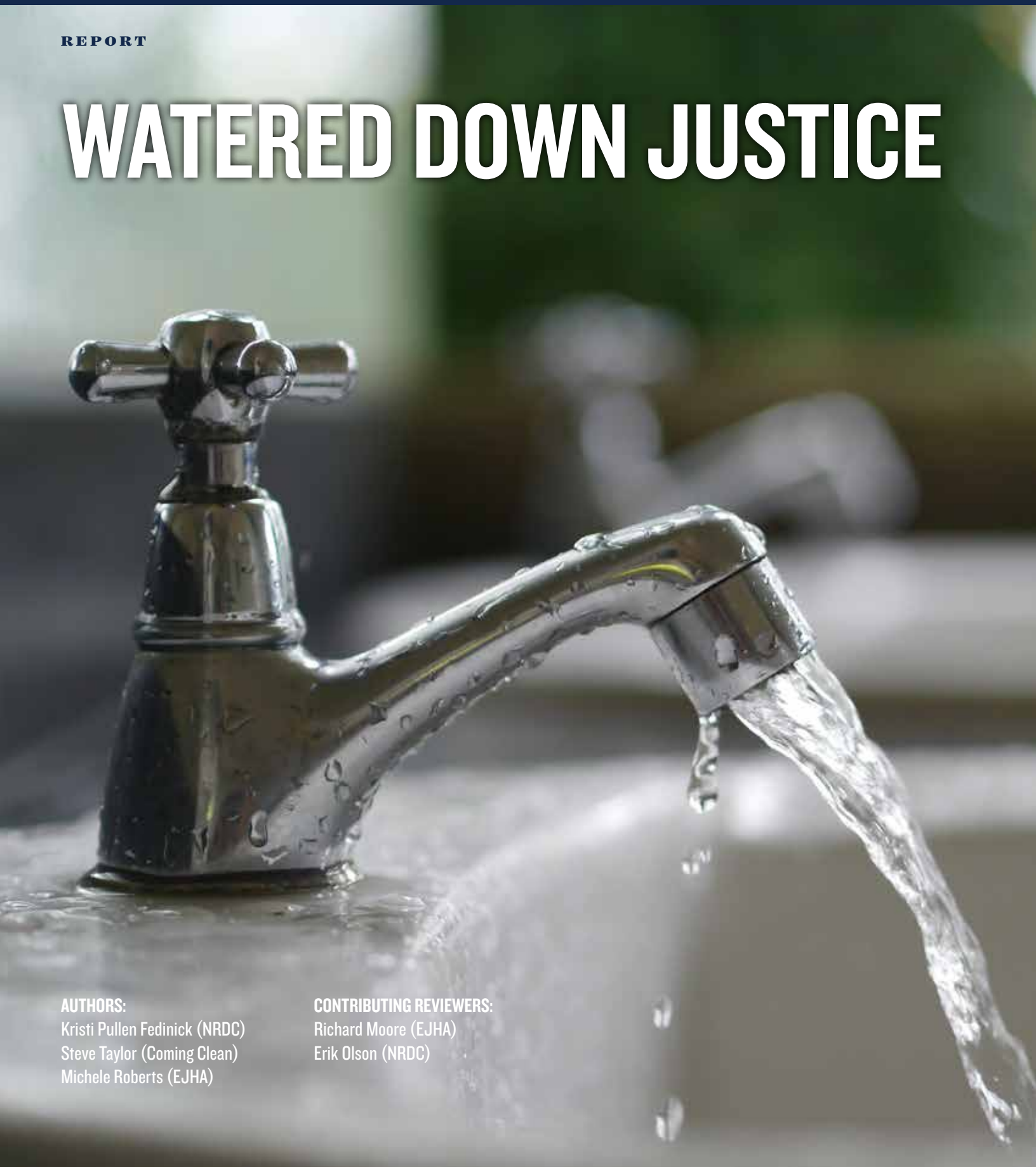
NRDC NATURAL RESOURCES DEFENSE COUNCIL
coming clean
Environmental Justice Health Alliance
SEPTEMBER 2019
R: 19-09-A

REPORT

# WATERED DOWN JUSTICE



**AUTHORS:**
Kristi Pullen Fedinick (NRDC)
Steve Taylor (Coming Clean)
Michele Roberts (EJHA)

**CONTRIBUTING REVIEWERS:**
Richard Moore (EJHA)
Erik Olson (NRDC)

## ACKNOWLEDGMENTS

We would like to humbly acknowledge and thank the countless numbers of individuals and communities that fight tirelessly to abolish systems of oppression, particularly those fighting for Environmental Justice.

We also thank the numerous staff at NRDC, Coming Clean, and EJHA that have helped make this report possible including Jason Babbie, Lisa Goffredi, Phoebe Gooding, Stephanie Herron, Margie Kelly, Fabiola Nunez, Shelley Poticha, Jenny Powers, Susan Sabella, Leah Stetcher, Eric Whalen, and Mae Wu.

We are also indebted to many peer reviewers and editors of this report including Dr. Christina Swanson and Mary Heglar, and an extraordinary group of external experts who reviewed earlier versions of this report including Dr. Carolina Balazs (CalEPA/OEHHA), Dr. Lara Cushing (San Francisco State University), Dr. Juan Declet-Barreto (Union of Concerned Scientists), Marianne Engleman-Lado, and Dr. Robin Saha (University of Montana). We also extend our thanks to Rachael Johnson for her contributions to early drafts of the report. All errors are ours, however.

Finally, we would like to thank our funders and other donors for their generous support for our drinking water work.



*NRDC Chief Communications Officer:* Michelle Egan
*NRDC Chief Program Officer:* Susan Casey-Lefkowitz
*Coming Clean Executive Director:* Judith Robinson
*Environmental Justice Health Alliance for Chemical Policy Reform National Co-Coordinators:* Richard Moore and Michele Roberts

*Design and Production:* www.suerossi.com

# *Table of Contents*

# *Executive Summary*




Enacted in 1974, the Safe Drinking Water Act (SDWA) was supposed to ensure access to safe drinking water across the country, but the law clearly has not been enforced equally for everyone. For example, since 2015, Flint, Michigan, has become nearly synonymous with the critical failures of this bedrock public health law—and put a face on the victims of those failures.

NRDC, the Environmental Justice Health Alliance for Chemical Policy Reform (EJHA), and Coming Clean analyzed nationwide violations of the SDWA that occurred from 2016 to 2019 and found a disturbing relationship between multiple sociodemographic characteristics—especially race—and drinking water violations. **At the county level, as people of color, low-income people, non-native English speakers and crowded conditions and/or sparse access to transportation increased, the rate of drinking water violations also increased.**

Our analysis also revealed that **race, ethnicity, or language spoken had the strongest relationship to slow and inadequate enforcement[i] of the SDWA of any sociodemographic characteristic analyzed.**[ii]

Drinking water systems in counties with higher vulnerability (see Text Box - Vulnerability) related to race, ethnicity, or language spoken were likely to spend more time out of compliance with the law for more violations for more contaminants. In addition, as racial, ethnic, and language vulnerability increased at the county level, the average number of formal enforcement actions increased yet violations remained uncorrected despite enforcement actions.

i As defined by the percentile ranking of the "Minority Status/Language" theme (Theme 3) of the Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI), discussed in detail in Appendix A.

ii As defined by the percentile ranking of the "Minority Status/Language" theme (Theme 3) of the CDC-SVI.

## VULNERABILITY

As defined by the World Health Organization, vulnerability is "the degree to which a population, individual, or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters."[1] Vulnerability is "socially constructed, i.e., it arises out of the social and economic circumstances of everyday living."[2]

The vulnerability of some communities and populations to hazards (including chemical spills) is not a coincidence or their own fault, but rather the consequence of underlying social and political factors and decisions, especially racism and public policies that disadvantage communities of color and Indigenous communities. As noted 25 years ago in the literature on community vulnerability and "natural" disasters (and as known by these communities themselves for much longer), "there are no really generalized opportunities and risks in nature, but instead there are sets of unequal access to opportunities and unequal exposures to risks which are a consequence of the socio-economic system."[3]

## THE MOST VULNERABLE SHOULDER THE HEAVIEST BURDEN

SDWA violations fall into three main categories: health based, monitoring and reporting, and public notification and other violations. Health-based violations are the most severe and occur when systems have a problem that can directly affect human health (for example, arsenic in the water that exceeds levels set by the law). Monitoring and reporting violations occur when systems do not regularly monitor or submit monitoring results to authorities.[iii] Finally, public notification and other violations occur when systems do not properly notify the public about drinking water quality (public notification) or when a system violates a requirement not covered by any other violation type (other violations).[iv]

Between June 1, 2016 and May 31, 2019 (the most recent data available when this report was completed), there were 170,959 violations of the SDWA in 24,133 community water systems across the U.S.[v,vi] 129,907,275 people (nearly 40 percent of the U.S. population)[vii] obtained their water from drinking water systems that were in violation of the law. These violations included all violation types. Health threats associated with these violations can include cancer, impaired brain development, decreased kidney function, and potentially life-threatening gastrointestinal disease[4] (the Centers for Disease Control and Prevention estimates that approximately 19.5 million Americans become sick annually from waterborne pathogens such as *Escherichia coli*, *Giardia*, and other infectious agents found in contaminated water from public water systems.)[5]

© Foo Conner

***The relationship between racial, ethnic, and language vulnerability and persistence of violations was the strongest of all the relationships we studied across all compliance, enforcement, and sociodemographic characteristics.***

iii Although some monitoring or reporting violations may be minor, in other instances they may mask health-based violations—such as when water is not tested for a contaminant that is present at health-endangering levels.

iv Examples of other violations include failure to maintain proper lead and copper rule-related records on site, failure to develop a written siting plan that identifies sampling sites and collection schedules for coliform bacteria, and failure to notify state authorities that state-specific requirements for ground water monitoring have not been met.

v Statistics for violations, number of systems in violation, and population served were performed using a dataset of all community water systems in the U.S. (including tribal areas and territories). The demographic analyses in this report (inlcuding mapping), however, exclude systems in counties that are not included in the U.S. 2016 CDC-SVI data—including systems in Puerto Rico. See Appendix A ("Methods") for additional details. NRDC has separately analyzed the serious and widespread violations and poor enforcement in Puerto Rico, finding that water systems in violation served more than 99 percent of the archipelago's residents, including nearly 70 percent of systems violating health-based standards—and this was *before* hurricane Maria devastated the archipelago's water systems. NRDC, *Threats on Tap: Drinking Water Violations in Puerto Rico*, May 10, 2017, https://www.nrdc.org/resources/threats-tap-drinking-water-violations-puerto-rico (accessed July 29, 2019).

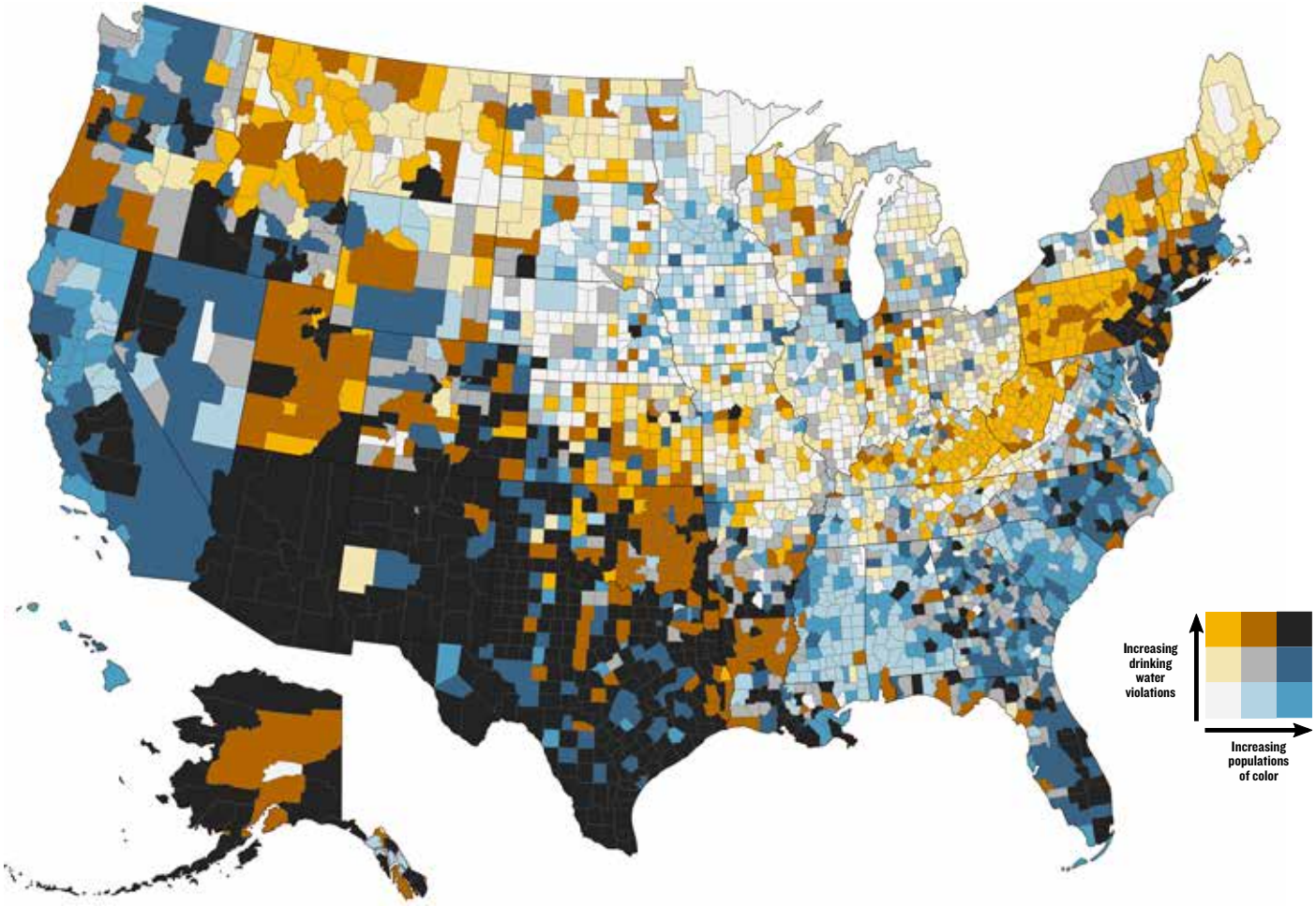
vi There were 49,678 community water systems in the 2019 quarter 2 Safe Drinking Water Information System dataset.

vii The estimated U.S. population on May 31, 2019, was 328,972,138. (See https://www.census.gov/popclock/ for population calculator.) Between June 1, 2016, and May 31, 2019, community water systems with at least one violation of the SDWA each served 39.5 percent of the U.S. population.

We identified 431 counties across the country (Figure 1) with the highest rate of drinking water violations (counties in the top third, nationally) **and** the highest racial, ethnic, and language vulnerability (counties in the top third, nationally).[viii]

**FIGURE 1: INTERSECTION OF ALL DRINKING WATER VIOLATIONS AND RACIAL, ETHNIC, AND LANGUAGE VULNERABILITY BY COUNTY, JUNE 1, 2016 TO MAY 31, 2019.**

Counties are shaded by the intersections of increasing rate of drinking water violations and increasing racial, ethnic, and language vulnerability. Demographic data from the 2016 Centers for Disease Control and Prevention Social Vulnerability Index.



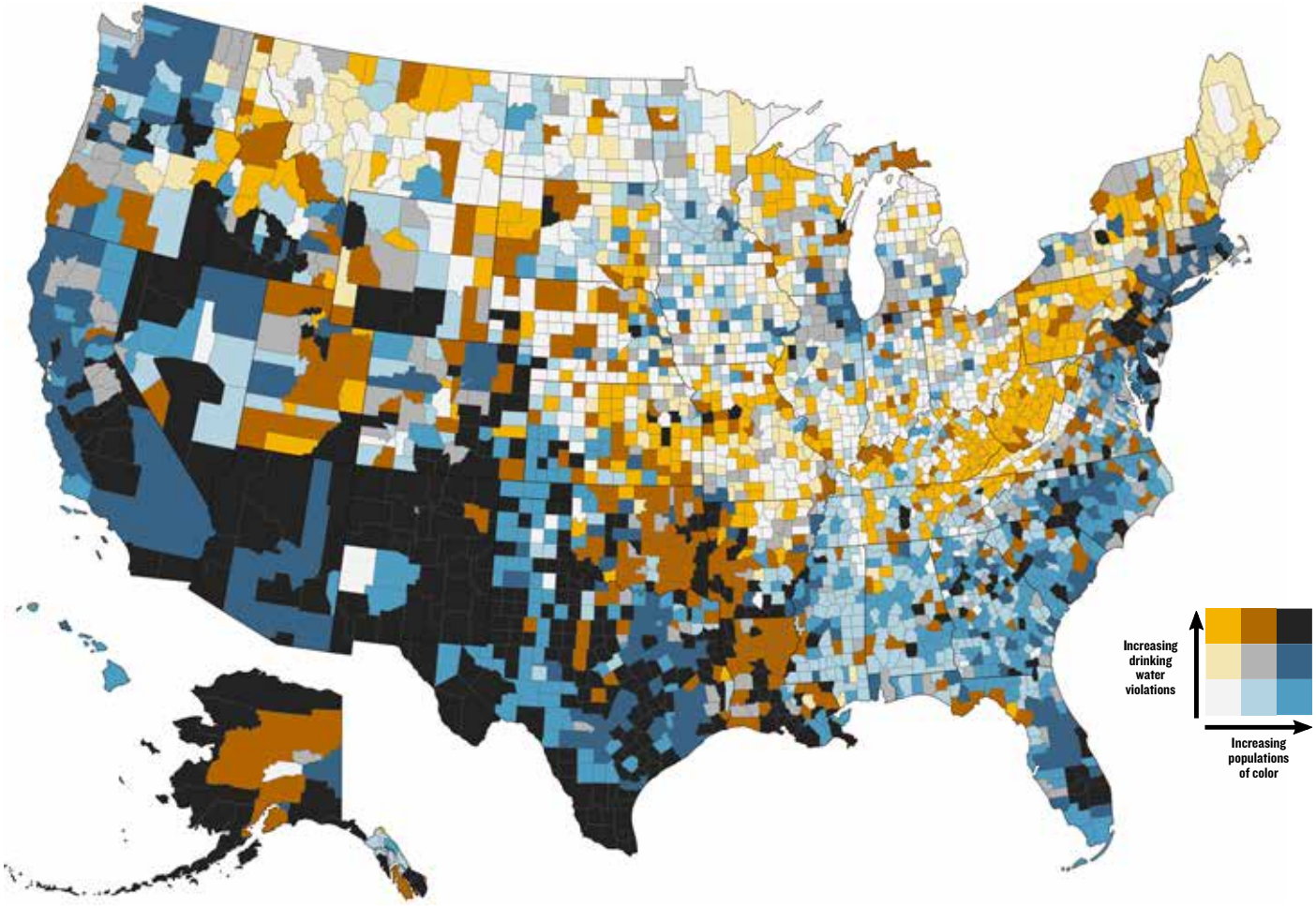

We found that 5,634 community water systems with a combined 23,040 health-based violations (the most severe violations) served 44,980,846 people. Potential health effects associated with these violations include cancer, developmental effects, compromised fertility, and nervous system effects. Some risks (for example, gastrointestinal disease caused by certain pathogens) can be especially dangerous and even fatal for members of vulnerable populations (for example, the elderly and immunocompromised).

Our analysis identified 406 counties (shaded black in Figure 2) with the highest rate of health-based drinking water violations (counties in the top third for violations)[ix] **and** the highest racial, ethnic, and language vulnerability.[x]

viii Counties in the top tertile (top 33rd percentile) ranked by percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.
ix Counties in the top tertile of the percentile ranking of number of violations per system.
x Counties in the top tertile ranked by percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.

**FIGURE 2: INTERSECTION OF HEALTH-BASED DRINKING WATER VIOLATIONS AND RACIAL, ETHNIC, AND LANGUAGE VULNERABILITY ACCORDING TO COUNTY, JUNE 1, 2016 TO MAY 31, 2019.**

Counties are shaded by the intersections of increasing rate of health-based drinking water violations and increasing racial, ethnic, and language vulnerability. Demographic data from the 2016 Centers for Disease Control and Prevention Social Vulnerability Index.




In addition to high rates of violations, **the relationship between racial, ethnic, and language vulnerability and persistence of violations was the strongest of all the relationships we studied across all compliance, enforcement, and sociodemographic characteristics.**

When examining slow or inadequate enforcement actions, we identified 437 counties across the country (Figure 3) with the longest average length of time out of compliance per system (counties in the top third, nationally) **and** the highest racial, ethnic, and language vulnerability (counties in the top third, nationally).[xi] These counties were predominantly in the southwest, including nearly every county in Arizona.

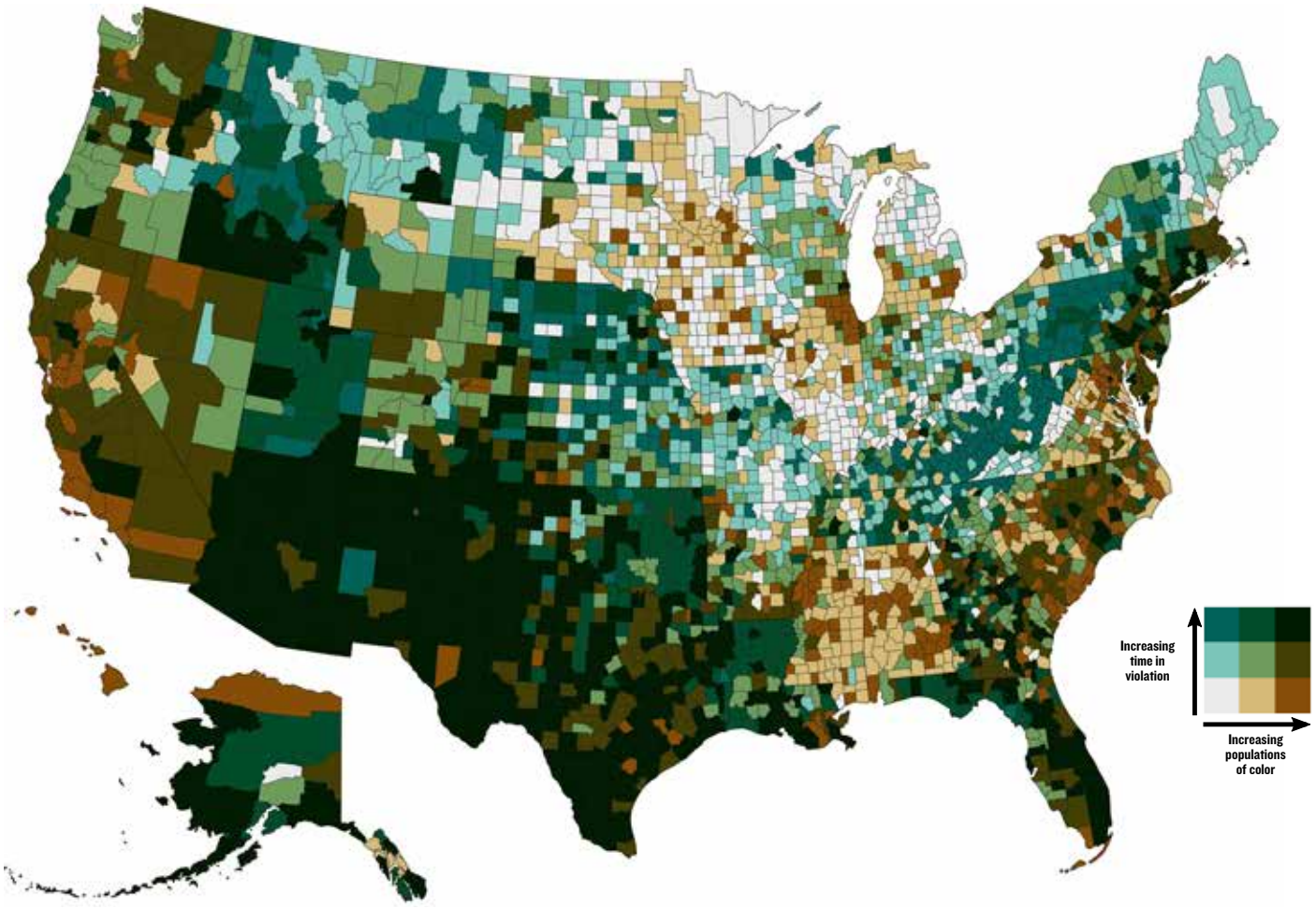
The percentage of systems with violations for 12 consecutive quarters (i.e., systems in chronic noncompliance) was 40 percent higher in counties with the highest racial, ethnic, and language vulnerability compared to counties with the lowest racial, ethnic, and language vulnerability.[xii]

xi Counties in the top tertile (top 33rd percentile) ranked by percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.

xii Counties with high racial, ethnic, and language vulnerability were those that were in the top tertile (top 33rd percentile) percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.

