Environmental Protection Agency, July 24, 2017, EPA-HQ-OLEM-2018-0024-0002.

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[176] Virginia Department of Environmental Quality, Blue Ridge Regional Office. (2018). State Water Control Board Enforcement Action – Order by Consent Issued to Crop Production Services, Inc. Cloverdale, VA Facility. https://www.wfxrtv.com/wpcontent/uploads/sites/20/2018/08/CropProd.2018_1533671816321_50977093_ver1.0.pdf

[177] Fabris, C. (2017, August 7). Tinker Creek Recreation Advisory Lifted Nearly.2 Weeks After Chemical Spill. The Roanoke Times. https://roanoke.com/news/local/tinker-creek-recreation-advisory-lifted-nearly-2-weeks-after-chemical-spill/article_305e8428-673c-5f75-96dc-85accfb0bc82.html

[178] Virginia Department of Health. (2017). Tinker Creek Fish Kill. https://www.vdh.virginia.gov/news/tinker-creek-fish-kill/

[179] This should include, minimally, all hazardous and extremely hazardous substances designated by EPA pursuant to Clean Water Act, CERCLA, and EPRCA, and other such chemicals that Virginia regulators designate as hazardous.

[180] For example, nearly all of the reports we analyzed (98 percent) did not describe corrective actions taken by DEQ or another agency in response to the incident.

[181] After this spill, the Virginia General Assembly passed a law requiring aboveground tanks storing more than 100,000 gallons

of fertilizer, only, to comply with industry standards for tank inspection, repair, alteration, and reconstruction. Smaller fertilizer tanks and other tanks storing hazardous chemicals remain unregulated under Virginia law.

[182] E.g. Cal. Code Regs. tit. 19, § 2762.13; see also, Glenn Hess and Jeff Johnson, Deconstructing Inherently Safer Technology, Chemical and Engineering News, March 10, 2014, Volume 92, Issue 10. Available at https://cen.acs.org/articles/92/i10/Deconstructing-Inherently-Safer-Technology.html.

[183] Massachusetts Office of Technical Assistance and Technology. (Dec., 2018). Annual Report: Massachusetts Toxics Use Reduction Program Fiscal Year 2018, at 6. Available at https://www.mass.gov/doc/fiscal-year-2018-progress-report-on-the-massachusetts-toxics-use-reduction-program-0/download.

[184] Consent Decree, Envtl. Justice Health All. for Chem. Policy Reform, et al. v. EPA, 19-cv-2516, (S.D.N.Y. entered Mar. 12, 2020) at 3-4; EPA, Virtual Public Listening Sessions on the Risk Management Program Rule, available at https://www.epa.gov/rmp/forms/virtual-public-listening-sessions-risk-management-program-rule (last accessed Nov. 1, 2021).

[185] Consent Decree, Envtl. Justice Health All. for Chem. Policy Reform, et al. v. EPA, 19-cv-2516, (S.D.N.Y. entered Mar. 12, 2020) at 3-4.

[186] 2018 EJHA Comment Letter at 6 and 10-11 (citing EPA, Bi-Annual Update #1 (Aug. 16, 2016), available at https://www.epa.gov/sites/production/files/2016-08/documents/biannual_update_1_aug-16-16.pdf (Attachment 1)).

[187] See, e.g., President J. Biden, Exec. Order 13990: Protecting Public Health and The Environment and Restoring Science to Tackle the Climate Crisis (Jan. 20, 2021), https://www.whitehouse.gov/briefingroom/presidentialactions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackleclimate-crisis/; President J. Biden, Exec. Order 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (Jan. 20, 2021), https://www.whitehouse.gov/briefingroom/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underservedcommunities-through-the-federal-government/. See also https://www.whitehouse.gov/briefing-room/statementsreleases/2021/01/27/fact-sheet-president-biden-takes executive-actions-to-tackle-the-climate-crisis-at-home-andabroad-create-jobs-and-restore-scientific-integrity across-federal-government/.

[188] J. Goodwin and E. Winter. (2021). Building a Progressive Regulatory Agenda: How a better cost-benefit analysis process can be used to tackle climate change, Center for Progressive Reform and Data for Progress, https://www.filesforprogress.org/memos/dfp-building-a-progressive-regulatory-agenda.pdf. J. Goodwin et al., Reclaiming Regulation: Making the Public's Values Heard in Regulatory Analysis (Feb. 2021), Center for Progressive Reform and Data for Progress, https://www.filesforprogress.org/memos/reclaiming-regulation.pdf.

[189] 2018 EJHA Comment Letter at 30.

[190] 40 C.F.R. § 117.3

[191] See 33 U.S.C. § 1321(b)(2) (requiring EPA to "revise as may be appropriate" its list of CWA hazardous substances to reflect "such elements and compounds which, when discharged in any quantity into or upon the navigable waters of the United States or adjoining shorelines . . . present an imminent and substantial danger to the public health or welfare, including, but not limited to, fish, shellfish, wildlife, shorelines, and beaches"); 2018 EJHA Comment Letter at 30-31; 60 FR 30937, June 12, 1995.

[192] 40 C.F.R. § 112.8(c)(2).

[193] See e.g. 80 FR 41566, July 15, 2015 (updating EPA underground storage tank regulations to include secondary containment and other mechanical, maintenance, and training standards), available at https://www.epa.gov/ust/revising-underground-storage-tank-regulation-revisions-existing-requirements-and-new.

[194] 2018 EJHA Comment Letter at 8-9.

[195] Conservation Law Foundation v. Exxon Mobil, 448 F.Supp.3d 7 n.4 (D. Mass. 2020). Professional engineering associations, such as the American Society of Civil Engineers and the World Federation of Engineering Organizations have recognized the need to adapt good engineering practices to worsening climate impacts and, in some cases, have begun to establish new standards of practice accordingly. See e.g. World Federation of Engineering Organizations, Model Code of Practice: Principles of Climate Change Adaptation for Engineers. (Dec. 2015), available at http://www.wfeo.org/wp-content/uploads/code-ofpractice/WFEO_Model_Code_of_Practice_Principles_Climate_Change_Adaptation_Engineers.pdf.

[196] 33 U.S.C. § 1321(A)(24)(B). ("'worst case discharge' means— in the case of an offshore facility or onshore facility, the largest foreseeable discharge in adverse weather conditions.")

[197] James Goodwin. (2019). Regulation as Social Justice, A Crowdsourced Blueprint for Building a Progressive Regulatory System, Center for Progressive Reform. Available at https://cpr-assets.s3.amazonaws.com/documents/Regulation-as-Social-Justice-Report-FINAL.pdf.

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