**FIGURE 3: INTERSECTION OF LENGTH OF TIME OUT OF COMPLIANCE AND RACIAL, ETHNIC, AND LANGUAGE VULNERABILITY BY COUNTY, JUNE 1, 2016 TO MAY 31, 2019.**

The most darkly shaded counties are those with the highest average number of quarters out of compliance per drinking water system (counties in the top third, nationally) and the highest racial, ethnic, and language vulnerability (counties in the top third, nationally). Racial, ethnic, and language vulnerability data from the 2016 Centers for Disease Control and Prevention Social Vulnerability Index.




## ENVIRONMENTAL JUSTICE COMMUNITIES FACE NUMEROUS, CUMULATIVE, AND DISPROPORTIONATE HEALTH AND ENVIRONMENTAL HAZARDS THAT COMBINE TO AMPLIFY THE HARM TO THESE COMMUNITIES

Extensive scholarship documents the disproportionate health and environmental hazards that Environmental Justice communities face. These communities are referred to as "Environmental Justice communities" because they often face greater numbers of or more dangerous hazards than other communities. These hazards include sites that are no longer operational but still pose a risk to communities (legacy sites), active facilities or sites currently or constantly emitting toxic pollution (polluting sites), and facilities or sites that present other hazards that are not routine or ongoing (for example, chemical storage tanks, facilities that could have chemical explosions or disasters). The multiple hazards can then aggregate to amplify the harm inflicted on these communities. These cumulative impacts can affect multiple generations and place additional weight on already overburdened communities.

### ENVIRONMENTAL JUSTICE COMMUNITY:

Communities of color, low-income communities, or Indigenous communities or populations that experience disproportionate environmental harms and risks, compared to communities with more white or more affluent people.

## FLINT, MICHIGAN, AS A MICROCOSM OF THE STATE OF OUR DRINKING WATER SYSTEM


© Brittany Greeson for NRDC

In 2015, the drinking water emergency in Flint, Michigan, leapt into the national headlines and gave the nation a startling glimpse into the drinking water crisis that plagues communities across the United States. Tens of thousands of Flint residents were exposed to lead—a potent neurotoxin for which there is no safe level of exposure—in some cases at levels 100 times higher[6] than the level of lead at which the EPA requires action.[xiii] This mass poisoning was the result of improper treatment of highly corrosive water from the Flint River, which caused a cascade of events resulting in lead leaching from thousands of service lines throughout the city.

Flint's ongoing public health crisis is a striking example of environmental injustice. Years of political neglect and ethical failures, including government officials callously downplaying or ignoring Flint's toxic water, meant that the majority-Black community's calls for help were ignored. As the Michigan Civil Rights Commission found, "a complex mix of historical, structural and systemic racism combined with implicit bias led to decisions, actions, and consequences in Flint [that] would not have been allowed to happen in primarily white communities."[7]

## SMALL SYSTEMS FACE ADDITIONAL CHALLENGES

Many small water systems do not have the capacity to maintain and improve their physical infrastructure, identify and address threats to drinking water (which facilities, industries, or factors outside their control often cause), or comply with current standards, as the Environmental Protection Agency (EPA) has noted. In addition, many small systems "are likely to serve low-income, vulnerable populations."[8] Our analysis found that small community water systems—those that serve fewer than 3,300 people—accounted for more than 80 percent of all violations and of health-based violations.[xiv] Nearly 50 percent of small systems had at least one violation compared to 43 percent of systems serving more than 3,300 people.[xv] We found that very small systems—those that serve less than 500 people—were responsible for more than 60 percent of all violations and 50 percent of health-based violations.[xvi] Similar to small systems, 50 percent of very small systems had at least one violation compared to 46 percent of systems serving more than 500 people.[xvii, xviii]

***The percentage of systems with violations for 12 consecutive quarters (i.e., systems in chronic noncompliance) was 40 percent higher in counties with the highest racial, ethnic, and language vulnerability compare to counties with the lowest racial, ethnic, and language vulnerability.***

## IT IS LIKELY THAT THE FULL SCOPE OF THE PROBLEM IS MUCH BIGGER

Although our analysis identified disproportionate risk from drinking water contamination in counties with high racial, economic, and housing/transportation vulnerability, it is likely that our research underestimates the true burden that Environmental Justice communities across the country face. The EPA regulates only a small subset of drinking water contaminants, and the agency has failed to adopt a single new standard for an unregulated contaminant since 1996. Therefore, many serious drinking water contamination threats (including polyfluoroalkyl and perfluoroalkyl substances or PFASs) are not violations of the law. In addition, monitoring and compliance data on regulated substances are woefully incomplete and occasionally even falsified. Finally, for most contaminants, drinking water is monitored at the point of entry into the distribution system, which does not detect contamination that enters the water or multiplies after that (as is the

xiii The U.S. EPA has set an "action level" for lead concentrations in water that exceeds 15 parts per billion, although experts warn that there is no safe level of lead in drinking water. This action level is not meant to be protective of health or an enforceable standard. It is merely a level that triggers further action by the water utility.

xiv The U.S. EPA designates drinking water systems serving fewer than 3,300 people as "small" systems. These systems accounted for 85.2 percent of all violations and 80.1 percent of health-based violations.

xv For systems serving less than 3,300 people, 49.9 percent of systems were in violation across all violation types. For systems serving more than 3,300 people, 42.7 percent of systems were in violation across all violation types. 11.3 percent systems serving fewer than 3,300 people and 11.7 percent of those serving more than 3,300 people had health-based violations.

xvi The U.S. EPA designates drinking water systems serving fewer than 500 people as "very small" systems. These systems accounted for 63.3 percent of all violations and 50.0 percent of health-based violations.

xvii For systems serving less than 500 people, 50.6 percent of systems had at least one violation across all violation types. For systems serving more than 500 people, 46.1 percent of systems had at least one violation across all violation types.

xviii 10.9 percent of systems serving fewer than 500 people and 11.9 percent of systems serving more than 500 people had health-based violations.

case with some microbial contaminants that can grow in the distribution system and certain chemical contaminants that can infiltrate into or leach from system pipes). For all of these reasons, it is likely that the true scope and severity of drinking water contamination, and the full picture of disproportionate effects, is greater than this study found.

## COMMON-SENSE SOLUTIONS EXIST

The EPA, states, and water systems have the necessary authority (and the responsibility) to uphold the intent of the SDWA to ensure clean, safe drinking water for all. Common-sense solutions—implemented quickly and equitably—can ensure safe water for all communities. Actions should be prioritized to address the needs of Environmental Justice communities. We recommend that federal, state, and local authorities:

***IDENTIFY, ENGAGE, and SUPPORT disproportionately impacted communities.***

Identification of underserved, overburdened, disproportionately affected communities is an important first step in developing plans and timelines to engage and support them. Environmental Justice policies and recommendations must be adopted and implemented quickly at all levels of decision-making. The sovereignty of Indigenous tribes must be respected, and community members must be engaged as active partners in setting agendas and priorities that affect their lives and communities.

***PREVENT water contamination.***

The Resource Conservation and Recovery Act, Superfund statute, Clean Water Act, and other laws give the EPA and states clear responsibility and many tools to prevent contamination and violations, but they too often fail to use them. The SDWA also should be strengthened to require comprehensive and enforceable source water protection measures. By the time serious water contamination has occurred, it is often too late to prevent damage to public health. Decision makers at all levels must use all the tools available to them (including the Clean Water Act and other laws and regulations) to prevent contamination of drinking water before it occurs.



***ACT immediately to address crisis situations to prevent exposure.***
The EPA and states routinely fail to respond quickly to immediate threats to drinking water or chronic drinking water crises, especially in Environmental Justice communities. In 2016, the EPA Inspector General concluded that crises like Flint's massive lead contamination should "generate a greater sense of urgency" and issued a management alert as a means of facilitating immediate EPA action in the future.[9] Decision makers at all levels should use all available tools to address crisis situations, closely monitor hazardous situations (for example, via news reports, resident complaints, databases) that pose threats to drinking water, and ensure immediate notification of affected communities. The EPA, and Congress, should also provide greater oversight and support when needed to ensure that crisis situations are efficiently and effectively addressed.

***FUND water infrastructure projects, giving priority to Environmental Justice communities.***
The EPA has noted that "some communities may be more challenged than others in their efforts to achieve the goals of safe and clean water" and that vulnerable, overburdened communities often lack the financial resources needed to ensure safe water.[10] Congress and state legislatures should make a major infusion of additional drinking water infrastructure funding, including grants for Environmental Justice communities, a top priority. In addition, the EPA and the states should redirect current funds to improve infrastructure in disproportionately affected, chronically neglected communities and ensure that underserved communities have the knowledge and capacity necessary to apply for funding resources (particularly in the form of grants, not loans). When funding improvements to infrastructure, decision makers must ensure that these improvements do not make water bills unaffordable for low-income customers.

***STRENGTHEN small systems.***
As the EPA itself notes, "small community water systems and tribal systems are often disproportionately impacted by technical, managerial, and financial capacity challenges."[11] Many of these systems serve Environmental Justice communities. The EPA and states should work with affected communities to strengthen and support the capacity of these systems to meet SDWA requirements and maintain safe drinking water, including restructuring small systems with serious or longstanding violations, or exploring partnering or consolidating them with nearby systems with greater capacity.

***ENFORCE the law.***
Laws and regulations are meaningless without full implementation and enforcement. The EPA and states should improve enforcement to include incentives and support for water utilities willing to acknowledge problems and work in good faith to solve them. Meaningful consequences for systems in willful violation, including tough penalties for falsified data, obfuscation, or refusal to remedy violations promptly, should also be used. States and the EPA must be held accountable for full enforcement of the SDWA, and our nation's civil rights laws (including Title VI of the Civil Rights Act of 1964 and Title VIII of the Civil Rights Act of 1968) must be implemented and enforced when systems (or states) are found to create disparate impacts based upon race.

***UNDERSTAND, DISCLOSE, AND PLAINLY EXPLAIN health threats and all impacts of water contamination.***
The EPA and states need to improve their processes for data collection and reporting regarding water contamination and its impacts. They must then convey that information using accessible language and distribution methods appropriate for the affected communities. For example, Spanish-speaking communities should receive the information in Spanish. Officials should take care not to minimize health risks. When local authorities or water utilities fail to inform people served adequately about health risks, it is incumbent upon the EPA and state officials to do so.

# *Introduction*

© Demetrius Freeman for NRDC

In 2015, the drinking water crisis in Flint, Michigan, exploded into the headlines, forcing the nation to confront the reality of its crumbling drinking water infrastructure and lax enforcement of its laws. Flint's water was laced with multiple contaminants (including harmful bacteria that killed at least a dozen people[12]), most infamously lead, which is especially dangerous for children and expectant mothers. No level of lead is safe for human consumption, but thousands of Flint residents were exposed to lead in their drinking water, in some cases at levels 100 times higher than the "action level"[xix] set by the EPA.[13] This mass poisoning was the result of intentional, ill-considered, and unlawful decisions that resulted in improper treatment of highly corrosive water from the Flint River, which caused a cascade of events resulting in lead leaching from thousands of service lines and lead-containing plumbing and fixtures into the drinking water throughout the city.

Flint's ongoing tragedy is a striking example of environmental injustice. Years of political neglect and ethical failures left the majority-Black community's requests for help unanswered. At the height of the uproar, government officials callously downplayed or ignored Flint's toxic water, insisting that the brown, stinking water was safe to drink. According to the Michigan Civil Rights Commission's final report on its investigation into the crisis, "the people of Flint have been subjected to unprecedented harm and hardship, much of it caused by structural and systemic discrimination and racism."[14]

What is even more alarming is that Flint is not an isolated case. Threats to our drinking water systems are everywhere: agricultural practices, chemical releases, antiquated and crumbling infrastructure that allows contaminants to leach into and infiltrate tap water, and inadequate contaminant removal. A 2017 NRDC analysis showed that, in 2015, more than 77 million people were served by systems that were in violation of the Safe Drinking Water Act (SDWA)[15]—the federal law intended to help ensure clean drinking water as a right for all Americans. That's nearly 25 percent of the U.S. population. Although these violations occurred in every state and territory in the nation, the magnitude was not spread equally across the country. For example, in 2015, drinking water systems that violated the SDWA served more than 99 percent of Puerto Rico's population.

So, it is no surprise that drinking water safety is a significant concern, especially for communities of color. A 2017 Gallup poll revealed that 80 percent of U.S. residents of color worry "a great deal" about the purity of their drinking water[16]—up from 73 percent in 2015.[17] For communities already overburdened with health and environmental hazards, which tend to be low-income communities and/or communities of color, toxic drinking water can be devastating.

NRDC, the Environmental Justice Health Alliance for Chemical Policy Reform (EJHA), and Coming Clean analyzed national drinking water data to investigate the relationships between SDWA violations and sociodemographic characteristics such as race and income, and found that drinking water violations, long-term noncompliance, and weak enforcement were more likely to occur in counties with greater racial, housing, transportation, and economic disenfranchisement. Racial, ethnic, and language vulnerability and poor housing and transportation quality, had the strongest relationships to drinking water violations. Racial, ethnic, and language vulnerability, had the strongest relationships of the characteristics studied with most indicators of weak compliance and enforcement, including length of time out of compliance.

This report documents how SDWA failures are related to race and class, deepens our understanding of the relationship between race and drinking water violations, and identifies common-sense solutions to ensure safe drinking water for Environmental Justice communities and all U.S. residents.

xix The EPA has set an "action level" for lead concentrations in water that exceeds 15 parts per billion—although experts warn that there is no safe level of lead in drinking water. This action level is not meant to be protective of health or an enforceable standard. It is merely a level that triggers further action by the water utility.


© Shutterstock

## ENVIRONMENTAL JUSTICE COMMUNITY:

Communities of color, low-income communities, or Indigenous communities or populations that experience disproportionate environmental harms and risks, compared to communities with more white or more affluent people.

## ENVIRONMENTAL INJUSTICE: A LONG HISTORY OF RESISTANCE

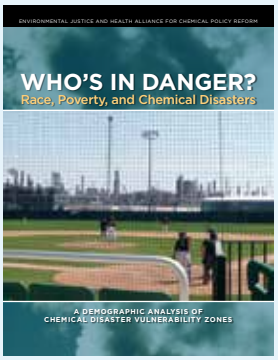
Hazardous soil. Noxious air. Undrinkable water. Toxic homes. Environmental contamination takes many forms. These threats can be found anywhere, but far too often the burden falls disproportionately on communities of color, low-income communities, and Indigenous communities.[18] These communities are referred to as Environmental Justice communities because they face greater environmental and health hazards compared to communities with more white or affluent people. They also often bear the weight of multiple old, current, and emerging threats to individual and community health.

Extensive evidence has demonstrated that Environmental Justice communities face extreme threats to their health and environments, including:

- Disproportionate numbers of toxic "legacy" sites (for example, former industrial areas, military facilities, closed or abandoned contaminated sites);[19]
- Large numbers and concentrations of chemical storage and industrial facilities that release toxic substances into the air, water, or soil and may present a constant risk of chemical disaster (see text boxes: *Who's in Danger*, *Life at the Fenceline*, and Charleston);[20]
- Air pollution from heavy traffic or ports;[21]
- Environmental exposure to heavy metals such as lead;[22]
- Workplace health and safety hazards for blue-collar jobs, which may also cause "take home" exposures to family members (for example, agricultural workers,[23] first responders, salon workers, custodial workers[24])
- Natural and human-caused disasters due to uneven preparedness and response, including the effects of climate change (for example, hurricanes Harvey and Maria);[25]
- Exposure to toxic chemicals and other contamination in consumer products, pesticides, food, and air.[26]

Exposure to these threats, particularly when combined with one another, can lead to severe health problems, including cancer, developmental and behavioral challenges, asthma, and premature death, which often occur at higher rates in Environmental Justice communities.

## *WHO'S IN DANGER?* AND *LIFE AT THE FENCELINE*



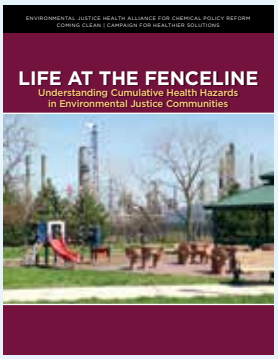

### WHO'S IN DANGER? RACE, POVERTY, AND CHEMICAL DISASTERS

In May 2014, the Environmental Justice Health Alliance for Chemical Policy Reform (EJHA), Coming Clean, and the Center for Effective Government released *Who's in Danger? Race, Poverty, and Chemical Disasters.*[xx] This groundbreaking report documented the disproportionate danger posed to people in "fenceline zones"[xxi] close to high-risk chemical facilities—areas that are home to disproportionate numbers of people of color and low-income people.

The analysis examined five demographic indicators (home value, household income, race and ethnicity, education level, poverty rate) near 3,433 facilities in several common industries that use or store highly hazardous chemicals. Their findings were sobering. **The percentage of Blacks in these fenceline zones was 75 percent greater than for the United States as a whole, and the percentage of Latinos was 60 percent greater.** The poverty rate in fenceline zones was 50 percent higher than for the United States as a whole.

### LIFE AT THE FENCELINE: UNDERSTANDING CUMULATIVE HEALTH HAZARDS IN ENVIRONMENTAL JUSTICE COMMUNITIES

Four years later, in September 2018, the EJHA, Coming Clean, and the Campaign for Healthier Solutions published a new report on health and environmental hazards in Environmental Justice communities. *Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities* sought to identify and explain several interconnected health and environmental effects in Environmental Justice communities and to identify solutions.[xxii] The report examined key national data and additional data for nine EJ communities.




The report analyzed the demographic characteristics of communities within 3 miles of the most high-risk industrial and commercial facilities, the cancer and respiratory risks these communities face from toxic air pollution, whether they have access to healthy food, and locations of key institutions (schools, hospitals, nursing homes, dollar stores).

In most of the communities studied, large majorities of the total community population lived in "fenceline zones"[xxiii] around highly hazardous facilities, and most of their schools and medical institutions were located in these zones, at much higher rates than nationally. **These fenceline zone populations face multiple health hazards and risks and were disproportionately Black, Latino, and impoverished.** In addition to the constant threat of catastrophic chemical releases or explosions, fenceline zones faced higher risk of cancer from toxic air pollution than the entire area (and often much higher than for the United States as a whole). Areas that were both low income and had limited access to healthy foods were even more heavily and disproportionately affected.



xx The full report and related documents are available at https://comingcleaninc.org/assets/media/images/Reports/Who's%20in%20Danger%20Report%20FINAL.pdf.

xxi In this report, "fenceline zones" were defined as one-tenth the distance of the full worst-case chemical release scenario for a high-risk facility (which can be as large as 25 miles in radius).

xxii The full report and related documents are available at https://ej4all.org/life-at-the-fenceline.

xxiii In this report, "fenceline zones" were defined as those within 3 miles of the most hazardous industrial and commercial facilities, which have "worst case" chemical release zones that can extend up to 25 miles in radius.

***Drinking water violations, long-term noncompliance, and weak enforcement were more likely to occur in counties with greater racial, housing, transportation, and economic disenfranchisement.***

Lack of access to health care facilities, healthy food, and adequate formal education opportunities can further hamstring communities. Inequities that arise from racial, economic, and political barriers (for example, poverty, residential segregation, poor or hazardous housing, racial discrimination) can also result in physiological changes in whole populations (for example, changes to the immune, neuroendocrine, and cardiovascular systems),[27] making them even more susceptible to environmental health threats.[28] Life stage and health status (for example, infancy, pregnancy, older age, underlying health conditions) can heighten this susceptibility.[29] These multiple health, social, and environmental hazards create interconnected, cumulative impacts in Environmental Justice communities, which can severely limit their ability to grow and thrive.[30]

Nevertheless, these communities have maintained a strong spirit of resistance. The modern Environmental Justice movement began with protests over the dumping of poison-laced soil in rural North Carolina (Text Box—Warren County, North Carolina). It remains a grassroots-led effort that asserts that all people have the right to a safe environment. Environmental Justice is also a set of principles designed to dismantle the unequal distribution of environmental burdens across communities (see "Principles of Environmental Justice"). It is also designed to ensure that community members are able to participate meaningfully in making decisions that affect their future.

## CHARLESTON, WEST VIRGINIA

Each year, across the United States, thousands of hazardous substance spills occur from aboveground storage tanks,[xxiv] often spoiling drinking water sources. From 2005 to 2014, U.S. facilities reported 20,432 spills (an average of more than 2,000 per year).[31] These incidents included 149 different hazardous substances, commonly including benzene, sulfuric acid, chlorine, hydrogen cyanide, and hydrochloric acid.[32] Many of these chemicals cause immediate and severe health effects, such as chemical burns or even death. Others cause a range of chronic health problems, including impairment of nervous system function, corrosion of the respiratory and gastrointestinal organs, and cancer.[33] These spills are more likely to occur in majority non-white counties than majority white counties.[34]

In January 2014, a chemical storage tank at Freedom Industries near Charleston, West Virginia, leaked more than 10,000 gallons of the toxic chemical 4-methylcyclohexanemethanol into the Elk River, which provides drinking water for nearly 300,000 people in nine counties. This spill cost local businesses and the local economy $19 million a day.[35] Workers in lower-wage service industries suffered more from the spill than workers in higher-wage industries because of loss of output or business for which clean water is essential to services or production.[36]

Charleston and other West Virginia residents face a wide variety of chemical threats to their drinking water, health, and daily safety. The Charleston area hosts 13 high-risk chemical facilities included in the Environmental Protection Agency's Risk Management Plan program,[37] which covers industrial and commercial facilities that use or store extremely hazardous chemicals that create constant risk of a catastrophic chemical release or explosion. Seventy percent of Charlestonians live within 3 miles of these facilities, compared with 39 percent nationally.[38]

© Maya Nye/Courtesy of Coming Clean, Inc.

People in Charleston face the highest cancer risk from toxic air pollutants of all nine areas studied in *Life at the Fenceline*.[39] That risk is even greater for those living in low-income/low food access areas within 3 miles of a Risk Management Plan facility in the Charleston area.

***"Hazardous substance spills pose a significant public health threat, particularly to those who live in low-income communities and communities of color," said Pam Nixon, People Concerned About Chemical Safety.[xxv] "West Virginia residents know exactly what it's like to lose our drinking water to a chemical spill and to have state authorities and federal regulators fail to hold polluting industries accountable and prevent contamination. We need action at all levels to protect our drinking water."***

xxiv Aboveground storage tanks are bulk storage containers that are used to store chemicals and petroleum products, hazardous waste, or other hazardous materials. No one, not even the federal government, knows how many aboveground storage tanks there are across the country (although there are at least several tens of thousands), what chemicals they contain, how close they are to drinking water sources, how often they are inspected (if ever), or what spill prevention or containment measures are (or are not) in place. Most drinking water providers do not know where tanks are, what chemicals they hold, or how close they are to water sources.

xxv People Concerned About Chemical Safety, a community organization in Charleston, West Virginia, and the chemical industry center of Kanawha Valley and a member of the Environmental Justice Health Alliance, promotes international human rights pertaining to environmental and chemical safety through education and advocacy and serves as a watchdog to ensure that facilities uphold existing chemical safety laws.


## WARREN COUNTY, NORTH CAROLINA—BIRTH OF THE MODERN ENVIRONMENTAL JUSTICE MOVEMENT

In the summer of 1978, men hired by the Ward Transformer Company to remove its hazardous waste began illegally spraying 31,000 tons of transformer oil containing toxic polychlorinated biphenyls (PCBs) along 240 miles of North Carolina highways. These midnight dumpings took place over 14 counties and ignored the hazardous waste disposal regulations established in the Resource Conservation and Recovery Act. Upon discovering the massive contamination resulting from the spraying, the state of North Carolina decided to build a landfill to hold the 60,000 tons of contaminated soil in a politically neglected, majority-Black, economically starved community in Warren County.

Upon hearing of the state's decision, residents immediately began organizing against the landfill. They established community groups, brought litigation, and attended state and Environmental Protection Agency (EPA) meetings in droves. They were concerned that the contaminants in the soil could contaminate their water supply and believed that the decision to dump it in their backyard was based on racial discrimination.

The six-week long Warren County protests began in September 1982 and garnered national media attention. In the end, 523 people, including 94 juveniles, were arrested as a result of the public demonstrations against the toxic dumping.[40] Rev. Donald Jarboe, one of the protestors, told the *New York Times*, "This is a life-and-death issue."[41]

Although the protests did not stop the siting of the landfill, the Warren County protests are widely recognized as the beginning of the modern Environmental justice movement,[42] which has achieved many successes in the ensuing decades,[43] including President Clinton's Executive Order 12898 on Environmental Justice,[44] the first (1991) and second (2002) National People of Color Environmental Leadership Summits,[45] and establishment of the EPA Office of Environmental Justice[46] and the National Environmental Justice Advisory Council.[47] Many states and cities have also adopted Environmental Justice polices, and many Environmental Justice communities have won important victories. The movement's accomplishments have been well documented, including in *Environmental Justice Milestones and Accomplishments: 1964–2014*.[48]

## PRINCIPLES OF ENVIRONMENTAL JUSTICE

Seventeen principles of Environmental Justice were adopted on October 27, 1991, at the First National People of Color Environmental Leadership Summit.

PREAMBLE

WE, THE PEOPLE OF COLOR, gathered together at this multinational People of Color Environmental Leadership Summit, to begin to build a national and international movement of all peoples of color to fight the destruction and taking of our lands and communities, do hereby re-establish our spiritual interdependence to the sacredness of our Mother Earth; to respect and celebrate each of our cultures, languages and beliefs about the natural world and our roles in healing ourselves; to ensure environmental justice; to promote economic alternatives which would contribute to the development of environmentally safe livelihoods; and, to secure our political, economic and cultural liberation that has been denied for over 500 years of colonization and oppression, resulting in the poisoning of our communities and land and the genocide of our peoples, do affirm and adopt these Principles of Environmental Justice:

1. **Environmental Justice** affirms the sacredness of Mother Earth, ecological unity and the interdependence of all species, and the right to be free from ecological destruction.
2. **Environmental Justice** demands that public policy be based on mutual respect and justice for all peoples, free from any form of discrimination or bias.
3. **Environmental Justice** mandates the right to ethical, balanced and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things.
4. **Environmental Justice** calls for universal protection from nuclear testing and the extraction, production and disposal of toxic/hazardous wastes and poisons that threaten the fundamental right to clean air, land, water, and food.
5. **Environmental Justice** affirms the fundamental right to political, economic, cultural and environmental self-determination of all peoples.
6. **Environmental Justice** demands the cessation of the production of all toxins, hazardous wastes, and radioactive materials, and that all past and current producers be held strictly accountable to the people for detoxification and the containment at the point of production.
7. **Environmental Justice** demands the right to participate as equal partners at every level of decision-making including needs assessment, planning, implementation, enforcement and evaluation.
8. **Environmental Justice** affirms the right of all workers to a safe and healthy work environment, without being forced to choose between an unsafe livelihood and unemployment. It also affirms the right of those who work at home to be free from environmental hazards.
9. **Environmental Justice** protects the right of victims of environmental injustice to receive full compensation and reparations for damages as well as quality health care.
10. **Environmental Justice** considers governmental acts of environmental injustice a violation of international law, the Universal Declaration on Human Rights, and the United Nations Convention on Genocide.
11. **Environmental Justice** must recognize a special legal and natural relationship of Native Peoples to the U.S. government through treaties, agreements, compacts, and covenants affirming sovereignty and self-determination.
12. **Environmental Justice** affirms the need for urban and rural ecological policies to clean up and rebuild our cities and rural areas in balance with nature, honoring the cultural integrity of all our communities, and providing fair access for all to the full range of resources.
13. **Environmental Justice** calls for the strict enforcement of principles of informed consent, and a halt to the testing of experimental reproductive and medical procedures and vaccinations on people of color.
14. **Environmental Justice** opposes the destructive operations of multi-national corporations.
15. **Environmental Justice** opposes military occupation, repression and exploitation of lands, peoples and cultures, and other life forms.
16. **Environmental Justice** calls for the education of present and future generations which emphasizes social and environmental issues, based on our experience and an appreciation of our diverse cultural perspectives.
17. **Environmental Justice** requires that we, as individuals, make personal and consumer choices to consume as little of Mother Earth's resources and to produce as little waste as possible; and make the conscious decision to challenge and reprioritize our lifestyles to ensure the health of the natural world for present and future generations.

# *Drinking Water Contamination and Environmental Justice Communities*

Although previous research has identified that drinking water violations burden Environmental Justice communities more heavily than other communities (see Text Box—The Science of Environmental Justice and Drinking Water Contamination), **no study to our knowledge has examined and mapped the relationship between sociodemographic characteristics and compliance with and enforcement of laws governing all drinking water contaminants in all community water systems in the country.** NRDC, the Environmental Justice Health Alliance for Chemical Policy Reform (EJHA), and Coming Clean conducted an in-depth analysis of the relationship between all SDWA violations by the approximately 50,000 active community water systems[xxvi] in the country and sociodemographic factors such as race and socioeconomic status. Our analysis relied on data from June 1, 2016 to May 31, 2019,[xxvii] and included nearly 200,000 SDWA violations.

Our analysis revealed that a given county's racial, housing, and economic vulnerability (see Text Box—Vulnerability) was related to drinking water violations. (See Appendix A and Text Box "Methods At-A-Glance" for additional details on our methods). More specifically, we found that the rate of drinking water violations[xxviii] was greater in counties with greater percentages of their populations with high racial, ethnic, and language vulnerability;[xxix] crowded housing and limited transportation access;[xxx] and low socioeconomic status.[xxxi] (See Appendix B for statistical details.) Racial, ethnic, and language vulnerability, and housing and transportation quality,[xxxii] had the strongest relationships.

## VULNERABILITY

As defined by the World Health Organization, vulnerability is "the degree to which a population, individual, or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters."[49] Vulnerability is "socially constructed, i.e., it arises out of the social and economic circumstances of everyday living."[50]

The vulnerability of some communities and populations to hazards (including chemical spills) is not a coincidence or their own fault, but rather the consequence of underlying social and political factors and decisions, especially institutional racism and public policies that disadvantage communities of color and Indigenous communities. As noted 25 years ago in the literature on community vulnerability and "natural" disasters (and as known by these communities themselves for much longer), "there are no really generalized opportunities and risks in nature, but instead there are sets of unequal access to opportunities and unequal exposures to risks which are a consequence of the socio-economic system."[51]

Our analysis also revealed that **of all the sociodemographic characteristics analyzed, racial, ethnic, and language vulnerability had the strongest relationship to slow and inadequate enforcement.**[xxxiii] Although all indicators of weak compliance and enforcement increased with increases in all of the sociodemographic characteristics studied, racial, ethnic, and language vulnerability (Appendix B, Table B-2) bore the strongest relationship to average number of quarters with violations,[xxxiv] number of violations, and average number of rules in violation.

These findings show that the drinking water systems in counties with greater racial, ethnic, and language vulnerability tended to spend more time out of compliance with the law for more violations for more contaminants. Although the average number of formal enforcement actions increased as racial, ethnic, and language vulnerability increased at the county level,

xxvi There were 49,678 active community water systems in the 2019 quarter 2 SDWIS dataset. The SDWA defines a community water system as a public drinking water system that "serves at least 15 service connections used by year-round residents" or "regularly serves at least 25 year-round residents" (42 U.S.C. § 300f(15)). This definition is in contrast to the broader term "public water system," which includes community water systems as well as water systems that do not serve people year-round. Active systems were defined as those that were operational as of May 31, 2019.

xxvii The most recent data available at the time of the study.

xxviii The rate of drinking water violations was defined as the number of drinking water violations in a county divided by the *total* number of community water systems in the county. This rate (number of violations per system) was then ranked, as a percentile, for all counties in the United States.

xxix Populations with high racial, ethnic, and language vulnerability face high risk of adversity from the effect of multiple stressors due to heightened social pressures associated with race and ethnicity and language spoken.

xxx Populations with poor housing and transportation quality reside in multiunit housing, live in crowded housing conditions, or have limited access to vehicles.

xxxi Populations of low socioeconomic status have higher unemployment, lower per capita income, and lower education attainment and are more likely to live below the poverty line.

xxxii As defined by the percentile ranking of the "Minority Status/Language" theme (Theme 3) of the CDC Social Vulnerability Index (SVI). The Minority Status/Language theme is a measure that captures the percentage of a given population (in this case the county) who are not non-Hispanic white and the percentage of the population over the age of five who do not speak English at all or do not speak English well.

xxxiii As defined by the percentile ranking of the "Minority Status/Language" theme (Theme 3) of the CDC-SVI.

xxxiv The SDWIS updates violations quarterly (every 3 months). Enforcement and Compliance History Online uses the SDWIS information to derive compliance and enforcement values for systems using this quarterly information.

violations remained uncorrected. That means that, as racial, ethnic, and language vulnerability increases in a county, long-term noncompliance and weak enforcement also increase. For communities with high racial, ethnic, and language vulnerability, problems remain uncorrected for longer periods of time even after they have been identified.

## INSUFFICIENT COMPLIANCE AND WEAK ENFORCEMENT LEAVE MILLIONS WAITING FOR SAFE WATER

### Rate of violations

Our analysis[xxxv] revealed 170,959 violations of the SDWA in 24,133 community water systems between June 1, 2016 and May 31, 2019.[xxxvi] 129,907,275 people (nearly 40 percent of the U.S. population) obtained their water from drinking water systems that were in violation of the law (see Appendix C, Table C-1 for violation statistics by rule).[xxxvii] These violations included health-based, monitoring and reporting, and disclosure violations.

We identified 431 counties across the country (Figure 1) with the highest rate of drinking water violations (counties in the top third, nationally) **and** the highest racial, ethnic, and language vulnerability (counties in the top third, nationally).[xxxviii]

For health-based violations, alone, we found that 5,634 community water systems with a combined 23,040 health-based violations (the most severe violations) served 44,980,846 people (see Appendix C, Table C-2 for health-based violation statistics by rule). Potential health effects associated with these violations include cancer, developmental effects, compromised fertility, nervous system effects, and gastrointestinal disease—potentially leading to death for members of vulnerable populations (for example, the elderly, and immunocompromised).

Our analysis identified 406 counties (shaded black in Figure 2) with the highest rate of health-based drinking water violations (counties in the top third for violations)[xxxix] **and** the highest racial, ethnic, and language vulnerability[xl] (counties in the top third) nationally.


© Brittany Greeson for NRDC

### SCIENCE OF ENVIRONMENTAL JUSTICE AND DRINKING WATER CONTAMINATION

In addition to the lived experiences of Environmental Justice communities, a growing body of scientific literature connects social characteristics such as race and income to subpar drinking water. In other words, it is not a coincidence.

- In 2011, Balazs *et al* found that systems with elevated nitrate levels in California's San Joaquin Valley were smaller, served larger percentages of Latino populations, and/or had more renters than systems with less-elevated nitrate levels.[52] Nitrates have been linked to blue-baby syndrome (a potentially life-threatening condition), reproductive toxicity, developmental effects, and various cancers.[53]
- In a follow-up study in 2012, Balazs *et al* found that communities with lower socioeconomic status in the San Joaquin Valley were more likely than those with higher socioeconomic status to be exposed to arsenic, a known human carcinogen.[54] In addition, systems serving these communities faced greater challenges in complying with the Safe Drinking Water Act (SDWA) because of limited technical, managerial, and financial capacity.
- A 2017 study by Switzer and Teodoro found that, nationally, low-income Black and Latino populations were more likely to experience health-based SDWA violations than similar low-income populations that were non-Latino and white.[55]
- A 2018 paper by McDonald and Jones found that populations with lower socioeconomic status and populations of color had greater odds of single and repeat SDWA violations.[56]

These findings highlight the grave local and national inequities that Environmental Justice communities face.

xxxv These values include violations in all community water systems in the U.S., including tribal areas and territories. Demographic analysis (including mapping efforts) excludes systems in counties that are not present in the U.S. 2016 CDC-SVI data, including systems in Puerto Rico. See Appendix A ("Methods") for additional details.

xxxvi There were 49,678 community water systems in the 2019 quarter 2 SDWIS dataset.

xxxvii The estimated population of the United States on May 31, 2019, was 328,972,138. (See https://www.census.gov/popclock/ for population calculator.) Between June 1, 2016 and May 31, 2019, community water systems with at least one violation of the SDWA served 39.5 percent of the U.S. population.

xxxviii Counties in the top tertile (top 33rd percentile) ranked by percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.

xxxix Counties in the top tertile of the percentile ranking of number of violations per system.

xl Counties in the top tertile ranked by percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.

**FIGURE 1: INTERSECTION OF ALL DRINKING WATER VIOLATIONS AND RACIAL, ETHNIC, AND LANGUAGE VULNERABILITY BY COUNTY, JUNE 1, 2016 TO MAY 31, 2019.**

Counties are shaded by the intersections of increasing rate of drinking water violations and increasing racial, ethnic, and language vulnerability. Demographic data from the 2016 Centers for Disease Control and Prevention Social Vulnerability Index.

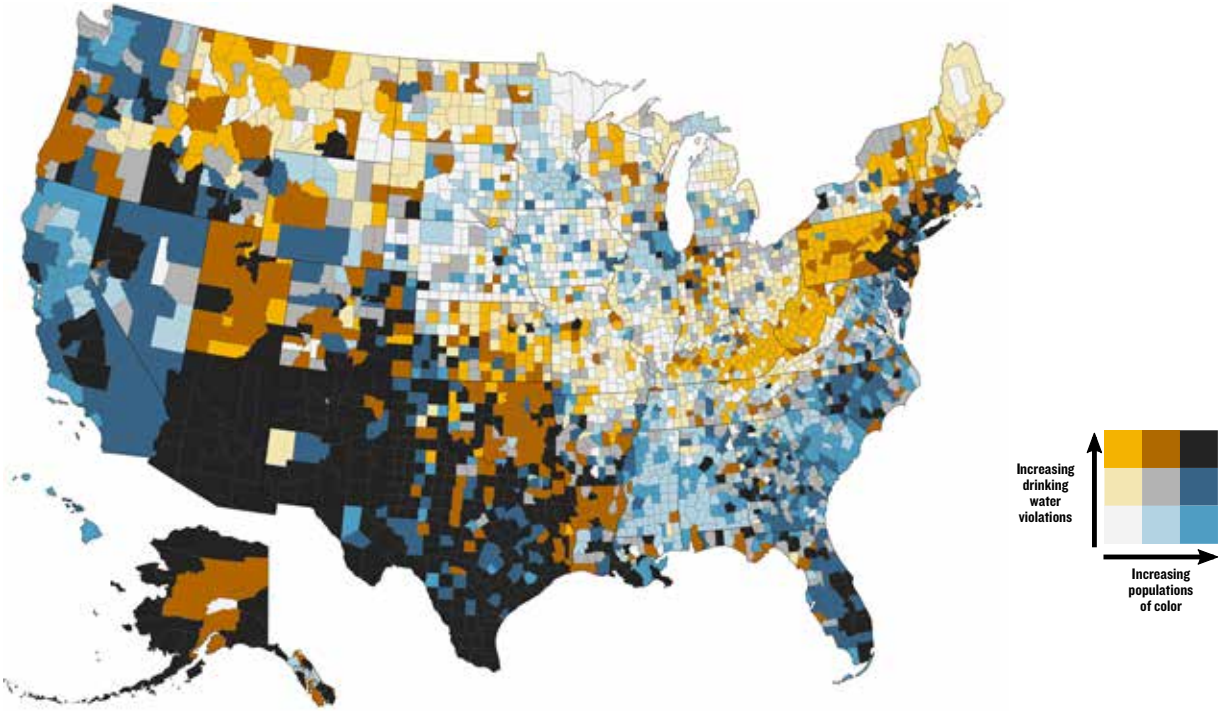
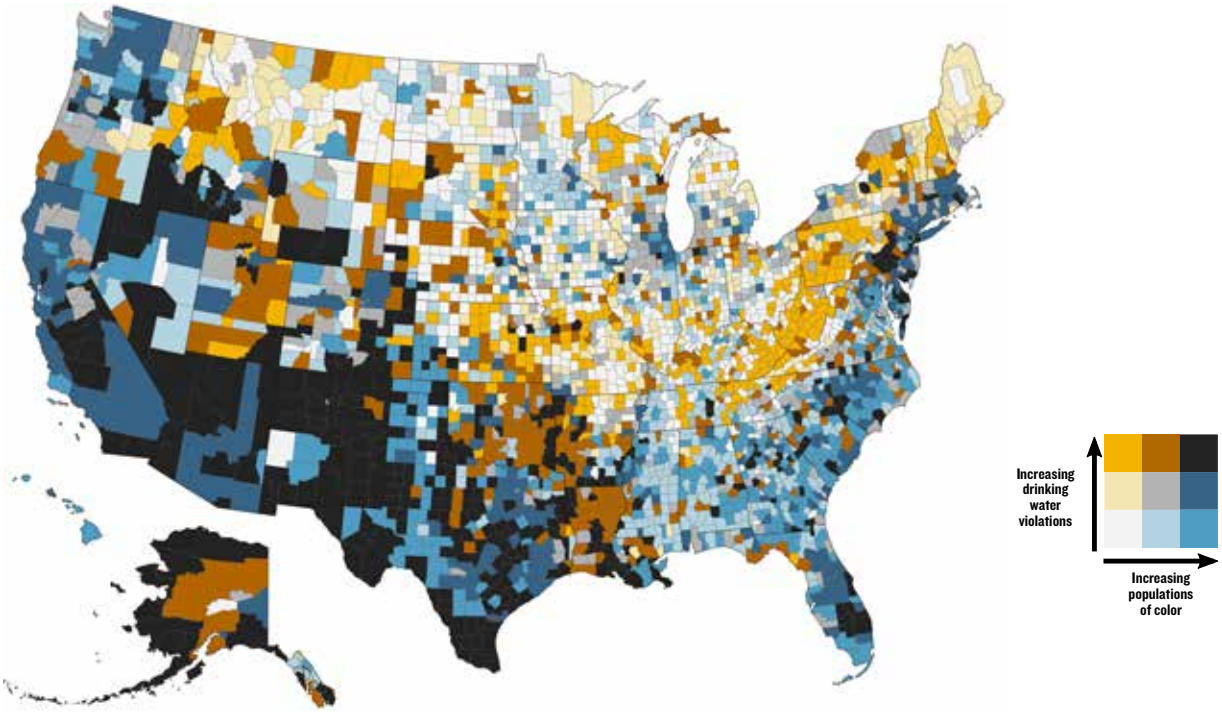



**FIGURE 2: INTERSECTION OF HEALTH-BASED DRINKING WATER VIOLATIONS AND RACIAL, ETHNIC, AND LANGUAGE VULNERABILITY ACCORDING TO COUNTY, JUNE 1, 2016 TO MAY 31, 2019.**

Counties are shaded by the intersections of increasing rate of health-based drinking water violations and increasing racial, ethnic, and language vulnerability. Demographic data from the 2016 Centers for Disease Control and Prevention Social Vulnerability Index.



## Length of noncompliance

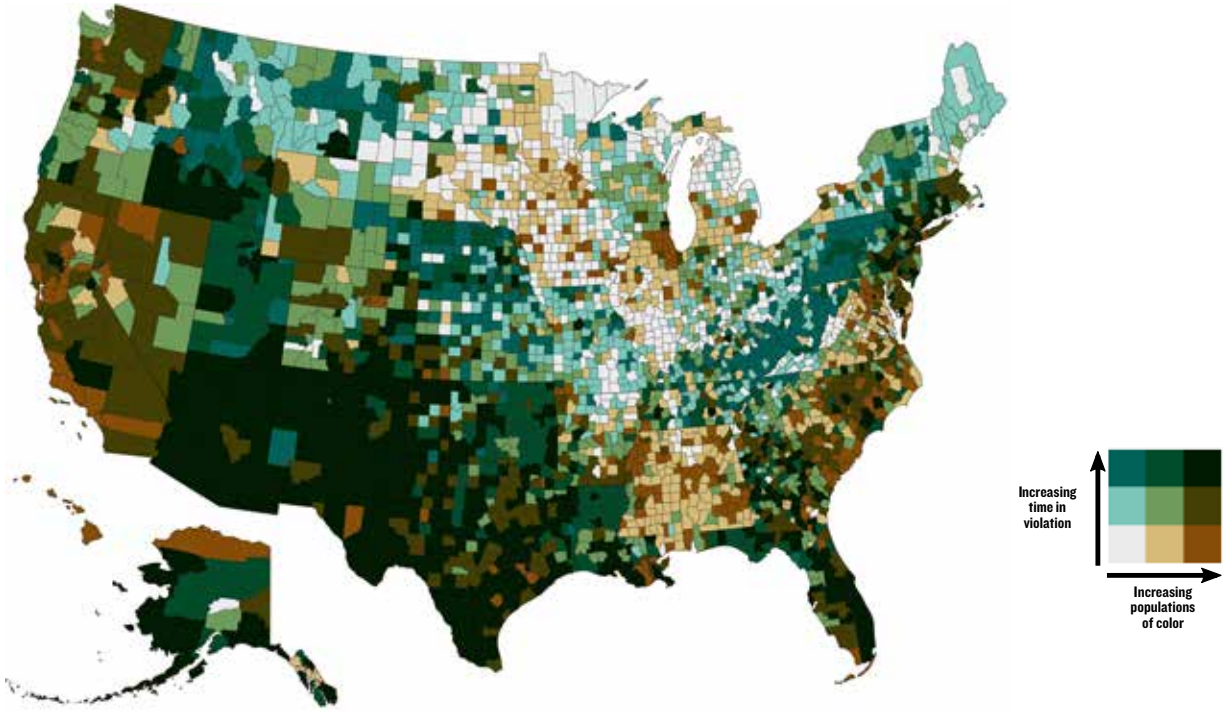
When the potential relationship between sociodemographic characteristics and length of time out of compliance were assessed, racial, ethnic, and language vulnerability had the strongest correlation with length of time out of compliance (Appendix B, Table B-2).

We identified 437 counties across the country (Figure 3) with the longest average length of time out of compliance per system (counties in the top third, nationally) **and** the highest racial, ethnic, and language vulnerability (counties in the top third, nationally).[xli] These counties were predominantly found in the southwest, including almost every county in Arizona.

The percentage of systems with violations for 12 consecutive quarters (i.e., systems in chronic noncompliance) was 40 percent higher in counties with the highest racial, ethnic, and language vulnerability compared to counties with the lowest racial, ethnic, and language vulnerability.[xlii]

**FIGURE 3: INTERSECTION OF LENGTH OF TIME OUT OF COMPLIANCE AND RACIAL, ETHNIC, AND LANGUAGE VULNERABILITY BY COUNTY, JUNE 1, 2016 TO MAY 31, 2019.**

The most darkly shaded counties are those with the highest average number of quarters out of compliance per drinking water system (counties in the top third, nationally) and the highest racial, ethnic, and language vulnerability (counties in the top third, nationally). Racial, ethnic, and language vulnerability data from the 2016 Centers for Disease Control and Prevention Social Vulnerability Index.




## SAFE DRINKING WATER VIOLATION TYPES DEFINED

Violations of the Safe Drinking Water Act fall into three primary categories:

- **HEALTH-BASED VIOLATIONS:** level of contamination exceeds, or treatment techniques fail to meet, health-based standards. These violations can directly harm human health.
- **MONITORING AND REPORTING VIOLATIONS:** failure to monitor or submit monitoring results regularly to the primacy agency or Environmental Protection Agency.
- **PUBLIC NOTIFICATION (DISCLOSURE) AND OTHER VIOLATIONS:** failure to notify the public about drinking water quality (public notification) and violations of other requirements that the above violation types do not cover (other violations).

xli Counties in the top tertile (top 33rd percentile) ranked by percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI.

xlii Counties with high racial, ethnic, and language vulnerability were those that were in the top tertile (top 33rd percentile) percentage ranking of the "Minority Status/Language" theme (Theme 3) in the CDC-SVI. The percentage of systems in chronic violation was determined by dividing the number of systems with at least one violation during all 12 quarters by the total number of systems serving a particular race/ethnicity/language category. 14.6 percent of systems in the lowest 33rd percentile and 20.2 percent of systems in the highest 33rd percentile for race/ethnicity/language were in chronic violation.

*For communities with high racial, ethnic, and language vulnerability, problems remain uncorrected for longer periods of time even after they have been identified.*

Although formal enforcement actions at the county level increased as racial, ethnic, and language vulnerability increased, enforcement actions taken against the systems were largely ineffective and failed to correct the violations (Appendix B, Table B-2). The persistence of violations despite formal enforcement actions had the strongest relationship of any variable we studied with racial, ethnic, and language vulnerability, and this relationship was the strongest of all the relationships we studied across all compliance, enforcement, and sociodemographic characteristics. This illustrates that enforcement in these communities, even formal enforcement actions,[xliii] has not been strong enough to correct the problems fully. Clearly, there is a need for substantial additional funding, technical assistance, and possibly restructuring or other long-term solutions to address these issues rather than allowing them to fester.

## METHODS AT A GLANCE

As described in greater detail in Appendices A through C, we used public data from the Environmental Protection Agency Safe Drinking Water Information System (SDWIS)[xliv] and focused on violations in the most recent data available at the time of this study (June 1, 2016 to May 31, 2019).[xlv] We analyzed trends for all violations combined and for health-based violations alone (a subset of all violations). To assess enforcement and compliance trends in the data, we used the SDWIS-based Enforcement and Compliance History Online tool.[xlvi]

For social and demographic factors such as race and income, we used data from the 2012 to 2016 U.S. Census Bureau American Community Survey[57] and the Centers for Disease Control and Prevention Social Vulnerability Index—a powerful tool that helps identify communities most in need of support before, during, and after a disaster (for example, disease outbreaks, chemical disasters, flooding)[xlvii] by generating percentile rankings for each county for each social and demographic feature. Our assessment used counties because they are the smallest, most uniform geographic unit available for drinking water systems in the SDWIS. (See Appendix A for more details about the methods.)

To identify relationships between drinking water violations and socioeconomic factors at the county level,[xlviii] we first divided the number of violations by the total number of drinking water systems in the county. We then ranked this county-level drinking water violation rate, as a percentile, for all counties in the United States. Then we used Pearson correlations to assess the magnitude, direction, and statistical significance of potential relationships. For other compliance (for example, length of time out of compliance) and enforcement (for example, number of formal enforcement actions) metrics, we calculated county-level averages and sums for relevant metrics and ranked values as percentiles for all counties in the United States. We then used Pearson correlations to assess the magnitude, direction, and statistical significance of potential relationships.

xliii Once the EPA establishes health standards and monitoring and reporting rules, primacy states are supposed to enforce them and report any violations and related information to the EPA every quarter. When a violation occurs, the state is supposed to bring the system back into compliance. States tend to begin with informal enforcement steps, such as warning letters, telephone calls, or field visits. If the violation continues or recurs, the state is supposed to initiate the formal enforcement process to bring the system into compliance. These actions could include issuing an administrative order, seeking administrative fines, referring a civil case to the state attorney general, and requesting the filing of criminal charges

xliv A U.S. EPA database containing information about all public water systems in the United States. It contains information about each public water system, including system name, number of people that the system serves, type of water that the system uses (e.g., surface water, groundwater), system type (e.g., community water system), and general location (e.g., county or city served). The SDWIS also includes information about any violations the system may have, including failure to treat water, remove contaminants from water, properly monitor water, and report results to state officials or the public. The SDWIS is generated from information that states submit to the EPA. Data in the SDWIS are updated quarterly and include information from 1976 to the present. See https://www3.epa.gov/enviro/facts/sdwis/search.html for more details.

xlv This study time period is for the most recent 12 quarters (3 years) of data in the SDWIS.

xlvi A U.S. EPA tool that integrates compliance and enforcement data for more than 900,000 regulated facilities, including public water systems, and allows users to search for specific facilities, analyze data trends, and look for specific enforcement cases. See https://echo.epa.gov/ for more details.

xlvii The SVI uses data from the U.S. Census to rank Census tracts or counties based upon 15 social factors that can make communities vulnerable, including poverty, race and ethnicity, lack of access to a vehicle, and crowed housing. The 15 factors are then grouped into four themes: socioeconomic status; household composition; race, ethnicity, and language; housing and transportation. For more information, see https://svi.cdc.gov/index.html (accessed January 15, 2019).

xlviii Although these findings were all statistically significant, it is possible that the use of counties for our analysis does not completely reflect the relationship between various sociodemographic characteristics and compliance with and enforcement of laws governing drinking water. Our analysis is based upon a detailed review of the EPA data at the county level, because this is the way that the geographic data are available in the EPA's database. (Individual water system service areas, such as the census blocks that the system serves, are not available in the EPA's or any national database). Counties can cover large geographic areas and may have extreme distributions of racial, economic, and housing characteristics. In addition, the population that a drinking water system serves is not typically confined to county boundaries. Therefore, the populations that drinking water systems serve may not match the demographic characteristics of a given county. Finally, county-level analysis excludes drinking water systems that do not have information about the counties they serve (e.g., drinking water systems for some Indigenous communities). It is possible that our analysis missed communities with true disparities. The EPA drinking water database does not allow for a more granular analysis. Despite these limitations, our analysis is a valuable first step toward assessing national drinking water disparities, and the overall pattern is unmistakable.

## IMPORTANT COMMUNITIES MISSING FROM OUR ANALYSIS

Because of the technical limitations of the available drinking water data, our analysis is missing several important communities that must be engaged in discussions about drinking water–related disparities. First, although we were able to perform some statistical analysis of tribal systems without county-level information (for example, for rates of violations), our spatial analysis did not include these systems. Indigenous communities face severe disparities in water-related infrastructure maintenance and improvement[58] and water contamination.[59] Tribal systems also face unique concerns associated with complex jurisdictional challenges and legal and regulatory gaps. They also often lack authority to create water districts.[60]

Second, our analysis did not include populations that obtain their water from private wells or noncommunity water systems. The SDWA does not cover private wells; in most states and communities, maintenance and testing are the responsibility of the well owner.[61] Private wells can be contaminated by pathogens, naturally occurring elements, agricultural chemicals, and nearby industrial activities.[62] Racial and economic disparities in private well–related drinking water contamination have been identified in the scientific literature,[63] particularly for communities excluded from nearby municipal water services[64] (Text Box—"Farmworkers and Drinking Water"). The U.S. Geological Survey estimates that more than 44 million people (15 percent of the U.S. population) obtain their water from private wells.[65]

### FARMWORKERS AND DRINKING WATER

Most drinking water provided to farmworkers in the fields or in labor camps (where migrant farmworkers are often housed) comes from private wells. These sources are not regulated under the Safe Drinking Water Act, and very few states regulate them. Because they live and work in heavily agricultural areas, farmworkers' drinking water is especially susceptible to chemical and biological hazards from toxic pesticides,[66] fertilizers, and animal and human waste.[67] For example, in southern California's Coachella Valley, at least 10,000 people (mostly farmworkers) live in trailer parks that are not served by public water systems. Many have wells with contaminants such as arsenic and bacteria.[68]

As is true for many Environmental Justice communities and populations, lack of farmworker access to safe drinking water becomes invisible because their drinking water sources are not federally regulated and because farmworker communities generally lack economic and political power. Decision makers at all levels need to take urgent action to ensure safe drinking water for farmworkers.[xlix]

Third, our spatial analysis does not include populations that live in U.S. territories, including Puerto Rico, the U.S. Virgin Islands, Guam, and American Samoa. Previous NRDC research has shown that community water systems that had violations of the SDWA in 2015 served 99.7 percent of the population in Puerto Rico.[69] Although Guam has developed management solutions to assist in water treatment capacity,[70] territories typically face unique challenges because of their geographic isolation, high energy costs, and limited labor pools.[71]

Finally, our analysis does not include populations that completely lack access to drinking water resources. Communities without access to potable water such as Sandbranch, Texas (Text Box—"Sandbranch, Texas") and the border *colonias* face inordinate injustice related to drinking water. In addition to lack of drinking water resources, these communities often lack other basic infrastructure needs, including paved roads, sewer systems, storm drainage, electricity, telecommunications, health care, and solid waste disposal. For communities like Sandbranch, which exist just outside of major metropolitan areas, the disparity in access to resources can feel even more pronounced.

xlix For more information, see Migrant Clinicians Network "Water and Sanitation," https://www.migrantclinician.org/issues/occupational-health/water-and-sanitation.html (accessed April 11, 2019).

# *The Safe Drinking Water Act*


© Demetrius Freeman for NRDC

In 1974, President Ford signed the Safe Drinking Water Act (SDWA)[72] into law, requiring the newly established EPA to identify and regulate drinking water contaminants through national health standards. A contaminant is any potentially harmful substance (chemical, biological, physical, radiological) present in drinking water that can harm human health. The SDWA regulates approximately 100 contaminants, including lead, *Escherichia coli*, atrazine, and radium.[l]

The law applies to every public water system in the United States that has at least 15 service connections or serves at least 25 people per day. The SDWA excludes private wells that serve fewer than 25 people.[73]

When the EPA identifies a contaminant for regulation,[li] it must set a goal for the contaminant in water that is fully protective of public health (known as a maximum contaminant level goal (MCLG)). The EPA also sets a maximum contaminant level (MCL), which allows for some health risks but factors in cost and technical feasibility of removal. For example, arsenic—a known human carcinogen[74]—has an MCLG of zero because no level of arsenic in drinking water is safe. The MCL for arsenic, however, is 10 parts per billion (ppb) because the EPA has found that the cost of removing arsenic to a lower level outweighs the health risks associated with exposure. (NRDC and health groups have urged a stricter standard of 3 ppb, which is technically feasible and poses lower cancer risks.) Because no amount of arsenic is safe, the 10 ppb MCL increases the risk of cancer in populations served by systems with arsenic in their water.[75] The SDWA does not require drinking water systems to control contamination levels that do not exceed the MCL, even if they are above the MCLG, although some states have adopted stricter MCLs for certain contaminants than the EPA has.

In addition to MCLGs and MCLs, the EPA can set treatment techniques for instances in which it is not economically and technically feasible to ascertain the level of a contaminant in water. In these cases, drinking water systems are required to treat the substance through specified filtration, disinfection, or other preventative treatments. For example, the EPA has found that it is not feasible to ascertain the level of the parasite *Cryptosporidium* in drinking water, so it has established a treatment technique that requires filtration and disinfection. Lead is also regulated using a treatment technique. The EPA has set an action level for lead that requires systems to take specified measures to reduce lead contamination.[lii] Like arsenic, experts and the EPA agree that lead is not safe at any concentration, which means that the action level does not ensure a safe level of lead.[76]

l See National Primary Drinking Water Regulations: Overviews and Factsheets. US EPA, November 30, 2015. https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations. for list of regulated contaminants.

li The SDWA regulates each contaminant, or class of contaminants, through a series of rules. Each of the dozen or so contaminant-related rules establishes the health-based standard for each contaminant according to an MCL or treatment technique. The rules cover approximately 100 contaminants, including toxic chemicals, radioactive elements, microorganisms, and metals, and are designed to protect the public from negative health effects such as birth defects, cancer, and cognitive impairment. For more details on each of the rules, see Appendix D to this report, and the NRDC *Threats on Tap* report and appendices at https://www.nrdc.org/resources/threats-tap-widespread-violations-water-infrastructure.

lii The current action level for lead is 15 ppb. A system must take action to reduce lead concentration (e.g., remove sources of lead such as lead service lines and generally must add a chemical to reduce lead leaching from pipes) when the top 10 percent of samples (the 90th percentile) have an average lead concentration above 15 ppb.

© Bryan Anselm for NRDC

Public water systems are responsible for satisfying SDWA requirements under the supervision of state drinking water officials, with ultimate oversight by the EPA. In turn, the EPA grants states and territories "primacy," which acknowledges that they will adopt and enforce the EPA's drinking water rules (Appendix D—SDWA rules) as a minimum standard. Under this authority, states are tasked with safeguarding our water systems by ensuring that they test for contaminants, conduct on-site inspections and sanitary surveys, undertake proper review of plans for improvement to the water system, and hold water systems accountable for not meeting drinking water standards.[liii] All states and territories, with the exception of Wyoming and the District of Columbia, have primacy.[77] Only one Indigenous Nation, the Navajo Nation, and one state (Alaska) have primacy over public water systems on Indigenous lands.[78]

When a system fails to meet the SDWA standards, it should receive a notice of violation from the primacy agency or EPA. If the system does not promptly eliminate the violation, the SDWA says the primacy state is to bring an enforcement action; if the state fails to appropriately enforce and fix the problem, EPA is obliged to step in and to enforce. Violations generally fall into three primary categories:

- **Health-based violations**: the level of contamination exceeds, or the treatment technique fails to meet, health-based standards. These violations can have a direct effect on human health.
- **Monitoring and reporting violations**: results are not regularly monitored or submitted to the primacy agency or EPA.
- **Public notification and other violations**: failure to notify the public about drinking water quality (public notification) and violations of other requirements that the above violation types do not cover (other violations).

Although health-based violations are considered the most troubling because of their direct link to adverse health effects, monitoring and reporting and public notification violations can mask health-based violations. For example, a system with many monitoring violations may be masking a health-based violation by failing to conduct required water quality testing. Therefore, examination of all violation types provides a complete picture of a water system's ability to provide clean, safe water.

liii See "Safe Drinking Water Act section 1413," https://www.epa.gov/dwreginfo/primacy-enforcement-responsibility-public-water-systems.

# *Disinvestment in People and Places*

According to the EPA 2016 Drinking Water Action Plan, crumbling water infrastructure and limited funding are two of the major water challenges threatening public health.[79] Populations of color and low-income populations are more likely to live with aging, underdeveloped, and underfunded water infrastructure, largely because of residential segregation in the United States.[80] Although the American Society of Civil Engineers gave the country as a whole a D+ for the condition and performance of its overall infrastructure,[81] infrastructure in marginalized communities is generally even worse.

When long-term infrastructure needs are addressed, racially and economically segregated neighborhoods have been grossly overlooked (see Text Box—Sandbranch, Texas). This disinvestment has contributed to economic decline and reinforced patterns of segregation for people of color and low-income communities.[liv]

## SANDBRANCH, TEXAS[82]

© Courtney Collins/KERA News

Sandbranch, Texas, is an unincorporated, historically African-American community founded by former slaves in 1878 and located about 14 miles from Dallas. It is the poorest community in Dallas County, with all residents living under the federal poverty threshold. The average household income in Sandbranch is less than $800 a month. In its 140-year history, the community has never had public water service, sewage service, or trash pickup—even though the Dallas Southside Water Treatment Plants is right next to the community. For decades, residents relied on their own wells, but since the 1980s, water from the wells has been too contaminated to drink, forcing most residents to rely on donated bottled water.

Sandbranch residents continue to organize, especially through the community's Mount Zion Baptist Church. In 2016, they formed the Sandbranch Development and Water Supply Corporation as a new approach to providing water service and presented to the Environmental Protection Agency National Environmental Justice Advisory Council about their struggle for clean water. They have engaged legal and technical support and are building partnerships with government agencies.

In October 2016, the EPA charged its National Environmental Justice Advisory Council (NEJAC) with developing recommendations on Environmental Justice and water infrastructure finance and capacity.[83] The NEJAC's final recommendations, issued in March 2019,[84] focused on eight goals to achieve Environmental Justice in providing clean, affordable water and sanitation for all communities, including:

- Require that governments treat water as a human right;
- Request that Congress allocate more funding to help communities with infrastructure building, oversight, and public health protection;
- Promote affordable water and wastewater rates;
- Prioritize problems in Environmental Justice communities;
- Involve Environmental Justice communities meaningfully in infrastructure decisions;
- Build community capacity in water systems;
- Support innovative technologies;
- Be accountable and rebuild public confidence and trust in regulations.

The report stressed the importance of prioritizing Environmental Justice community needs, building community capacity to protect and provide safe drinking water, and creating opportunities to address water infrastructure challenges and needs across the county.

liv For additional reading on this topic, see Dorceta E. Taylor, *Toxic Communities: Environmental Racism, Industrial Pollution, and Residential Mobility, New York:* NYU Press, 2014 and Richard Rothstein, *The Color of Law: A Forgotten History of How Our Government Segregated America*, New York: Liveright, 2018.

## SMALL SYSTEMS COULD FACE ADDITIONAL BURDENS

Our analysis found that small community water systems—those that serve fewer than 3,300 people—accounted for more than 80 percent of all violations and of health-based violations.[lv] Nearly 50 percent of small systems had at least one violation compared to 43 percent of systems serving more than 3,300 people.[lvi] We found that very small systems—those that serve less than 500 people—were responsible for more than 60 percent of all violations and 50 percent of health-based violations.[lvii] Similar to small systems, 50 percent of very small systems had at least one violation compared to 46 percent of systems serving more than 500 people.[lviii] Approximately 11 percent of all system sizes had health-based violations.[lix]

Many small systems do not have the capacity to maintain and improve their infrastructure, identify and address threats to drinking water, hire experienced and highly-trained engineering staff, and comply with current standards. The EPA has noted that "vulnerable, overburdened and economically distressed communities" may face disproportionate hazards and lack the resources or capacity to address them, and many small systems "are likely to serve low-income, vulnerable populations."[85]

Through its 2015 Environmental Justice strategic plan,[86] the EPA has committed to making concentrated efforts to address the national challenge of small and tribal drinking water systems, but it is unclear what progress the agency has made toward this goal or whether it is dedicating sufficient staff, resources, and management attention to it. In addition, President Trump has proposed eliminating the EPA Office of Environmental Justice and slashing funding for other programs that support Environmental Justice communities or address Environmental Justice concerns.[87]

## THE TRUE SCOPE OF THE PROBLEM IS PROBABLY MUCH BIGGER

Our analysis has revealed that there tended to be more drinking water violations in counties with more racial, economic, and housing/transportation vulnerability, although it is likely that this study has underestimated the true burden that Environmental Justice communities across the country face. In addition to the analytical constraints from limited geographic data for drinking water violations below the county level, several other important factors could lead to gaps in our understanding of the true magnitude of this problem.

***The percentage of systems with violations for 12 consecutive quarters (i.e., systems in chronic noncompliance) was 40 percent higher in counties with the highest racial, ethnic, and language vulnerability compare to counties with the lowest racial, ethnic, and language vulnerability.***

### The SDWA currently regulates only a small subset of drinking water contaminants

The SDWA currently regulates approximately 100 contaminants—a fraction of the many thousands of contaminants known or anticipated to occur in tap water.[88] Although some states, such as California, have adopted a limited number of more stringent standards and cover more chemicals, the EPA has failed to adopt any new drinking water standards for unregulated contaminants since 1996,[lx] which health and environmental experts have amply criticized.[89]

While there are reasons for the slow progress (for example, the law is complex and creates numerous hurdles for new standards, and there is strong political opposition from water utilities and other industries, local governments, and antiregulatory members of Congress), EPA, Congress, state and local agencies, and water utilities have duties to ensure that the communities are protected.[90] The complete failure to adopt protective standards for so many unregulated drinking water contaminants endangers the public's health. This is the case for biological and chemical contaminants. For example, Harvard researchers found that two of the thousands of polyfluoroalkyl and perfluoroalkyl substances (PFASs)—toxic chemicals released from industrial, firefighting, and military operations[91]—are present in the tap water of more than 6 million people in the United States.[92] PFASs have been associated with myriad negative health effects, including cancer of the kidneys and testicles, developmental and reproductive damage, and immune system and liver damage (see Text Box—GenX).[93]

lv The U.S. EPA designates drinking water systems serving fewer than 3,300 people as "small" systems. These systems accounted for 85.2 percent of all violations and 80.1 percent of health-based violations.

lvi For systems serving less than 3,300 people, 49.9 percent of systems were in violation across all violation types. For systems serving more than 3,300 people, 42.7 percent of systems were in violation across all violation types.

lvii The US EPA designates drinking water systems serving fewer than 500 people as "very small" systems. These systems accounted for 63.3 percent of all violations and 50.0 percent of health-based violations.

lviii 50.6 percent of systems serving fewer than 500 people and 46.1 of those serving more than 500 people were in violation.

lix Approximately 1 in 9 (11.3 percent) systems serving fewer than 3,300 people and 11.7 percent of those serving more than 3,300 people had health-based violations. Similarly, 10.9 percent of systems serving fewer than 500 people and 11.9 percent of those serving more than 500 people had health-based violations.

lx Although the EPA has updated certain standards, such as the arsenic standard, and has updated its microbial and surface water treatment and disinfection byproduct rules, the statute explicitly mandated these with deadlines, see *Safe Drinking Water Amendments* of *1996* (Pub.L. No.104-182), section 1412. What EPA has not yet done is issue a new standard for a contaminant using the unregulated contaminant provisions of the 1996 Amendments in section 1412.

## GENX

Beginning in 2012,[94] scientists from the Environmental Protection Agency and local universities began detecting GenX[lxi] and other dangerous polyfluoroalkyl and perfluoroalkyl substances (PFASs) in the Cape Fear River in North Carolina. This was just downstream of the PFAS-producing Chemours Company, a spin-off of DuPont. These toxic chemicals, which have been associated with damage to the immune system, reproduction, and development,[95] were making their way down river to Wilmington, North Carolina, and into the taps of 200,000 people that the Cape Fear Public Utility Authority serves. Because GenX and the other PFASs are not regulated under the Safe Drinking Water Act, testing for them is not legally required. Had it not been for the research of local scientists, the water utility—and the 200,000 people it served—would have been completely unaware of the contamination.

Although the state has made progress in decreasing discharges of GenX from the Chemours plant,[lxii] their communication strategies have been ineffective at best.[96] The state and others have failed to translate important sources of information into Spanish (including the Cape Fear Public Utility Authority website[lxiii] and the State of North Carolina resource page for PFAS-relevant health-related resources[lxiv]), made minimal effort to communicate with residents who lack access to traditional media, and hosted events in only a few affected locations.[97] In stakeholder meetings after the community was made aware of the contamination,[98] several participants highlighted a need for greater engagement with affected communities of color and low-income communities.

In addition, technologies to remove PFAS substances from drinking water also create challenges for low-income community members. Without large-scale removal of these substances from the water at the water utility, the high cost of removing PFASs at the household level will leave many families in the area without options for obtaining clean water.[99]

### Data on drinking water violations are woefully incomplete

The EPA Safe Drinking Water Information System (SDWIS) logs SDWA violations. Although states are required to report drinking water system information to the SDWIS, audits of the system show that states often fail to report many violations. For example, the SDWIS did not include lead violations for Flint's lead crisis from 2014 to 2017.[100]

In 2004, the EPA Inspector General found that states were reporting only 65 percent of health-based violations and a miniscule 23 percent of the monitoring and reporting violations.[101] Although no recent analysis of data quality has been made public, a 2017 report by the Inspector General found that, although the EPA is working to improve the tools and mechanisms it uses to evaluate state and system compliance with the law, its data collection efforts remain inconsistent, incomplete, and unreliable—limiting the agency's ability to manage a "nationally consistent drinking water oversight program."[102] Our analysis could be missing many violations that were not reported or recorded. In other words, our findings—as alarming as they are—could very well be the tip of the iceberg.

### Current monitoring rules allow systems to avoid detection of contaminants

Under EPA monitoring rules, water utilities can intentionally or unintentionally test water in ways that would decrease the likelihood of finding a regulated contaminant. For example, systems could monitor for seasonal pesticides[lxv] right before those pesticides are applied to fields rather than at the peak of application, which would be more health protective.[103]

### System administrators have little chance of getting caught for falsifying data

After a public audit of the national water systems in 2004, the EPA Inspector General found that 18 percent of data collection was questionable and 12 percent of the data was invalid or falsified. It remains unclear whether those percentages have changed for the better or worse, because those public audit values have not been updated,[104] but the EPA has not insisted that states implement programs that can determine the integrity of the data submitted (see Text Box—Newark, New Jersey).

lxi GenX is the trade name for perfluoro-2-propoxypropanoic acid—a replacement for perfluorooctanoic acid. GenX and other substances like it are used to add nonstick and water and stain resistance to fabrics, electronics, and cooking devices.

lxii See "FACT SHEET: Proposed Chemours Consent Order, Dec. 21, 2018," https://files.nc.gov/ncdeq/GenX/Fact-Sheet-Chemours-Proposed-Consent-Order.pdf

lxiii See "Emerging Contaminants | Cape Fear Public Utility Authority Official Site," https://www.cfpua.org/761/Emerging-Compounds (accessed April 30, 2019).

lxiv See "NC DEQ: Health-Related Resources About GenX, PFOA and PFAS." https://deq.nc.gov/news/key-issues/genx-investigation/health-related-resources-about-genx-pfoa-and-pfas. (accessed June 25, 2019).

lxv See John K. Stamer, Kathryn D. Gunderson, and Barbara J. Ryan, "Atrazine Concentrations in the Delaware River, Kansas," USGS Fact Sheet 001-94, April 1995, http://ks.water.usgs.gov/pubs/fact-sheets/fs.001-94.stamer.html.

## NEWARK, NEW JERSEY

Since the beginning of 2017, the drinking water in Newark, New Jersey has shown documented lead levels above the federal action level. In fact, the city has seen some of the highest levels recently recorded by a large water system in the United States. As early as September 2017, community and advocacy groups, alongside NRDC, alerted city officials about Newark's drinking water crisis. In June 2018, the Newark Education Workers Caucus (NEW Caucus), a group of public school educators, and NRDC initiated a lawsuit in federal court alleging numerous violations of the Safe Drinking Water Act. Two months later, the groups asked the court to order preliminary relief, including a safe, alternative source of water, for Newark's most at-risk residents, especially young children and pregnant women. Despite the community calls for action, the city relentlessly denied the existence of the crisis and misled residents about the potential dangers of their lead-contaminated water.

Newark is the most populous city in New Jersey with more than 285,000 residents.[105] The median household income is approximately $35,000 and nearly 30 percent of the population lives in poverty. Almost 50 percent of the city's residents speak a language other than English at home and more than 85 percent are Black or Latino.

City and state officials failed the residents of Newark, not only by incorrectly treating the drinking water coming from the city's treatment plants to prevent lead from leaching out of pipes and plumbing,[106] but also by neglecting to fully inform residents about the risks posed by their lead-contaminated water. The future of Newark's children is at risk—even low lead levels are associated with serious, irreversible damage to developing brains and nervous systems. As this report was going to press, Newark had begun to improve its water treatment and promised to replace its lead service lines. However, many questions remain about those measures, and plans are unclear for assuring safe water in the years until the lead lines are replaced.

© Bryan Anselm for NRDC

NEW Caucus member and longtime Newark resident Yvette Jordan's home tested for lead at levels nearly three times the federal action level. She and other residents harbor fears about the health and wellbeing of their community. "I'm concerned about my health and what this exposure means for my students, since even low levels of lead can impair children's brain development."

### Monitoring for contamination as water enters the distribution system is inadequate for proper detection

The SDWA requires that most contaminants be monitored for at the "point of entry" into the distribution system (at a water treatment facility). Although some distribution-related contaminants such as lead, copper, coliform, disinfectants, and disinfection byproducts must be monitored at the tap, others such as asbestos and polyvinyl chloride are only monitored at the water treatment plant. Asbestos-cement pipes account for approximately 13 percent of the total length of all drinking water mains,[107] but much of this piping is aging and beginning to deposit asbestos particles into our tap water.[108] In addition, vinyl chloride, a cancer-causing component of polyvinyl chloride pipes, can leach from older pipes into our tap water.[109]

© Bryan Anselm for NRDC

Missing or incomplete data can underrepresent the true burden for Environmental Justice communities. This was made especially clear in an NRDC analysis of 2015 Lead and Copper Rule violations.[110] As noted above, that report showed that the city of Flint—at the height of its drinking water crisis—had no recorded violations of the Lead and Copper Rule in the EPA SDWIS database. The lack of reported violations was a result of the state's failure to report known violations and of the inadequacy of the system's lead monitoring.

# *Recommendations*

All communities—but especially Environmental Justice communities—must be protected and given equal opportunities to thrive in a clean and healthy environment. Decision makers must therefore prioritize and target the solutions outlined below to benefit the most disproportionately affected populations. The EPA and states should use the SDWA and other authorities to adopt a multifaceted strategy to ensure rapid, measurable progress to ensure that *all* Americans have clean drinking water and sanitation.

## IDENTIFY, ENGAGE, AND SUPPORT DISPROPORTIONATELY AFFECTED COMMUNITIES

Identification of underserved, overburdened communities is an important first step in developing plans and timelines to engage and support them. Environmental Justice policies and recommendations must be quickly adopted and implemented at all levels of decision-making. The sovereignty of Indigenous tribes must be respected, and community members must be engaged as active participants in setting agendas and priorities that affect their lives and communities. Congress, the EPA, the states, utilities, and other relevant decision-makers must:

- Fully implement the EPA Environmental Justice policies—beginning with the *Guidance on Considering Environmental Justice During the Development of Regulatory Actions*[111] and the *Environmental Justice 2020 Action Agenda*[lxvi]—throughout the agency's SDWA programs and all related programs. At the same time, implement specific goals and timetables to measurably increase Environmental Justice communities' access to safe drinking water, beyond the basic actions already identified in the Action Agenda.
- Identify underserved, overburdened communities and develop specific plans and timelines to engage and support them.
- Quickly and fully implement recommendations from the EPA National Environmental Justice Advisory Council work group on Environmental Justice and Water Infrastructure Finance and Capacity.
- Meaningfully engage[lxvii] community members in decision-making processes, including setting priorities for drinking water protection, infrastructure spending, and identification of and response to threats to drinking water. All communities, especially those with vulnerable populations, should be:
  - Fully informed about the state of their drinking water, potential contamination hazards, (for example, large chemical storage tanks, outdated infrastructure such as lead pipes), how to register a concern about drinking water, how residents will be notified in case of contamination, and response plans in case of a major contamination incident (for example, chemical spill), to honor their right to know about threats to their health and welfare.
  - Provided regular opportunities to engage directly with drinking water providers; local, state, and federal regulators; and the industries that create the highest risk to drinking water (for example, chemical storage facilities, large agricultural operations) to understand and address threats to drinking water.
  - Provided with grants or other financial support for community-based drinking water needs assessments and planning and for technical expertise to allow them to engage fully in decision-making processes.
- Respect the sovereignty of Indigenous tribes and engage with them on a government-to-government basis to develop solutions that reflect their unique needs.[lxviii]

lxvi EPA's *EJ 2020 Action Agenda*, which details goals, strategies, and measures to address key environmental justice issues, including the need for safe drinking water, is the agency's current environmental justice strategy. See https://www.epa.gov/environmentaljustice/ej-2020-action-agenda-epas-environmental-justice-strategy.

lxvii The EPA has well-developed resources to guide community engagement, including the *Public Participation Guide* and the "Achieving Meaningful Involvement" section of *Guidance on Considering Environmental Justice During the Development of Regulatory Actions* (which includes suggestions and best practices applicable in any situation, not just development of regulatory actions). The EPA Office of Environmental Justice and the National Environmental Justice Advisory Council are important additional resources for meaningful engagement.

lxviii For example, the EPA Environmental Justice 2020 Action Agenda notes that: "As part of our efforts to achieve environmental justice, Executive Order 12898 requires that these efforts apply equally to Native American programs. EPA recognizes the right of tribes as sovereign governments to self-determination and acknowledges the federal government's trust responsibility to tribes. EPA works with tribes on a government-to-government basis to protect the land, air, and water in Indian country. Furthermore, in focusing attention on tribal and indigenous populations with respect to EJ 2020, our goal will be to fully implement the EPA Policy on Environmental Justice for Working with Federally Recognized Tribes and Indigenous Peoples, and will be guided by the 1984 Indian Policy."

## PREVENT WATER CONTAMINATION

By the time serious water contamination or violations have occurred, it is often too late to prevent harm to public health. The Clean Water Act, Superfund statute, and other laws give the EPA and states clear responsibility and many tools to prevent contamination of drinking water or sources of drinking water and violations, but the agency and states have too often failed to use these tools. The SDWA also should be strengthened to require comprehensive and enforceable source water protection measures. The best way to prevent contamination of drinking water is to remove hazards before contamination occurs.

- EPA and states must aggressively identify and address the most important sources of drinking water contamination in Environmental Justice communities, including chemical, oil, and other industrial facilities and sites. They must identify the greatest threats to drinking water, take concrete steps to reduce and prevent water contamination, and hold companies that pollute or contaminate sources of drinking water fully accountable for clean-up, provision of alternative sources of drinking water, and restitution. They can use authorities and measures such as:
  - Adopting the standards that Section 311 of the Clean Water Act requires to protect against spills by facilities that use or store large amounts of hazardous chemicals (which can be addressed through transition to safer chemicals and processes or strong, well-enforced requirements for prevention of spills and other releases);
  - Reducing and eliminating industrial discharges under Section 402 of the Clean Water Act;
  - Protecting against pollution from large animal agriculture operations (which can be addressed by requiring that discharges that could reach water be reported, reduced, or eliminated).
- More substances and classes of substances should be regulated under the SDWA—especially widely used toxic chemicals such as PFASs, perchlorate, pharmaceuticals, personal care product ingredients, endocrine-disrupting compounds, algal toxins, and unregulated pathogens such as *Legionella*—that are already contaminating drinking water or are likely to do so in the future.
- To ensure that new standards are established and protective, Congress must fix the SDWA's broken standard-setting provisions. The law must be modified to require the EPA to set health-protective standards without burdensome cost–benefit and other requirements that have stifled and weakened standard setting since the law was changed in 1996.
- Aggressively use the SDWA Section 1431[lxix] authority to prevent risks to health from drinking water contamination by acting before water contamination or health impacts have occurred.

## ACT IMMEDIATELY TO ADDRESS CRISIS SITUATIONS TO PREVENT EXPOSURE

The EPA and states routinely fail to respond quickly to immediate threats to drinking water or chronic drinking water crises, especially in Environmental Justice communities. In 2016, the EPA Inspector General concluded that crises such as the massive lead contamination in Flint "should generate a greater sense of urgency" and issued a management alert as a means to "facilitate immediate EPA action" in the future.[112]

- The EPA and states should enforce the SDWA. In Environmental Justice communities that are having difficulty complying because of capacity or financial constraints, the states and the EPA should direct technical assistance, funding, and potential partnerships with other water systems to remedy problems so they do not worsen and pose serious ongoing health risks.
- The EPA should use its emergency authority under Section 1431 of the SDWA and other tools to address emerging and crisis situations, such as PFASs, lead, and chemicals stored in aboveground storage tanks.
- The EPA and states should closely monitor alert systems, databases, news reports, resident complaints, and other sources to promptly identify releases of chemicals or other hazardous substances likely to reach drinking water.[lxx]

lxix Section 1431 of the SDWA (42 U.S.C. § 300i) gives the EPA broad authority to act quickly to protect public health when there is an "imminent and substantial endangerment" due to "a contaminant that is present in or likely to enter a public water system or an underground source of drinking water." The EPA may act under this section only if state and local authorities have not acted in a timely and effective fashion to protect public health and, if the situation allows, must consult with those authorities first. The EPA may take virtually any action necessary to address the situation and protect health, including requiring the collection of information, public notification, monitoring, provision of alternative water supplies, and clean-up. Section 1431 is intended not only to respond to, but also to prevent health harms by addressing contamination of drinking water that is likely to happen. The statute makes clear, and the Congressional record also specifies, that emergency action is intended to be applicable to hazards associated with regulated and unregulated contaminants. For additional details, see U.S. EPA, OECA. "Updated Guidance on Emergency Authority under SDWA Section 1431." Policies and Guidance. US EPA, September 24, 2018. https://www.epa.gov/enforcement/updated-guidance-emergency-authority-under-sdwa-section-1431.

lxx As the Source Water Collaborative has recommended, the EPA should work with states and localities to: "Develop or enhance an early warning system using on-line water quality monitoring, contaminant sampling and analysis, enhanced security monitoring, consumer complaint surveillance, public health surveillance, and c onsequence management to detect contaminants before they reach the intake or well, and within the distribution system." Source Water Collaborative, "Call to Action Resource Document," http://www.sourcewatercollaborative.org/wp-content/themes/sm-swc/img/CalltoActionResources_022615.docx.

- The EPA and states should create and enforce systems to help prevent exposure through immediate, aggressive, accessible public notification to all affected communities, paying special attention to communities of color and low-income communities that may have limited access to information. They should use communication methods and language that work best for these communities.
- The EPA and Congress should provide greater oversight and support, and intervention when needed, to ensure that EPA regions and states are responding immediately and aggressively to current or potential drinking water contamination.

## FUND WATER INFRASTRUCTURE PROJECTS, ESPECIALLY IN ENVIRONMENTAL JUSTICE COMMUNITIES

The EPA has already noted that "some communities may be more challenged than others in their efforts to achieve the goals of safe and clean water" and that vulnerable and overburdened communities often lack the financial resources needed to ensure safe water.[113]

- Congress and state legislatures should substantially increase funding for water infrastructure, including specific additional set-aside grants for disadvantaged communities.
- The EPA and states should direct funds to improve water infrastructure in highly affected, underserved communities, including leveraging state revolving funds or prioritizing and funding underserved, inadequately protected communities under the Drinking Water State Revolving Fund.
- The EPA and states should ensure that underserved communities have adequate knowledge and capacity to identify funding opportunities and apply for grants or loans to address inequities and gaps in the ability of different communities to seek and obtain funding.
- The EPA and states should substantially increase water infrastructure grants (not loans) to disproportionately affected communities that prioritize spending in areas least able to afford solutions.
- The EPA and states should provide grants to economically challenged and Environmental Justice communities (including Indigenous communities) to support water system technical and management capacity.
- The EPA and states should ensure that local costs of improving infrastructure do not make water bills unaffordable for low-income customers, including new and expanded low-income affordability programs and more equitable rate structures.

## STRENGTHEN SMALL SYSTEMS

As EPA itself notes, "small community water systems and tribal systems are often disproportionately impacted by technical, managerial, and financial capacity challenges."[114] The EPA and states should work with affected communities to strengthen and support the capacity of these systems—many of which serve Environmental Justice communities—to meet SDWA requirements and maintain safe drinking water.

- The EPA and states should create, fund, and implement comprehensive plans to support small water systems, especially those in vulnerable and disproportionately affected communities, so that they can provide clean and safe drinking water. In many cases, partnerships and restructuring or consolidation of troubled small water systems that cannot comply with the SDWA and cannot supply safe water may be the best solution.
- The EPA and states should provide direct technical assistance and grants or other resources to support operations, infrastructure improvements, and technical and management capacity for small water systems (including tribal systems, if the tribes desire) to avoid and resolve violations and to ensure safe drinking water for these communities.
- The EPA and states should fund and quickly implement the Environmental Justice 2020 Action Agenda action commitments to support small community water systems, including:
  - Assisting small communities in building capacity through activities of the EPA Capacity Building Program for Drinking Water Systems, which provides an approved program in each state for "ensuring technical, managerial, and financial (TMF) capacity in public water systems"[115] and through asset management resources and assistance;[116]
  - Strengthening small system financial sustainability through the EPA Water Infrastructure and Resilience Finance Center (an information and assistance center designed to help communities learn about financing drinking water and other infrastructure projects[117]);
  - Disseminating and delivering training and support based on "building the capacity of drinking water systems"[118] (a diverse set of information, tools, and training opportunities developed to help build the capacity of small water systems).

## ENFORCE THE LAW

Laws and regulations are meaningless without full implementation and enforcement. The EPA and states must better enforce requirements and related laws and regulations to ensure safe drinking water for all.

- The EPA and states should improve enforcement to include incentives and support for water utilities willing to acknowledge problems and work in good faith to solve them. This can include consolidating and restructuring, providing technical assistance, and applying for funding in underserved and inadequately protected communities.
- The EPA and states should enforce meaningful consequences for water systems in willful violation, including tough penalties for falsified data, obfuscation, or refusal to promptly remedy violations.
- The EPA should hold EPA regions and states accountable for full enforcement of the SDWA, the Clean Water Act and other requirements that protect drinking water, and use of Section 1431 authority and other authorities to prevent or immediately address water contamination.
- The EPA and other federal agencies must ensure that our nation's civil rights laws are fully implemented and enforced. This includes Title VI of the Civil Rights Act of 1964 and Title VIII of the Civil Rights Act of 1968—both of which prohibit the use of federal funds by entities (for example, drinking water systems) whose activities create disparate effects based on race. For example, vigorous enforcement of these landmark civil rights laws may have prevented Flint's drinking water crisis.[119]

## USE ALL AVAILABLE TOOLS

The EPA and states have many tools (for example, laws, regulations, grant programs) to ensure clean, safe drinking water for all communities. Protecting surface water and groundwater used as drinking water sources from contamination is critical to achieving this goal, because by the time contamination has reached a public water system and taps, harm is already occurring, and response and clean-up costs are likely to be much higher.

The EPA, states, the White House, and Congress should:

- Aggressively deploy the SDWA, the Clean Water Act, the Resource Conservation and Recovery Act, Title VI, and other laws and regulations to prevent and respond to chemical and other hazardous substance spills or releases that could contaminate drinking water or sources of drinking water.
- As required under the Clean Water Act decades ago, the EPA should write and adopt:
  - A rule to prevent chemical spills from aboveground chemical storage tanks. Under a consent decree approved in 2016, the EPA agreed to adopt this rule by late 2019 (although the EPA issued a decision in August 2019 saying that the agency would issue no such rule despite the consent decree and a clear mandate in the Clean Water Act, an action that may trigger additional litigation);[120]
  - A companion rule requiring facilities with aboveground storage tanks to produce worst-case spill scenario analyses and response plans and submit these plans to the EPA.
- The EPA should abandon attempts to roll back common-sense measures that help prevent chemical releases and explosions that threaten drinking water, such as the recent Risk Management Program Amendments, and redirect their efforts toward aggressive implementation and enforcement instead.
- Likewise, the EPA should abandon efforts to undo the landmark 2015 Clean Water Rule, which aims to protect critical wetlands and the streams that feed the drinking water sources of 117 million Americans.
- Congress should reverse recent changes that have weakened the regulations governing coal ash dumps that leach toxic contaminants into groundwater.
- Congress should abandon efforts to weaken a 2015 rule that established long-overdue updates to federal limits on toxic metals that power plants discharge in wastewater—a potential source of contamination of drinking water.
- Congress should scrap a planned rulemaking that would allow wastewater treatment plants to discharge sewage that is only partially treated during rainstorms.[121]

## UNDERSTAND, DISCLOSE, AND PLAINLY EXPLAIN HEALTH THREATS AND ALL EFFECTS OF WATER CONTAMINATION

The EPA and states must do a better job of collecting and reporting complete, accurate data on water contaminants and violations and on the health, economic, environmental, and other effects of water contamination.

- Water systems must be made to report all required data and violations fully, promptly, and accurately. In the same manner, states must relay all data to the EPA promptly.
- The EPA and states must ensure that residents are well informed of the health risks posed by drinking water contaminants to which they are exposed. These risks should not be minimized or downplayed, and outreach should be tailored to the audience, including using plain language and the first language of the people served. If local authorities or water utilities are failing to ensure that the people served are well informed about the risks that their water poses, it is incumbent upon EPA and state officials to ensure that such information is provided in a way that is understandable to the local population.
- The EPA and states should ensure that monitoring techniques are effective and do not avoid the times likely to detect contaminants.
- The EPA and states should ensure that robust data on hazards, needs, and possible solutions are collected and disseminated to Environmental Justice communities.
- The EPA and states should impose fines or other meaningful penalties on water systems that report false or misleading data and on states that fail to ensure complete and accurate reporting or to report full and accurate information to EPA promptly.
- The EPA and states should ensure that dischargers understand and address all effects on and threats to surface waters and ground water, including by requiring animal agriculture operations (for example, concentrated animal feeding operations) to report and reduce or eliminate discharges that reach or could reach water, which industrial facilities and most other dischargers are already required to do.

# *Conclusion*

Between June 1, 2016 and May 31, 2019, drinking water systems that had at least one violation of the SDWA served nearly 40 percent of the U.S. population. Although violations were pervasive and occurred in every U.S. state and territory, violations were more likely in counties with racial, ethnic, and language vulnerability and subpar housing and transportation quality. In addition, racial, ethnic, and language vulnerability had the strongest relationship of all the sociodemographic characteristic studied to length of time out of compliance.

For communities already facing severe burdens due to racism, social conditions, and/or environmental and health hazards, the inability to turn on a tap and receive clean, safe water is particularly devastating—and unjust. Our findings are consistent with the long-standing pattern of disproportionate and cumulative hazards in communities of color and low-income communities. It is therefore incumbent upon our policy makers, water utilities, and other responsible parties to protect the most vulnerable populations and ensure their right to safe water.

# Glossary

| TERM | DEFINITION |
|---|---|
| Community Water System (CWS) | A public drinking water system that has at least 15 service connections used by people year-round OR a public drinking water system that regularly serves at least 25 people year-round |
| *Cryptosporidium* | A parasite that can cause cryptosporidiosis—a diarrheal disease that can be life threatening in immunocompromised individuals |
| ECHO | Enforcement and Compliance History Online |
| Environmental Justice | A set of principles and grassroots-led movement that asserts that all people have the right to a safe environment where they live, work, play, and pray |
| Environmental Justice community | Communities of color, low-income communities, or Indigenous communities or populations that experience disproportionate environmental harms and risks, compared to communities with more white or more affluent people |
| health-based violation | Violations of health-based standards such as maximum contaminant levels, maximum residual disinfectant levels, and treatment technique rules that can have a direct effect on human health |
| MCL | Maximum contaminant level |
| MCLG | Maximum contaminant level goal |
| monitoring and reporting violation | Violations that occur when a system fails to regularly monitor or submit monitoring results to the primacy agency or EPA |
| NEJAC | National Environmental Justice Advisory Council |
| PFAS | Polyfluoroalkyl and perfluoroalkyl substance |
| ppb | Parts per billion |
| primacy | Primary enforcement responsibility granted to states and tribes to ensure compliance with federal law |
| primacy states | States that have been granted authority to enforce the Safe Drinking Water Act, have regulations that are at least as stringent as those that the EPA imposes, and have demonstrated the authority to compel compliance with the federal Safe Drinking Water Act |
| public notification (disclosure) and other violations | Violations that occur when a system fails to notify the public about drinking water quality (public notification) or violations of requirements that the other violation types do not cover (other violations) |
| public water system | A drinking water system that has at least 15 service connections or serves at least 25 people for at least 60 days a year |
| SDWA | Safe Drinking Water Act |
| SDWIS | Safe Drinking Water Information System |
| serious violator | Public water system that the primacy agency has flagged as needing a response action to resolve violations |
| vulnerability | As defined by the World Health Organization, vulnerability is "the degree to which a population, individual, or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters." Vulnerability is "socially constructed, i.e., it arises out of the social and economic circumstances of everyday living." |

# *Appendix A: Data Analysis Methods*

The goal of this analysis was two-fold. First, we sought to determine the number and types of violations (including separate analyses for all violations in the aggregate and for health-based violations alone) of the Safe Drinking Water Act (SDWA) by community water systems[lxxi] between June 1, 2016 and May 31, 2019. This analysis assessed the number of violations (for all violations and health-based violations alone), number of systems with violations, and number of people that systems with violations served.

The second goal of this analysis was to determine whether there is a relationship between various sociodemographic characteristics at the county level, including but not limited to race and income, and drinking water violations across the county. For this portion of the analysis, we used statistical methods to determine correlations and visualized the relationships using geographical information systems software. The data used in this assessment came from the 2019 quarter 2 dataset of the U.S. Environmental Protection Agency (EPA) Safe Drinking Water Information System (SDWIS)[lxxii] and the 2016 Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI).[lxxiii]

## Use of counties as the geographic unit of analysis

Counties were used as the unit of analysis for the drinking water and social factors because of geographic limitations of drinking water data. Counties are the smallest geographic scale available for drinking water systems in the EPA drinking water database (SDWIS[122]). Although demographic information is available at finer scales (for example, Census tract level), county-level demographic indicators were used to match properly with the available drinking water data.

Drinking water systems are not confined by county boundaries. There can be multiple drinking water systems in a single county, and single drinking water systems can span multiple counties. Additionally, county demographic features such as race and income do not necessarily represent the demographic features of the population that a drinking water utility serves in the county. For example, it is possible for a drinking water utility to serve predominantly people of color or a low-income population within a majority-white or high-income county. If the drinking water utility serving the people of color or low-income population in the majority-white or high-income county had excessive drinking water violations, these violations could be missed in our analysis.

## Calculations of number of systems, populations they serve, and number of violations of the SDWA

The SDWIS is an EPA-maintained database that includes state-reported information about public water systems[lxxiv] and their violations of federal drinking water laws. EPA regulations[lxxv] require primacy states to report violations and enforcement actions to the EPA quarterly. Primacy states are those that have been granted authority to enforce the SDWA. These states have regulations that are at least as stringent as those that the EPA imposes. They have also demonstrated the authority to compel compliance with the federal SDWA.

To calculate the populations and systems that violations of the SDWA affect, we downloaded drinking water data from the 2019 quarter 2 dataset from the EPA SDWIS on August 12, 2019.[lxxvi]

Data were limited to community water systems that were active in the 2019 quarter 2 dataset and included systems with violations between June 1, 2016 and May 31, 2019, and were downloaded for each violation as a separate entry. For systems with unresolved open violations (those with no fixed compliance period), data were downloaded from the SDWIS for all open violations regardless of the violation start date (Figure A-1). Data were analyzed using Microsoft Access.

Figure A-1. Violation inclusion criteria. Violations were included in the analysis if they occurred in systems that were active in the 2019 quarter 2 Safe Drinking Water Information System dataset. Compliance periods that began or ended at any time during the study period (June 1, 2016 to May 31, 2019) were included.

lxxi The SDWA defines a community water system as a public drinking water system that "serves at least 15 service connections used by year-round residents" or "regularly serves at least 25 year-round residents" (42 U.S.C. § 300f(15)). This definition is in contrast to the broader term "public water system," which includes community water systems and noncommunity water systems that do not serve people year-round. Active systems were defined as those that were operational as of May 31, 2019.

lxxii See U.S. EPA, "Envirofacts: SDWIS: Search," https://www3.epa.gov/enviro/facts/sdwis/search.html

lxxiii See Agency for Toxic Substances and Disease Registry, "CDC's Social Vulnerability Index (SVI)," https://svi.cdc.gov/data-and-tools-download.html

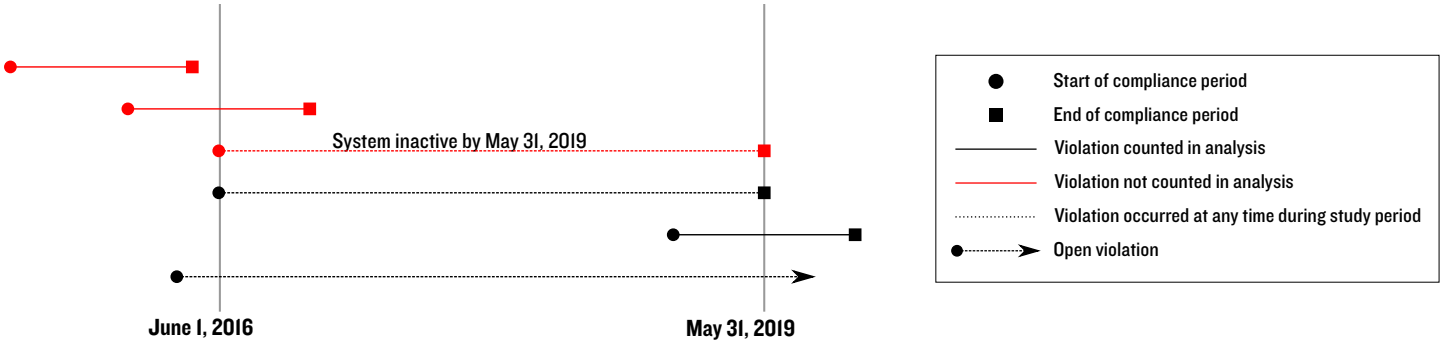
lxxiv A public water system is defined as a drinking water system that has at least 15 service connections or serves at least 25 people for at least 60 days a year. There are currently more than 150,000 public water systems in the United States, which serve more than 300 million people. Community water systems are a subset of public water systems. (Source: EPA; https://www.epa.gov/dwstandardsregulations/background-drinking-water-standards-safe-drinking-water-act-sdwa)

lxxv See 40 CFR 142.15(a)

lxxvi See EPA, "Safe Drinking Water Information System (SDWIS) Federal Reporting Services," https://www.epa.gov/your-drinking-water/safe-drinking-water-information-system-sdwis-federal-reporting-services

## FIGURE A-1: VIOLATION INCLUSION CRITERIA

Violations were included in the analysis if they occurred in systems that were active in the 2019 quarter 2 Safe Drinking Water Information System dataset. Compliance periods that began or ended at any time during the study period (June 1, 2016 to May 31, 2019) were included.




### *All violations*

Violations of the SDWA are classified in one of the three following categories:

- **Health-based violations**—exceeding health-based standards such as maximum contaminant levels and maximum residual disinfectant levels or failing to treat water properly to prevent contamination. These are violations that can have a direct effect on human health.
- **Monitoring and reporting violations**—failures of systems to regularly monitor or submit monitoring results to the primacy agency or EPA.
- **Public notification and other violations**—failure to notify the public about drinking water quality and violation of other requirements that the other two violation types do not cover.

All violations include each of these violation categories, and health-based violations are a subset of all violations. Each violation listed in the SDWIS contains information about the violation type (for example, health-based, monitoring and reporting), the rule in violation (for example, Arsenic Rule, Total Coliform Rule), and the specific contaminant involved in the violation (for example, mercury, atrazine).

To calculate the populations served and numbers of community water systems with violations (including all violation types) of the SDWA, individual violations were aggregated by system to give the total number of violations per system. The numbers of systems were then summed to give the total number of systems with violations. The numbers of violations per system were summed to give the total number of violations. System population totals were summed to give the total population that systems in violation of the SDWA served.

To calculate the populations served and numbers of community water systems with violations by rule, violations were first aggregated by system and rule. Rules were identified using the "Rule Code" data field in the downloaded 2019 quarter 2 dataset of the SDWIS. The numbers of systems with violations under the specific rule were then summed to give the total number of systems with violations of that rule. The numbers of violations by each system under the specific rule were summed to give the total number of violations for that rule. Population totals for systems with violations of the specific rule were summed to give the total population that systems in violation of the specific rule served.

### *Health-based violations alone*

To calculate the populations served and community water systems with health-based violations of the SDWA, records of health-based violations were identified and extracted using the binary "Is Health-Based" field in the downloaded 2019 quarter 2 dataset of the SDWIS. Out of this subset, rules with health-based violations were identified using the "Rule Code" data field.

To calculate the populations served and numbers of community water systems with health-based violations of the SDWA, individual health-based violations were aggregated by system to give the total number of health-based violations per system. Numbers of systems were then summed to give the total number of systems with health-based violations. Numbers of health-based violations per system were summed to give the total number of health-based violations. System population totals were summed to give the total population that systems with health-based violations of the SDWA served.

To calculate the populations served and numbers of community water systems with health-based violations by rule, health-based violations were first aggregated by system and rule. Rules were identified using the "Rule Code" data field in the downloaded 2019 quarter 2 dataset of the SDWIS. Numbers of systems with health-based violations under the specific rule were then summed to give the total number of systems with health-based violations for that rule. Numbers of health-based violations per system under the specific rule were summed to give the total number of health-based violations for that rule. Population totals for systems with violations of the specific rule were summed to give the total population that systems in violation of the specific rule served.

## Social Characteristics

Social characteristics at the county level were obtained from the 2016 CDC-SVI—the most recent data available. The Geospatial Research, Analysis and Services Program of the Agency for Toxic Substances Control created the CDC-SVI as a tool to help identify communities with severe needs before, during, and after a hazardous event (for example, hurricane, flood, disease outbreak, chemical spill). The CDC-SVI ranks[lxxvii] geographic areas (for example, Census tracts and counties) on 15 sociodemographic factors[lxxviii] grouped into four themes: low socioeconomic status, minority status and language, household composition and disability, housing conditions and access to transportation. The 2016 CDC-SVI was created using the American Community Survey, 2012 to 2016 (5-year) data.[lxxix]

## Statistical Analysis

To determine the potential relationship between drinking water violations and the CDC-SVI factors and themes, we geocoded all active community water systems in the SDWIS using the geographic area table of the 2019 quarter 2 dataset. For systems with city-level information only, counties were identified through web searches for county locations or by joining latitude and longitude coordinates for city locations to county layers in QGIS (a free open-source cross-platform desktop geographic information system application that supports viewing, editing, and analysis of geospatial data).

Number of systems in violation, number of systems in a county, number of violations, and total populations that systems in violation and all systems in the county served were calculated for each county. To reduce potential bias associated with larger counties and those with more systems, number of violations (for aggregated violations and health-based violations alone) were divided by total number of systems in county. To create uniformity between the CDC-SVI data and the normalized violations data, percentile ranking values for the normalized violations data were then calculated for each county. The percentile rankings were then matched with county-level percentile ranking SVI data, and Pearson correlations were performed using R (an open source software for statistical and graphical analysis) to identify the strength,[lxxx] direction,[lxxxi] and statistical significance[lxxxii] of the possible relationships. For our analysis, correlation coefficients above 0.1 or below –0.1 with p-values less than 0.05 were considered indicative of potential relationships.

Pearson correlations were chosen because the variables being analyzed were continuous and because of the simplicity of identifying potential relationships. The study design does not provide insight into causality, and correlations are merely indications of relationships. In addition, Pearson correlations do not allow for isolation of the relationship between drinking water violations and a single sociodemographic factor that may be influenced by another—for example, income independent of race.

lxxvii The CDC-SVI theme score is a ranking of each county by percentile rank (PERCENTRANK.INC in Excel) for that theme. Percentile ranking provides a value for each county between 0 and 1 that identifies how that country ranks relative to all other counties on that variable. For example, a county with a score or percentile rank of 1 in the minority status and language theme (RPL_THEME3) would be the county with the highest percentage of its population (relative to all other counties in the United States) that were people of color and/or spoke English "less than well." A county with a score or percentile rank of 0 in the minority status and language theme (RPL_THEME3) would be the county with the lowest percentage of its population (relative to all other counties in the United States) that were people of color and/or spoke English "less than well."

lxxviii Example factors include per capita income, age, race (or minority status), crowded housing, lack of access to vehicles, and number of single-parent households.

lxxix See U.S. Census Bureau, "American Community Survey (ACS). 2012-2016 ACS 5-year Estimates," https://www.census.gov/programs-surveys/acs/technical-documentation/table-and-geography-changes/2016/5-year.html

lxxx Correlation coefficients range from 0 to 1, with greater magnitude indicating a stronger relationship.

lxxxi Correlation coefficients can be positive or negative. Coefficients are positive (>0) when two factors operate in the same way (as one factor increases, the other factor also increases). An example of a positive correlation is that, as temperature outside increases, air conditioner use also increases. Correlation coefficients are negative when two factors operate in opposite ways (as one factor increases, the other factor also decreases). An example of a negative correlation is that, as daylight decreases outside, the use of indoor lighting increases.

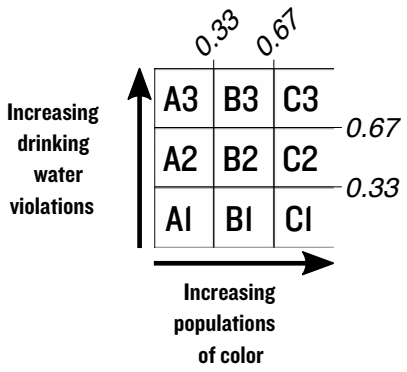
lxxxii Statistical significance is reflected using p-values. The smaller the p-value, the less likely it is that the relationship is a matter of chance—the more "statistically significant" the relationship is. We considered p-values less than 0.05 to be statistically significant.

### *Geographic representation of relationship between racial, ethnic, and language vulnerability and drinking water violations*

To help visualize the areas of the country in which there were a large relative number of SDWA violations and populations of color (areas with high racial, ethnic, and language vulnerability), we developed a bivariate choropleth map with nine classes. On the x-axis, we shaded for increasing populations of color. On the y-axis, we shaded for increasing drinking water violations (Figure A-2).

**FIGURE A-2: BIVARIATE CHOROPLETH CLASSIFICATION SCHEME**

Percentile rankings are indicated in italics next to diagram.




To assign classes for each county, we calculated a percentile ranking for number of violations per community water system for each county relative to each county in the country and matched it with the percentile ranking for the county's minority status and language theme score or percentile ranking from the CDC-SVI. We then calculated tertile values for each of the percentile ranking ranges and assigned a value (A, B, or C for the CDC minority status and language variable and 1, 2, or 3 for normalized drinking water violations[lxxxiii]) for each tertile.

Maps with county and state boundaries[lxxxiv] were obtained from the 2015 U.S. Census Bureau Master Address File/ Topologically Integrated Geographic Encoding and Referencing system.[lxxxv]

For systems serving multiple counties, the system and the population that the system served were counted in the totals for each county served for geographic and statistical analyses. For example, a system serving 500 people in two counties would have its total population (500 people) counted in both counties. The system would also be counted as a community water system in both counties. Populations and systems were not double-counted for calculations of total number of violations, total number of systems, or total populations served at the national level. For single counties with multiple systems, populations that each system served were assumed not to be overlapping.

Populations that were served by systems with unobtainable county-level information (for example, some tribal lands) were not included in the correlation analysis and mapping, but the populations were included in the aggregate population- and system-level totals (for example, total number of community water systems or total U.S. population that systems with violations of the SDWA served). Puerto Rico was also excluded from the correlation and mapping analysis because of its separate assessment in the CDC-SVI. Although the SVI could be reconstructed to include data for Puerto Rico, these data would significantly alter the national social vulnerability percentile rankings, particularly for race and language vulnerability. The populations served, systems with violations, and number of violations for Puerto Rico were included in the aggregate totals (Appendix C Tables C-1 and C-2).

### *Assessment of county-level enforcement and compliance*

To assess the status of enforcement actions and compliance by drinking water systems at the county level, we first downloaded data for all community water systems from the latest version of the EPA Enforcement and Compliance History Online (ECHO)[lxxxvi] tool. ECHO integrates compliance and enforcement data for more than 900,000 regulated facilities, including public water systems, and allows users to search for specific facilities, analyze data trends, and look for specific enforcement cases. For public water systems, ECHO uses SDWIS data and provides information about various compliance and enforcement indicators, including but not limited to number of quarters a system has been in violation, whether the system is a serious violator (the primacy agency has identified it as needing a quick response action to resolve violations),[lxxxvii] and numbers and types of enforcement actions taken against each system. The EPA compiles and curates ECHO data into a publicly available, user-friendly format that that the EPA Office of Enforcement and Compliance Assurance, states, and communities then use to evaluate compliance and enforcement effectiveness.

lxxxiii The 0th – 33rd percentile was assigned A or 1. The 33th – 67th percentile was assigned B or 2. The 67th – 100th percentile was assigned C or 3.

lxxxiv County- and state-level 20-meter-resolution cartographic boundary shapefiles for geographic visualization of drinking water violations

lxxxv U.S. Census Bureau, "Geography Program," Accessed January 17, 2019. https://www.census.gov/geo/maps-data/data/tiger.html.

lxxxvi Data were downloaded on August 18, 2019 from the 07/12/2019 data extraction version of ECHO (see https://echo.epa.gov/resources/echo-data/about-the-data) and include 3- and 5-year data through May 31, 2019.

lxxxvii Serious violators are identified using a scoring mechanism that gives each violation a numerical value of 1, 5, or 10 points, depending on the severity of the violations. Serious violators are those with an aggregate score of 11 or greater.

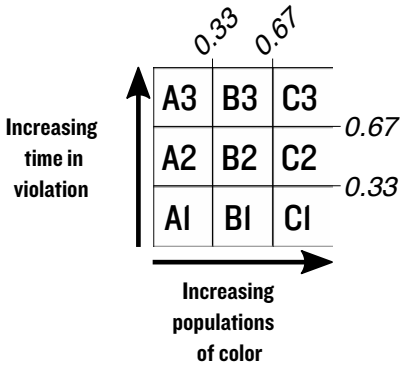
Data from ECHO were then matched to geocoded system-level information. (See *Social characteristics and statistical analysis* section, above.) System-level information was then aggregated at the county level and Pearson correlation assessments were made using R.

### *Geographic representation of relationship between racial, ethnic, and language vulnerability and drinking water violations*

To help visualize the areas of the country in which length of time out of compliance with the SDWA and racial, ethnic, and language vulnerability intersect, we developed a bivariate choropleth map with nine classes. On the x-axis, we shaded for increasing populations of color (racial, ethnic, and language vulnerability). On the y-axis, we shaded for increasing length of time out of compliance (Figure A-3).

**FIGURE A-3: BIVARIATE CHOROPLETH CLASSIFICATION SCHEME**

Percentile rankings are indicated in italics next to diagram.




To assign classes for each county, we calculated a percentile ranking for length of time out of compliance per community water system for each county relative to each county in the country and matched with the percentile ranking for the county's minority status and language theme score/percentile ranking from the CDC-SVI. We then calculated the tertile values for each of the percentile ranking ranges and assigned a value (A, B, or C for the CDC minority status and language variable and 1, 2, or 3 for average length of time out of compliance[lxxxviii]) for each tertile.

lxxxviii The 0th – 33rd percentile was assigned A or 1. The 33th – 67th percentile was assigned B or 2. The 67th – 100th percentile was assigned C or 3.

# *Appendix B: Details on Statistical Relationships*

Pearson correlation coefficients for the relationship between the percentile ranking of the number of violations at the county level and the following percentile rankings for variables from the Centers for Disease Control and Prevention (CDC) Social Vulnerability Index (SVI) are shown in Table B-1.

**TABLE B-1: RELATIONSHIPS BETWEEN DRINKING WATER VIOLATIONS AND CENTERS FOR DISEASE CONTROL AND PREVENTION SOCIAL VULNERABILITY INDEX VARIABLES**

| | NUMBER OF VIOLATIONS PER COMMUNITY WATER SYSTEM | | NUMBER OF HEALTH-BASED VIOLATIONS PER COMMUNITY WATER SYSTEM | |
|---|---|---|---|---|
| **CDC SOCIAL VULNERABILITY THEME** | $r^2$ | P | $r^2$ | P |
| **Socioeconomic Status (RPL_THEME1)** | **0.1114**** | <0.001 | 0.0830** | <0.001 |
| Household Composition and Disability (RPL_THEME2) | 0.0503** | <0.005 | 0.0554** | <0.005 |
| **Minority Status and Language** (RPL_THEME3) | **0.1528**** | <0.001 | **0.1249**** | <0.001 |
| **Housing and Transportation** (RPL_THEME4) | **0.1466**** | <0.001 | **0.1557**** | <0.001 |

Notes: Values with ** are considered statistically significant. Values in **bold** were considered indicative of a relationship between variables. All values are comparisons of percentile rankings for each variable. Number of violations per community water system and number of health-based violations per community water system were generated by dividing number of violations by total number of community water systems (not just those with violations) for each county. For additional details on Centers for Disease Control and Prevention variable descriptions, see https://svi.cdc.gov/Documents/Data/2016_SVI_Data/SVI2016Documentation.pdf.

Pearson correlation coefficients for the relationship between percentile ranking of the Minority Status and Language theme (RPL_THEME3) of the CDC-SVI and the following percentile rankings for enforcement and compliance variables are shown in Table B-2.

**TABLE B-2: RELATIONSHIPS BETWEEN MINORITY STATUS AND LANGUAGE VARIABLE OF CENTERS FOR DISEASE CONTROL AND PREVENTION SOCIAL VULNERABILITY INDEX AND ECHO VARIABLES**

| ENFORCEMENT AND COMPLIANCE HISTORY ONLINE VARIABLE | $r^2$ | P |
|---|---|---|
| Average number of quarters with violation (3 years) | **0.1577**** | <0.001 |
| Average number of quarters as a serious violator (3 years) | **0.1222**** | <0.001 |
| Average number of rules in violation (3 years) | **0.1402**** | <0.001 |
| Average number of violation points+ accrued (5 years) | **0.1220**** | <0.001 |
| Average number of remaining uncorrected violation points+ (5 years) | **0.1760**** | <0.001 |
| Average number of violation points+ under formal enforcement but not yet corrected (5 years) | **0.2377**** | <0.001 |
| Average number of violation points+ returned to compliance by formal enforcement (5 years) | **0.1637**** | <0.001 |
| Average number of violation points+ returned to compliance without formal enforcement (5 years) | 0.0210 | 0.2407 |
| Average number of informal enforcement actions (5 years) | 0.0416* | 0.0200 |
| Average number of formal enforcement actions (5 years) | **0.1748**** | <0.001 |

Notes: Variables with 3-year timeframe are for the 12 most recent quarters of data—June 1, 2016 to May 31, 2019. Variables with a 5-year timeframe are for the 20 most recent quarters—June 1, 2014 to May 31, 2019. Percentile rankings for each of the ECHO variables and the Minority Status and Language variable of the Centers for Disease Control and Prevention Social Vulnerability Index were used for the correlation analyses. Values in **bold** are considered indicative of a relationship between variables. Values with * are statistically significant with p-value $p<0.05$. Values with ** are statistically significant with p-value <0.001.

+ The EPA assigns violation points to help primacy agencies identify systems most in need of a response (for example, formal or informal enforcement) of the agency. Each violation a system accrues is assigned a point value, with point values increasing as violations become more severe. Systems with high total point values can be flagged as being in serious noncompliance.

# *Appendix C: Violation Summaries by Rule*

Between June 1, 2016 and May 31, 2019, 24,133 community water systems[lxxxix] serving 129,907,275 people—nearly 40 percent of the U.S. population—had 170,959 violations of the Safe Drinking Water Act (SDWA).[xc] These violations included health-based, monitoring and reporting, and disclosure violations. By population served, the most commonly reported violations during the study period were for coliform (bacteria), disinfection by-products, and lead and copper (Table C-1).

**TABLE C-1: SAFE DRINKING WATER ACT VIOLATIONS FROM 2016 TO 2019,[xci] RANKED BY POPULATION SERVED[xcii]**

| RULE NAME | NUMBER OF VIOLATIONS | NUMBER OF SYSTEMS WITH VIOLATIONS | POPULATION SERVED BY SYSTEMS WITH VIOLATIONS |
|---|---|---|---|
| Consumer Confidence Rule | 12,606 | 8,097 | 28,788,304 |
| Stage 2 Disinfectants and Disinfection Byproducts Rule | 17,364 | 4,302 | 26,485,383 |
| Lead and Copper Rule | 13,930 | 8,301 | 25,889,139 |
| Revised Total Coliform Rule | 16,839 | 7,382 | 24,419,866 |
| Long-Term 2 Enhanced Surface Water Treatment Rule | 2,735 | 510 | 20,126,916 |
| Long-Term 1 Enhanced Surface Water Treatment Rule | 2,781 | 749 | 16,842,301 |
| Stage 1 Disinfectants and Disinfection Byproducts Rule | 8,166 | 3,917 | 15,602,515 |
| Public Notice Rule | 22,481 | 4,732 | 13,308,880 |
| Ground Water Rule | 7,378 | 3,449 | 13,247,486 |
| Surface Water Treatment Rule | 4,636 | 1,214 | 10,009,635 |
| Nitrates | 3,938 | 1,884 | 7,989,698 |
| Synthetic Organic Contaminants[xciii] | 18,170 | 682 | 4,414,809 |
| Volatile Organic Chemicals | 23,455 | 704 | 4,174,265 |
| Radionuclides | 6,193 | 943 | 3,533,394 |
| Arsenic | 3,202 | 771 | 3,361,665 |
| Not Regulated[xciv] | 4,211 | 887 | 3,188,237 |
| Inorganic Chemicals | 2,832 | 356 | 2,003,130 |
| Miscellaneous | 28 | 17 | 159,064 |
| Filter Backwash Rule | 1 | 1 | 14,728 |
| Total Coliform Rule | 13 | 13 | 6,518 |

lxxxix There were 49,678 community water systems in the 2019 quarter 2 Safe Drinking Water Information System dataset.

xc The estimated population of the United States on May 31, 2019, was 328,972,138 (see https://www.census.gov/popclock/ for population calculator). Between June 1, 2016, and May 31, 2019, a community water system with at least one violation of the SDWA served 39.5 percent of the U.S. population.

xci Data are for June 1, 2016 to May 31, 2019.

xcii Data are from the 2019 quarter 2 dataset of the Safe Drinking Water Information System and include community water systems on tribal lands; in all U.S. states; and in all reporting U.S. territories including Puerto Rico, Guam, Mariana Islands, and American Samoa.

xciii These violation totals are only for *regulated* chemicals and do not include unregulated chemicals such as polyfluoroalkyl and perfluoroalkyl substances. These values are therefore an underestimate of the overall burden populations may face as a result of manmade chemicals in their drinking water.

xciv Includes contaminants that fall under the Unregulated Contaminant Monitoring Rule, those that were monitored in systems before adoption of a rule, and those included in the National Secondary Drinking Water Regulations.

### *Health-Based Violations*

Our analysis identified 23,040 health-based violations of the SDWA by 5,634 systems serving 44,980,846 people between June 1, 2016 and May 31, 2019. Health-based violations are a subset of all violations. By population served, the most common violations during the study period were for coliform (bacteria), disinfection by-products,[xcv] and improper treatment of surface water (Table C-2).

**TABLE C-2: HEALTH-BASED SAFE DRINKING WATER ACT VIOLATIONS FROM 2016 TO 2019,[xcvi] RANKED BY POPULATION SERVED[xcvii]**

| RULE NAME | NUMBER OF HEALTH-BASED VIOLATIONS | NUMBER OF SYSTEMS WITH HEALTH-BASED VIOLATIONS | POPULATION SERVED BY SYSTEMS WITH HEALTH-BASED VIOLATIONS |
|---|---|---|---|
| Long-Term 2 Enhanced Surface Water Treatment Rule | 385 | 152 | 14,958,391 |
| Stage 2 Disinfectants and Disinfection Byproducts Rule | 9,471 | 1,837 | 14,858,180 |
| Long-Term 1 Enhanced Surface Water Treatment Rule | 667 | 260 | 6,229,618 |
| Revised Total Coliform Rule | 994 | 791 | 4,388,520 |
| Lead and Copper Rule | 571 | 401 | 2,683,108 |
| Ground Water Rule | 2,195 | 978 | 2,043,547 |
| Surface Water Treatment Rule | 1,051 | 407 | 1,995,732 |
| Stage 1 Disinfectants and Disinfection Byproducts Rule | 823 | 389 | 1,846,247 |
| Nitrates | 1,269 | 307 | 1,717,848 |
| Not Regulatedx[cviii] | 173 | 73 | 594,589 |
| Arsenic | 2,422 | 412 | 582,947 |
| Radionuclides | 2,357 | 342 | 549,601 |
| Inorganic Chemicals | 613 | 98 | 236,785 |
| Volatile Organic Chemicals | 35 | 14 | 49,402 |
| Synthetic Organic Contaminants[xcix] | 11 | 6 | 17,559 |

xcv Includes any violation of the disinfection by-product rule, including maximum contaminant level, maximum residual disinfectant level, treatment techniques, and monitoring and reporting violations.

xcvi Data are for June 1, 2016 to May 31, 2019.

xcvii Data are from the 2019 quarter 2 dataset of the Safe Drinking Water Information System and include community water systems on tribal lands; in all U.S. states; and in all reporting U.S. territories including Puerto Rico, Guam, Mariana Islands, and American Samoa.

xcviii Includes contaminants that fall under the Unregulated Contaminant Monitoring Rule, those that were monitored in systems before adoption of a rule, and those included in the National Secondary Drinking Water Regulations.

xcix These violation totals are only for *regulated* chemicals and do not include *unregulated* chemicals such as polyfluoroalkyl and perfluoroalkyl substances. These values are therefore an underestimate of the overall burden populations may face as a result of manmade chemicals in their drinking water.

# *Appendix D: Safe Drinking Water Act Rules*

| RULE NAME | DESCRIPTION | POTENTIAL HEALTH EFFECTS |
|---|---|---|
| **Stage I and 2 Disinfectant and Disinfection Byproduct Rules** | Establishes health standards for disinfection byproducts for community water systems that add disinfectants to their water. Although adding chlorine or other chemical disinfectants to water has benefits, these disinfectants can react with organic matter in the water to create byproducts that can harm human health. | ■ Cancer<br>■ Eye or nose irritation<br>■ Stomach discomfort<br>■ Nervous system effects in infants and young children<br>■ Liver, kidney, and central nervous system problems |
| **Total Coliform Rule** | Sets MCLG and MCL for presence of total coliform bacteria levels in drinking water. Coliform bacteria are a family of bacteria common in soils, plants, and the guts of animals. | ■ Presence of coliform bacteria may indicate that harmful pathogens are present that can lead to:<br>▪ diarrhea<br>▪ cramps<br>▪ nausea<br>▪ vomiting<br>▪ death (in severe cases) |
| **Combined Surface, Groundwater, and Filter Backwash Rules**<br>■ Groundwater Rule<br>■ Surface Water Rule<br>■ Filter Backwash Rule<br>■ Long-Term I Enhanced Surface Water Treatment Rule<br>■ Long-Term 2 Enhanced Surface Water Treatment Rule | Establishes treatment requirements to protect people from potential pathogens from groundwater or surface water sources. | ■ Pathogens such as *Cryptosporidium* and *Giardia* can cause severe gastrointestinal distress, nausea, diarrhea, and potentially life-threatening infections (particularly in elderly, young, and immunocompromised individuals). |
| **Nitrate Rule**[c] | Sets MCLG and MCL for nitrates and nitrites in drinking water. These contaminants commonly come from run-off from synthetic fertilizer or waste from large animal agriculture operations or human sewage or septic systems. | ■ Blue baby syndrome<br>■ Developmental defects<br>■ Infant death (in extreme cases)<br>■ Impaired thyroid function<br>■ Decreased cardiovascular function<br>■ Cancer[123] |
| **Lead and Copper Rule** | A complex treatment technique to control lead levels in tap water. All water systems serving more than 50,000 people must treat their water to "optimize corrosion control" or demonstrate that their water is not corrosive and they have no lead problems. Additional requirements also apply. | ■ Nervous system effects, including irreversible brain damage<br>■ Miscarriage and stillbirth<br>■ Fertility problems<br>■ Cardiovascular and kidney effects<br>■ Cognitive dysfunction<br>■ Elevated blood pressure in healthy adults |
| **Radionuclides Rule** | Regulates combined radium-226/-228; (adjusted) gross alpha, beta particle, and photon radioactivity; and uranium. | ■ Cancer<br>■ Problems with kidney function |

c Regulated under Phase II of the Inorganic Contaminants Rule. The Environmental Protection Agency classifies these contaminants independently in the Safe Drinking Water Information System

| RULE NAME | DESCRIPTION | POTENTIAL HEALTH EFFECTS |
|---|---|---|
| **Arsenic Rule** | Sets MCLG and MCL for presence of arsenic in drinking water. | ■ Cancer<br>■ Developmental defects<br>■ Pulmonary disease<br>■ Skin lesions<br>■ Cardiovascular disease |
| **Synthetic Organic Contaminants Rule** | Sets MCLG and MCL for 34 synthetic (man-made) organic chemicals that do not exist in nature. | ■ Cancer<br>■ Developmental defects<br>■ Central nervous system and reproductive difficulties<br>■ Endocrine problems<br>■ Liver and kidney problems |
| **Inorganic Contaminants Rule** | Sets MCLG and MCL for 12 inorganic contaminants (excluding nitrate and nitrite)—materials of mineral origin that may be present in water because of human activity, such as mining. | ■ Cancer<br>■ Increased cholesterol<br>■ Kidney damage<br>■ Hair loss<br>■ Skin irritation<br>■ Circulatory problems<br>■ Nerve damage |
| **Volatile Organic Contaminants Rule** | Sets MCLG and MCL for 21 volatile organic contaminates, which are gases at room temperature. | ■ Cancer<br>■ Developmental issues<br>■ Skin problems<br>■ Reproductive problems<br>■ Cardiovascular problems<br>■ Adverse effects on liver, kidneys, and immune and nervous systems |
| **Consumer Confidence Rule (Right-to-Know)** | Requires community water systems to deliver an annual drinking water quality report to customers that provides information about local drinking water quality, including information on source water, levels of detected contaminants, potential health effects of detected contaminants, and compliance with drinking water rules. | Not applicable |
| **Public Notification Rule** | Requires public water systems (including community water systems) to notify customers when they violate Environmental Protection Agency drinking water regulations or when they provide drinking water that may pose a risk to consumer health. | Not applicable |

Notes: MCLG = maximum contaminant level goal; MCL = maximum contaminant level

ENDNOTES


1 Benjamin Wisner and John Adams, eds., "Environmental Health in Emergencies and Disasters: A Practical Guide." (Geneva: World Health Organization, 2002), https://apps.who.int/iris/bitstream/handle/10665/42561/9241545410_eng.pdf;jsessionid=A2F5920C9DBE093366A4E681E902D1DB?sequence=1 (accessed September 16, 2019).

2 Betty Hearn Morrow, "Identifying and Mapping Community Vulnerability," *Disasters* 23, no. 1 (1999): 1–18, doi: 10.1111/1467-7717.00102.

3 Cannon, Terry. "Vulnerability Analysis and The Explanation Of 'Natural' Disasters." Disasters, Development and Environment, January 1, 1994.

4 "Gastrointestinal Disease–an Overview | ScienceDirect Topics," https://www.sciencedirect.com/topics/medicine-and-dentistry/gastrointestinal-disease (accessed May 6, 2019).

5 Centers for Disease Control and Prevention, "Current Waterborne Disease Burden Estimates: 2008," https://www.cdc.gov/healthywater/burden/current-data.html (accessed July 29, 2019).

6 Erik Olson and Kristi Pullen, *What's in Your Water? Flint and Beyond,* 2016, https://www.nrdc.org/sites/default/files/whats-in-your-water-flint-beyond-report.pdf (accessed January 7, 2019).

7 Michigan Department of Civil Rights, "Michigan Civil Rights Commission Report: Race and Racism Played Roles in Causing the Flint Water Crisis, and Both Blacks and Whites Are Victims," February 17, 2017, https://www.michigan.gov/mdcr/0,4613,7-138--405318--a,00.html (accessed September 16, 2019).

8 EPA, "Environmental Justice and Water Infrastructure Finance and Capacity Charge." Overviews and Factsheets. US EPA, December 6, 2016. https://www.epa.gov/environmentaljustice/environmental-justice-and-water-infrastructure-finance-and-capacity-charge (accessed September 16, 2019).

9 EPA Office of Inspector General, "Management Alert: Drinking Water Contamination in Flint, Michigan, Demonstrates a Need to Clarify EPA Authority to Issue Emergency Orders to Protect the Public," October 20, 2016, https://www.epa.gov/sites/production/files/2016-10/documents/_epaoig_20161020-17-p-0004.pdf (accessed September 16, 2019).

10 EPA, "Environmental Justice and Water Infrastructure Finance and Capacity Charge."

11 EPA, "EJ 2020 Action Agenda: The U.S. EPA's Environmental Justice Strategic Plan for 2016-2020," October 27, 2016, https://www.epa.gov/sites/production/files/2016-05/documents/052216_ej_2020_strategic_plan_final_0.pdf (accessed September 16, 2019).

12 Kayla Ruble, Jacob Carah, Abby Ellis, and Sarah Childress, "Flint Water Crisis Deaths Likely Surpass Official Toll, PBS Frontline," July 24, 2018, https://www.pbs.org/wgbh/frontline/article/flint-water-crisis-deaths-likely-surpass-official-toll/ (accessed July 29, 2019).

13 Erik Olson and Kristi Pullen, *What's in Your Water? Flint and Beyond* (2016), https://www.nrdc.org/sites/default/files/whats-in-your-water-flint-beyond-report.pdf (accessed January 7, 2019).

14 Michigan Civil Rights Commission, *The Flint Water Crisis: Systemic Racism Through the Lens of Flint*, (2017) https://www.michigan.gov/documents/mdcr/VFlintCrisisRep-F-Edited3-13-17_554317_7.pdf (accessed January 7, 2019).

15 Kristi Pullen Fedinick et al., *Threats on Tap: Widespread Violations Highlight Need for Investment in Water Infrastructure and Protections,* 2017, https://www.nrdc.org/sites/default/files/threats-on-tap-water-infrastructure-protections-report.pdf (accessed January 7, 2019).

16 "Water Pollution Worries Highest Since 2001," https://news.gallup.com/poll/207536/water-pollution-worries-highest-2001.aspx (accessed September 4, 2019).

17 Ibid.

18 Robert D. Bullard, Paul Mohai, Robin Saha, and Beverly Wright, "Toxic Wastes and Race at Twenty, 1987-2007: A Report Prepared for the United Church of Christ Justice and Witness Ministries," *United Church of Christ*,[[Provide publication details]] 2007. Paul Mohai and Robin Saha, "Which Came First, People or Pollution? A Review of Theory and Evidence from Longitudinal Environmental Justice Studies." *Environmental Research Letters* 10, no. 12 (December 2015): 125011, https://doi.org/10.1088/1748-9326/10/12/125011.

19 Kristen Burwell-Naney, Hongmei Zhang, Ashok Samantapudi, Chengsheng Jiang, Laura Dalemarre, LaShanta Rice, Edith Williams, and Sacoby Wilson, "Spatial Disparity in the Distribution of Superfund Sites in South Carolina: An Ecological Study," *Environmental Health* 12, no. 1 (December 2013). https://doi.org/10.1186/1476-069X-12-96. Sangyun Lee and Paul Mohai, "Environmental Justice Implications of Brownfield Redevelopment in the United States," *Society & Natural Resources* 25, no. 6 (June 2012): 602–609, https://doi.org/10.1080/08941920.2011.566600.

20 Paul Orom, Richard Moore, Michelle Roberts, and Juaquin Sanchez, "Who's in Danger? Race, Poverty, and Chemical Disasters," Environmental Justice and Health Alliance for Chemical Policy Reform, May 2014, https://comingcleaninc.org/assets/media/images/Reports/Who's%20in%20Danger%20Report%20FINAL.pdf. Ron White, "Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities," Environmental Justice Health Alliance for Chemical Policy Reform, Coming Clean, and Campaign for Healthier Solutions, September 2018, https://new.comingcleaninc.org/assets/media/documents/Life%20at%20the%20Fenceline%20-%20English%20-%20Public.pdf.

21 J. M. Samet, "Urban Air Pollution and Health Inequities: A Workshop Report," *Environmental Health Perspectives Supplements* 109 (June 2001): 357. https://doi.org/10.2307/3434783.

22 Harley T. Davis, C. Marjorie Aelion, Jihong Liu, James B. Burch, Bo Cai, Andrew B. Lawson, and Suzanne McDermott, "Potential Sources and Racial Disparities in the Residential Distribution of Soil Arsenic and Lead among Pregnant Women," *Science of the Total Environment* 551–552 (May 2016): 622–630, https://doi.org/10.1016/j.scitotenv.2016.02.018.

23 Carly Hyland, and Ouahiba Laribi, "Review of Take-Home Pesticide Exposure Pathway in Children Living in Agricultural Areas," *Environmental Research* 156 (July 1, 2017): 559–570, https://doi.org/10.1016/j.envres.2017.04.017.

24 Seth A. Seabury, Sophie Terp, and Leslie I. Boden, "Racial and Ethnic Differences in the Frequency of Workplace Injuries and Prevalence of Work-Related Disability," *Health Affairs* 36, no. 2 (February 2017): 266–273, https://doi.org/10.1377/hlthaff.2016.1185.

25 Alice Fothergill, Enrique G. M. Maestas, and JoAnne DeRouen Darlington, "Race, Ethnicity and Disasters in the United States: A Review of the Literature," *Disasters* 23, no. 2 (1999): 156–173, https://doi.org/10.1111/1467-7717.00111. Jayajit Chakraborty, Timothy W. Collins, and Sara E. Grineski, "Exploring the Environmental Justice Implications of Hurricane Harvey Flooding in Greater Houston, Texas," *American Journal of Public Health* 109, no. 2 (February 2019): 244–250, https://doi.org/10.2105/AJPH.2018.304846. Gustavo A. García-López, "The Multiple Layers of Environmental Injustice in Contexts of (Un)Natural Disasters: The Case of Puerto Rico Post-Hurricane Maria," *Environmental Justice* 11, no. 3 (June 2018): 101–108, https://doi.org/10.1089/env.2017.0045.

26 Ami R. Zota and Bhavna Shamasunder, "The Environmental Injustice of Beauty: Framing Chemical Exposures from Beauty Products As a Health Disparities Concern," *American Journal of Obstetrics and Gynecology* 217, no. 4 (October 2017): 418.e1–418.e6, https://doi.org/10.1016/j.ajog.2017.07.020. R. Castorina, A. Bradman, L. Fenster, D. B. Barr, R. Bravo, M. G. Vedar, M. E. Harnly, T. E. McKone, E. A. Eisen, and B. Eskenazi, "Comparison of Current-Use Pesticide and Other Toxicant Urinary Metabolite Levels among Pregnant Women in the CHAMACOS Cohort and NHANES," *Environmental Health Perspectives* 118, no. 6 (June 2010): 856–863, https://doi.org/10.1289/ehp.0901568. Lara Cushing, John Faust, Laura Meehan August, Rose Cendak, Walker Wieland, and George Alexeeff, "Racial/Ethnic Disparities in Cumulative Environmental Health Impacts in California: Evidence from a Statewide Environmental Justice Screening Tool (CalEnviroScreen 1.1)," *American Journal of Public Health* 105, no. 11 (November 2015): 2341–2348, https://doi.org/10.2105/AJPH.2015.302643. Hongtai Huang, Rogelio Tornero-velez, and Timothy M. Barzyk, "Associations Between Socio-Demographic Characteristics and Chemical Concentrations Contributing to Cumulative Exposures in the United States," *Journal of Exposure Science and Environmental Epidemiology* 27, no. 6 (November 2017): 544–550, http://dx.doi.org/10.1038/jes.2017.15.

27 Robert-Paul Juster, Bruce S. McEwen, and Sonia J. Lupien, "Allostatic Load Biomarkers of Chronic Stress and Impact on Health and Cognition," *Neuroscience & Biobehavioral Reviews* 35, no. 1 (September 2010): 2–16, https://doi.org/10.1016/j.neubiorev.2009.10.002.

28 Ana Ribeiro, Joana Amaro, Cosima Lisi, and Silvia Fraga, "Neighborhood Socioeconomic Deprivation and Allostatic Load: A Scoping Review," *International Journal of Environmental Research and Public Health* 15, no. 6 (May 28, 2018): 1092, https://doi.org/10.3390/ijerph15061092.

29 EPA, "EJSCREEN Technical Documentation," 2017, https://www.epa.gov/sites/production/files/2017-09/documents/2017_ejscreen_technical_document.pdf.

30 Robert D. Bullard, *The Quest for Environmental Justice: Human Rights and the Politics of Pollution.* San Francisco: Sierra Club Books, 2005. Julian Agyeman, David Schlosberg, Luke Craven, and Caitlin Matthews, "Trends and Directions in Environmental Justice: From Inequity to Everyday Life, Community, and Just Sustainabilities," *Annual Review of Environment and Resources* 41, no. 1 (November 2016): 321–340.,https://doi.org/10.1146/annurev-environ-110615-090052.

31 Declaration of Yiliqi, *EJHA v. EPA*, 15-cv-5705 (S.D.N.Y. Dec. 11, 2015).

32 *Ibid.*

33 Memorandum in Support of Plaintiffs' Motion for Summary Judgment, *EJHA v. EPA*, 15-cv-5705 (S.D.N.Y. Dec. 11, 2015).

34 Rahul Gupta, "Report to the Joint Committee on Government and Finance of the West Virginia Legislature by the Public Water System Supply Study Commission," n.d., 59. http://dhsem.wv.gov/West%20Virginia%20Public%20Water%20Supply%20Study%20Commission/Documents/December%202014%20Report%20of%20the%20Water%20Commission.pdf (accessed September 16, 2019).

35 U.S. Chemical Safety Board, "Final Investigation Report: Chemical Spill Contaminates Public Water Supply in Charleston, West Virginia," Report No. 2014-01-I-WV, September 2016. Marshall University Center for Business and Economic Research, "CBER Calculates Impact from Chemical Spill into Elk River," February 4, 2014. http://www.cbermu.org/cber-calculates-impact-chemical-spill-elk-river (accessed September 16, 2019).

36 Center for Business and Economic Research, "CBER Calculates Impact from Chemical Spill into Elk River," February 4, 2014, http://www.cbermu.org/cber-calculates-impact-chemical-spill-elk-river/.

37 "Life at the Fenceline: Understanding Cumulative Health Hazards in Environmental Justice Communities," Workgroup for Public Policy Reform, https://ejforall.org/life-at-the-fenceline (accessed February 13, 2019).

38 *Ibid.*

39 *Ibid.*

40 "Carolinians See Governor in PCB Landfill Dispute," The New York Times, October 10, 1982, sec. U.S., https://www.nytimes.com/1982/10/10/us/carolinians-see-governor-in-pcb-landfill-dispute.html (accessed January 7, 2019).

41 "55 Arrested in Protest at a Toxic Dump in Carolina" The New York Times, Sep 16, 1982 https://www.nytimes.com/1982/09/16/us/55-arrested-in-protest-at-a-toxic-dump-in-carolina.html (accessed January 7, 2019).

42 Robert D. Bullard, *Dumping in Dixie: Race, Class, and Environmental Quality,* (Boulder, CO: Westview Press, 2000).

43 Robert D. Bullard, Glenn Johnson, Denae King, and Angel O. Torres, "Environmental Justice Milestones and Accomplishments: 1964-2014: A Report Prepared in Commemoration of the Twentieth Anniversary of the Environmental Justice Executive Order 12898 Principal Authors Environmental Justice Timeline and Milestones: 1964-2014," 2014. https://www.researchgate.net/publication/260338988_Environmental_Justice_Milestones_and_Accomplishments_1964-2014_A_Report_Prepared_in_Commemoration_of_the_Twentieth_Anniversary_of_the_Environmental_Justice_Executive_Order_12898_Principal_Authors_Envi

44 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," February 1994, https://www.archives.gov/files/federal-register/executive-orders/pdf/12898.pdf (accessed January 7, 2019).

45 Robert Connell, "National People of Color Environmental Leadership Summit." In *Green Culture: An A-to-Z Guide,* Kevin Wehr, ed., (Thousand Oaks, CA: SAGE Publications, Inc., 2011), https://doi.org/10.4135/9781412975711.n91.

46 EPA, "Environmental Justice." November 3, 2014, https://www.epa.gov/environmentaljustice (accessed September 16, 2019).

47 EPA, National Environmental Justice Advisory Council, "Overviews and Factsheets." February 17, 2015, https://www.epa.gov/environmentaljustice/national-environmental-justice-advisory-council (accessed September 16, 2019).

48 Bullard, "Environmental Justice Milestones and Accomplishments."

49 Benjamin Wisner and John Adams, eds., "Environmental Health in Emergencies and Disasters: A Practical Guide." (Geneva: World Health Organization, 2002), https://apps.who.int/iris/bitstream/handle/10665/42561/9241545410_eng.pdf;jsessionid=A2F5920C9DBE093366A4E681E902D1DB?sequence=1 (accessed September 16, 2019).

50 Betty Hearn Morrow, "Identifying and Mapping Community Vulnerability," *Disasters* 23, no. 1 (1999): 1–18, doi: 10.1111/1467-7717.00102.

51 Cannon, "Vulnerability Analysis and the Explanation of 'Natural' Disasters."

52 Carolina Balazs et al., "Social Disparities in Nitrate-Contaminated Drinking Water in California's San Joaquin Valley," *Environmental Health Perspectives* 119, no. 9 (September 2011): 1272–1278, https://doi.org/10.1289/ehp.1002878.

53 Mary Ward, Rena Jones, Jean Brender, Theo de Kok, Peter Weyer, Bernard Nolan, Cristina Villanueva, and Simone van Breda, "Drinking Water Nitrate and Human Health: An Updated Review," *International Journal of Environmental Research and Public Health* 15, no. 7 (July 23, 2018): 1557, doi:10.3390/ijerph15071557.

54 Carolina L Balazs et al., "Environmental Justice Implications of Arsenic Contamination in California's San Joaquin Valley: A Cross-Sectional, Cluster-Design Examining Exposure and Compliance in Community Drinking Water Systems," *Environmental Health* 11, no. 1 (December 2012), https://doi.org/10.1186/1476-069X-11-84.

55 David Switzer and Manuel P. Teodoro, "Class, Race, Ethnicity, and Justice in Safe Drinking Water Compliance*: Class, Race, Ethnicity, and Drinking Water Compliance," *Social Science Quarterly* 99, no. 2 (June 2018): 524–535, https://doi.org/10.1111/ssqu.12397.

56 Yolanda J. McDonald and Nicole E. Jones, "Drinking Water Violations and Environmental Justice in the United States, 2011–2015," *American Journal of Public Health* 108, no. 10 (October 2018): 1401–1407, https://doi.org/10.2105/AJPH.2018.304621.

57 US Census Bureau, "American Community Survey (ACS)," https://www.census.gov/programs-surveys/acs. (accessed February 13, 2019).

58 John T. Doyle, Larry Kindness, James Realbird, Margaret J. Eggers, and Anne K. Camper, "Challenges and Opportunities for Tribal Waters: Addressing Disparities in Safe Public Drinking Water on the Crow Reservation in Montana, USA," *International Journal of Environmental Research and Public Health* 15, no. 4 (April 2018): 567, http://dx.doi.org/10.3390/ijerph15040567.

59 Margaret J. Eggers, John T. Doyle, Myra J. Lefthand, Sara L. Young, Anita L. Moore-Nall, Larry Kindness, Roberta Other Medicine, et al., "Community Engaged Cumulative Risk Assessment of Exposure to Inorganic Well Water Contaminants, Crow Reservation, Montana," *International Journal of Environmental Research and Public Health* 15, no. 1 (January 2018): 76.\, http://dx.doi.org/10.3390/ijerph15010076.

60 Doyle, "Challenges and Opportunities for Tribal Waters."

61 "Overview of Water-Related Diseases and Contaminants in Private Wells | Wells | Private Water Systems | Drinking Water | Healthy Water | CDC," October 10, 2018, https://www.cdc.gov/healthywater/drinking/private/wells/diseases.html.

62 Ibid.

63 Christopher D. Heaney, Steve Wing, Sacoby M. Wilson, Robert L. Campbell, David Caldwell, Barbara Hopkins, Shannon OShea, and Karin Yeatts, "Public Infrastructure Disparities and the Microbiological and Chemical Safety of Drinking and Surface Water Supplies in a Community Bordering a Landfill," *Journal of Environmental Health* 75, no. 10 (June 2013): 24–36. Christopher Heaney, Sacoby Wilson, Omega Wilson, John Cooper, Natasha Bumpass, and Marilyn Snipes, "Use of Community-Owned and -Managed Research to Assess the Vulnerability of Water and Sewer Services in Marginalized and Underserved Environmental Justice Communities," *Journal of Environmental Health* 74, no. 1 (August 7, 2011): 8–17.

64 Frank Stillo and Jacqueline MacDonald Gibson, "Exposure to Contaminated Drinking Water and Health Disparities in North Carolina," *American Journal of Public Health* 107, no. 1 (January 1, 2017): 180-185, https://doi.org/10.2105/AJPH.2016.303482

65 Tyler D. Johnson and Kenneth Belitz, "Domestic Well Locations and Populations Served in the Contiguous U.S.: 1990," *Science of the Total Environment* 607–608 (December 31, 2017): 658–668, https://doi.org/10.1016/j.scitotenv.2017.07.018. U.S. Geological Survey "Domestic (Private) Supply Wells," https://water.usgs.gov/nawqa/home_maps/private_wells.html (accessed February 5, 2019).

66 Carolina Balazs et al., "Social Disparities in Nitrate-Contaminated Drinking Water in California's San Joaquin Valley," *Environmental Health Perspectives* 119, no. 9 (September 2011): 1272–1278, https://doi.org/10.1289/ehp.1002878.

67 Werner E. Bischoff, Maria Weir, Phillip Summers, Haiying Chen, Sara A. Quandt, Amy K. Liebman, and Thomas A. Arcury, "The Quality of Drinking Water in North Carolina Farmworker Camps," *American Journal of Public Health* 102, no. 10 (October 2012): e49–e54, https://doi.org/10.2105/AJPH.2012.300738.

68 "Water Deeply: Farmworkers' Dilemma: Affordable Housing, but Undrinkable Water," https://www.newsdeeply.com/water/articles/2017/09/26/farmworkers-dilemma-affordable-housing-but-undrinkable-water (accessed April 11, 2019).

69 Kristi Pullen Fedinick et al. "Threats on Tap: Widespread Violations Highlight Need for Investment in Water Infrastructure and Protections," 2017, https://www.nrdc.org/sites/default/files/threats-on-tap-water-infrastructure-protections-report.pdf (accessed January 7, 2019).

70 "Lessons from Drinking Water Systems in Hawai'i and the U.S. Territories," Environmental Finance Blog, August 14, 2013, http://efc.web.unc.edu/2013/08/14/lessons-from-drinking-water-systems-in-hawaii-and-the-u-s-territories-3 (accessed September 16, 2019).

71 Ibid.

72 EPA, "Safe Drinking Water Act (SDWA)," Collections and Lists, March 25, 2015, https://www.epa.gov/sdwa.

73 EPA Office of Ground Water and Drinking Water, "Understanding the Safe Drinking Water Act," n.d., https://www.epa.gov/sites/production/files/2015-04/documents/epa816f04030.pdf.

74 EPA National Center for Environmental Assessment, "Aresnic, inorganic, CASRN 7440-38-2," n.d., https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0278_summary.pdf#nameddest=woe (accessed September 16, 2019).

75 National Research Council, *Arsenic in Drinking Water: 2001 Update*, 2001, https://doi.org/10.17226/10194.

76 EPA, "Basic Information about Lead in Drinking Water," https://www.epa.gov/ground-water-and-drinking-water/basic-information-about-lead-drinking-water (accessed September 16, 2019).

77 EPA Office of Ground Water and Drinking Water, "Understanding the Safe Drinking Water Act."

78 EPA, "Tribal Public Water System Supervision Program: Policies and Guidance," January 12, 2015, https://www.epa.gov/tribaldrinkingwater/tribal-public-water-system-supervision-program.

79 "EPA's Drinking Water Action Plan," https://www.epa.gov/sites/production/files/2016-11/documents/508.final_.usepa_.drinking.water_.action.plan_11.30.16.v0.pdf.

80 Sacoby M. Wilson, Christopher D. Heaney, John Cooper, and Omega Wilson, "Built Environment Issues in Unserved and Underserved African-American Neighborhoods in North Carolina," *Environmental Justice* 1, no. 2 (June 2008): 63–72, https://doi.org/10.1089/env.2008.0509. Carolina L. Balazs and Isha Ray, "The Drinking Water Disparities Framework: On the Origins and Persistence of Inequities in Exposure," *American Journal of Public Health* 104, no. 4 (April 2014): 603–611, https://doi.org/10.2105/AJPH.2013.301664.

81 American Society of Civil Engineers, "America's Infrastructure Scores a D+," https://www.infrastructurereportcard.org (accessed September 16, 2019).

82 "A Blueprint for Achieving Social, Economic, and Environmental Justice for the Sandbranch Community," https://www.docdroid.net/yu3N18X/strategic-vision-and-plan-for-improvements-to-the-sandbranch-communityv2.pdf; https://www.sandbrancheverybodyscommunity.org/. Doyin Oyeniyi, "Sandbranch Is yet Another Poor, Black Community Without Clean Water," *Texas Monthly* February 2, 2016, https://www.texasmonthly.com/the-daily-post/sandbranch-is-yet-another-poor-black-community-without-clean-water/. Oliver Milman, "'America's Dirty Little Secret': The Texas Town That Has Been without Running Water for Decades," *The Guardian* November 23, 2017 sec. US news, https://www.theguardian.com/us-news/2017/nov/23/texas-town-without-running-water-sandbranch.

83 EPA, "NEJAC Environmental Justice and Water Infrastructure Finance and Capacity CHARGE," October 4, 2016, https://www.epa.gov/sites/production/files/2016-12/documents/nejac_environmental_justice_and_water_infrastructure_finance_and_capacity_final_charge.pdf (accessed September 16, 2019).

84 National Environmental Justice Advisory Council, "EPA'S Role in Addressing the Urgent Water Infrastructure Needs of Environmental Justice Communities," March 1, 2019, https://www.epa.gov/sites/production/files/2019-05/documents/nejac_white_paper_water-final-3-1-19.pdf (accessed September 16, 2019).

85 EPA, "NEJAC Environmental Justice and Water Infrastructure Finance and Capacity CHARGE."

86 EPA, "EJ 2020 Action Agenda: EPA's Environmental Justice Strategy." Reports and Assessments, April 10, 2015, https://www.epa.gov/environmentaljustice/ej-2020-action-agenda-epas-environmental-justice-strategy.

87 "Trump Wants to Kill the EPA's Environmental Justice Program," NRDC, June 1, 2017, https://www.nrdc.org/trump-watch/trump-wants-kill-epas-environmental-justice-program (accessed July 1, 2019) (accessed September 16, 2019).

88 SDWA, codified at 42 U.S.C. §300f et seq.

89 Annie Snider, "What Broke the Safe Drinking Water Act?" *The Agenda,* https://politi.co/2IgMs2b (accessed April 11, 2019).

90 Kristi Pullen Fedinick et al. *Threats on Tap: Widespread Violations Highlight Need for Investment in Water Infrastructure and Protections,* 2017, https://www.nrdc.org/sites/default/files/threats-on-tap-water-infrastructure-protections-report.pdf (accessed January 7, 2019). Erik Olson and Jennifer Sass, "White House and Pentagon Bias National Academy Perchlorate Report," January 10, 2005, https://www.nrdc.org/resources/white-house-and-pentagon-bias-national-academy-perchlorate-report (accessed July 30, 2019).

91 Arlene Blum et al., "The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)," *Environmental Health Perspectives* 123, no. 5 (May 2015): A107–A111, https://doi.org/10.1289/ehp.1509934.

92 Xindi C. Hu et al., "Detection of Poly- and Perfluoroalkyl Substances (PFASs) in US Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants," *Environmental Science & Technology Letters* 3, no. 10 (October 2016): 344–350, https://doi.org/10.1021/acs.estlett.6b00260.

93 "ATSDR - Toxicological Profile: Perfluoroalkyls," https://www.atsdr.cdc.gov/toxprofiles/TP.asp?id=1117&tid=237 (accessed April 11, 2019). Anna Reade, Tracy Quinn, and Judith S Schreiber, "Scientific and Policy Assessment for Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water," NRDC, March 15, 2019, https://www.nrdc.org/sites/default/files/assessment-for-addressing-pfas-chemicals-in-michigan-drinking-water.pdf (accessed September 16, 2019).

94 Mark Strynar, Sonia Dagnino, Rebecca McMahen, Shuang Liang, Andrew Lindstrom, Erik Andersen, Larry McMillan, Michael Thurman, Imma Ferrer, and Carol Ball, "Identification of Novel Perfluoroalkyl Ether Carboxylic Acids (PFECAs) and Sulfonic Acids (PFESAs) in Natural Waters Using Accurate Mass Time-of-Flight Mass Spectrometry (TOFMS)," *Environmental Science & Technology* 49, no. 19 (October 6, 2015): 11622–11630, https://doi.org/10.1021/acs.est.5b01215.

95 Anna Reade, "EPA Finds Replacements for Toxic 'Teflon' Chemicals Toxic," November 15, 2018, NRDC, https://www.nrdc.org/experts/anna-reade/epa-finds-replacements-toxic-teflon-chemicals-are-also (accessed April 30, 2019).

96 Allison Ballard, "GenX: Focus Shifts to Environmental Justice," *Coastal Review Online*, July 7, 2017, https://www.coastalreview.org/2017/07/genx-focus-shifts-to-environmental-justice/ (accessed January 7, 2019).

97 "Environmental Justice and Equity Advisory Board Could Leverage Local Communities to Pressure General Assembly for Stronger Laws." *The Progressive Pulse (blog),* July 16, 2018, http://pulse.ncpolicywatch.org/2018/07/16/environmental-justice-and-equity-advisory-board-could-leverage-local-communities-to-pressure-general-assembly-for-stronger-laws (accessed September 16, 2019).

98 Vaughn Hagerty, "Toxin Taints CFPUA Drinking Water" Wilmington Star News, Wilmington, NC," June 7, 2017, https://www.starnewsonline.com/news/20170607/toxin-taints-cfpua-drinking-water/1. Ballard, "GenX" (accessed September 16, 2019).

99 Ibid.

100 "EPA SDWIS for Flint," https://ofmpub.epa.gov/enviro/sdw_report_v3.first_table?pws_id=MI0002310&state=MI&source=Surface%20water%20purchased&population=98310&sys_num=0 (accessed September 16, 2019).

101 EPA Office of Inspector General, "EPA Claims to Meet Drinking Water Goals Despite Persistent Data Quality Shortcomings, Report No. 2004-P-0008," March 5, 2004, https://www.epa.gov/sites/production/files/2015-12/documents/20040305-2004-p-0008.pdf.

102 EPA Office of Inspector General, "EPA Is Taking Steps to Improve State Drinking Water Program Reviews and Public Water Systems Compliance Data, Report No. 17-P-0326," July 18, 2017, https://www.epa.gov/sites/production/files/2017-07/documents/_epaoig_20170718-17-p-0326.pdf

103 Matthew J. Ferrari, Scott Ator, Joel D. Blomquist, and Joel E. Dysart, "Pesticides in Surface Water of the Mid-Atlantic Region," 1997, USGS, WRIR 97-4280, http://md.water.usgs.gov/publications/wrir-97-4280/wrir_97_4280_html.html. See also M. Wu, et al., "Poisoning the Well: How the EPA is Ignoring Atrazine Contamination in Surface and Drinking Water in the Central United States," NRDC, 2009.

104 EPA Office of Inspector General, "EPA Claims to Meet Drinking Water Goals Despite Persistent Data Quality Shortcomings.

105 U.S. Census, "QuickFacts: Newark city, New Jersey," https://www.census.gov/quickfacts/fact/table/newarkcitynewjersey/PST045217.

106 C. D. M. Smith, "Pequannock WTP Corrosion Control Review and Recommendations – Draft; City of Newark Lead and Copper Rule Compliance Study; Newark NJ," https://www.politico.com/states/f/?id=00000166-e5f2-dd0d-afe7-eff264510000 (accessed August 18, 2019). New Jersey Department of Environmental Protection - Division of Water Supply and Geoscience, "FAQs About Newark Water Department and Lead," https://nj.gov/dep/watersupply/pdf/newark-lead-faq.pdf (accessed August 18, 2019).

107 Steven Folkman, "Water Main Break Rates in the USA and Canada: A Comprehensive Study," *Mechanical and Aerospace Engineering Faculty Publications*, 2018, Paper 174.

108 World Health Organization, "Asbestos in Drinking-Water," 2003, https://www.who.int/water_sanitation_health/dwq/asbestos.pdf.

109 EPA, "How Does Vinyl Chloride Get into My Drinking Water?" https://safewater.zendesk.com/hc/en-us/articles/212075267-5-How-does-vinyl-chloride-get-into-my-drinking-water-. EPA, "Permeation and Leaching," 2002, https://www.epa.gov/sites/production/files/2015-09/documents/permeationandleaching.pdf.

110 Erik Olson and Kristi Pullen, *What's in Your Water? Flint and Beyond,* 2016, https://www.nrdc.org/sites/default/files/whats-in-your-water-flint-beyond-report.pdf (accessed January 7, 2019).

111 Office of Chemical Safety and Pollution Prevention, Office of Enforcement and Compliance Assurance, Office of Air and Radiation, Office of Solid Waste and Emergency Response, Office of Water, and Office of Policy, "Guidance on Considering Environmental Justice During the Development of Regulatory Actions," May 29, 2015, https://www.epa.gov/environmentaljustice/guidance-considering-environmental-justice-during-development-action.

112 EPA Office of Inspector General, "Management Alert: Drinking Water Contamination in Flint, Michigan, Demonstrates a Need to Clarify EPA Authority to Issue Emergency Orders to Protect the Public," October 20, 2016, https://www.epa.gov/sites/production/files/2016-10/documents/_epaoig_20161020-17-p-0004.pdf.

113 EPA Charge to the NEJAC, Environmental Justice and Water Infrastructure Finance and Capacity, 10/4/16. https://www.epa.gov/environmentaljustice/environmental-justice-and-water-infrastructure-finance-and-capacity-charge (accessed September 16, 2019).

114 EPA, "EJ 2020 Action Agenda: EPA's Environmental Justice Strategy," Reports and Assessments, April 10, 2015, https://www.epa.gov/environmentaljustice/ej-2020-action-agenda-epas-environmental-justice-strategy (accessed September 16, 2019).

115 EPA, "Capacity Building Program Management for Drinking Water Systems," https://www.epa.gov/dwcapacity/capacity-building-program-management-drinking-water-systems (accessed September 16, 2019).

116 EPA, "Asset Management Resources for States and Small Drinking Water Systems," https://www.epa.gov/dwcapacity/asset-management-resources-states-and-small-drinking-water-systems (accessed September 16, 2019).

117 EPA, "Water Infrastructure and Resiliency Finance Center," https://www.epa.gov/waterfinancecenter (accessed September 16, 2019).

118 EPA, "Building the Capacity of Drinking Water Systems," Collections and Lists, April 16, 2015, https://www.epa.gov/dwcapacity.

119 Rachel Leven, "Critics Say Flint Complaint Reflects Systemic EPA Issue," *Bloomberg News*, July 12, 2016, https://news.bloombergenvironment.com/environment-and-energy/critics-say-flint-complaint-reflects-systemic-epa-issues?context=article-related (accessed September 16, 2019).

120 NRDC, "NRDC & Partners: EPA Refuses to Protect Americans from Hazardous Spills," June 19, 2018, https://www.nrdc.org/media/2018/180619-1 (accessed September 16, 2019).

121 Emily Atkin, "Déjà Poo All Over Again," *The New Republic*, April 19, 2018. https://newrepublic.com/article/148032/deja-poo-epa-considers-rule-blending-sewage (accessed September 16, 2019).

122 EPA, "Envirofacts, SDWIS Search," https://www3.epa.gov/enviro/facts/sdwis/search.html (accessed March 11, 2019).

123 Agency for Toxic Substances and Disease Registry, CDC, "Nitrate/Nitrite Toxicity: What Are the Health Effects from Exposure to Nitrates and Nitrites?" https://www.atsdr.cdc.gov/csem/csem.asp?csem=28&po=10 (accessed September 16, 2019).


NRDC
NATURAL RESOURCES
DEFENSE COUNCIL


coming clean


Environmental Justice
Health Alliance