An In-Depth Analysis of the Safe Drinking Water Act

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Written for Professor Sarah West • ECON-213 Environmental Economics and Policy

Abstract

The Safe Drinking Water Act, passed in 1974, was a critical step in improving the quality of drinking water across the United States. The act set permissible levels for hundreds of contaminants in public drinking water systems based on implemented health standards. While the policy is overseen by the EPA, enforcement occurs at the state level, with all public water systems required to report violations and annual water quality data to state governments. This paper analyzes the SDWA on the basis of two criteria: policy effectiveness and racial equity. We find that the SDWA does not meet either criterion.

Introduction

Over the past half-century, drinking water quality in the United States has emerged as a vital problem with significant public health concerns. The Safe Drinking Water Act (SDWA), passed in 1974, and amended both in 1986 and again ten years later, sought to limit naturally occurring and human-made contaminants and mitigate poor water quality along with the subsequent health risks. These amendments introduced measures such as issuing regulations on nearly one hundred contaminants, mandating disinfection and filtration of public water systems (PWSs), limiting lead pipe infrastructure, and redefining PWS classifications (Congress.gov, 1996). Public water systems draw from surface and groundwater sources, treating water through various practices before it is distributed to households for consumption. However, without proper treatment methods in place, numerous outbreaks of waterborne diseases like cholera and typhoid fever created a pressing need for regulatory measures to safeguard public health. With this, the enactment of the SDWA enforced more stringent regulations on these very water sources that enhanced filtration of fecal matter and temperature regulation to avoid waterborne diseases and bacteria.

Yet, despite early recognition of health-related issues associated with poor drinking water quality throughout the tail end of the 20th century, a nationwide survey conducted by the Environmental Protection Agency (EPA) in the early 1990s revealed that over 20% of PWSs had detectable levels of lead, a potent neurotoxin (Dignam et al., 2019). From this point onwards, contamination of drinking water in many urbanized areas contributed to even greater concerns and fear of toxic chemicals in the bodies of American people (Calabrese et al., 2018). Beyond lead, studies revealed the existence of heavy metals, pesticides, and various industrial chemicals across multiple states (Grooms, 2016). Over time, the potential sources of these contaminants only grew with copious amounts of agricultural runoff, increased local recreation around rivers and lakes, and bacterial infiltrations within groundwater aquifers, all worsening sources of drinking water for humans within the United States (Denchak, 2023). Given a rise in health risks, including more serious outcomes such as links to cancer and neurological disorders (Bondy et al., 2018), many of these findings underscored an urgent need for legislation to establish proper standards, water quality enforcement, and quality monitoring systems. A conglomeration of these methods would mitigate the public health effects of poor drinking water quality and ensure the provision of cleaner, safer drinking water to all citizens nationwide.

However, even while serving as a comprehensive mitigation mechanism, racial inequities have often exacerbated the impacts of SDWA violations. Historically, communities of color, particularly low-income Black, Hispanic, and Indigenous populations, have been the ones facing the majority of disproportionate exposure to unsafe drinking water as highlighted earlier in the paper. These communities often reside in areas with underfunded or poorly maintained water systems and may lack the political capital to demand timely enforcement of SDWA standards. Retrospectively, a perfect example of this is the Flint water crisis which highlighted how systemic racism and economic disparities contribute to prolonged water quality violations in marginalized communities, with insufficient penalties or oversight to protect residents against lead and other related minerals in public water provision. Recognizing and addressing these inequities is crucial for ensuring that the SDWA achieves its goal of providing safe drinking water for all. Thus, the SDWA was crafted as the nation's first viable solution to require "water quality standards to be met, treatment levels to be applied, system management to be conducted, and external communication to be managed" while continuously facing adaptations to meet the ongoing needs of more viable legislation that simultaneously involved racial equitability over time (Baum et al., 2015).

In this paper, we will first explain the context behind the SDWA and its methods of implementation. Then we will discuss the effectiveness of the policy, using abatement graphs to exhibit firms' behavior concerning the SDWA. Next, we will analyze the SDWA on racial equity criteria, noting disparities in the quality of drinking water along racial lines. Finally, we will evaluate the necessary policy criterion to answer our core research question: How effective is the SDWA from both firm behavior and racial equity standpoints? Unpacking this question from both perspectives is critical to comprehensively understanding its impact and identifying areas for future policy improvement.

Safe Drinking Water Act History and Implementation

The US EPA is an independent governmental agency tasked with protecting human health and the environment through its varying departments. Specifically, the Office of Ground Water and Drinking Water sets standards for drinking water to protect against health risks while taking into account technology and costs of mitigating dangerous levels of contaminants (Minnesota Department of Health, 2023). To set the standard for water quality, they first identify the contaminants that pose the greatest harm to the public through a risk assessment process that evaluates the health impacts of contaminants by identifying hazards, understanding the relationship between contaminant dosage and effect severity, and the frequency of exposure. They then set maximum contaminant levels for these harmful contaminants by analyzing treatment costs (Clark et al., 1998). Finally, the EPA considers the permissible level of each contaminant that is delivered to any user of the public water system. They consider aspects such as treatment techniques, required technology, and cost of compliance into consideration (Environmental Protection Agency, 2022). In order to maintain these standards, they require states to run frequent testing to observe the contaminant levels and ensure they meet the necessary standards (Environmental Protection Agency, 2004). They also mandate each state to certify water system operators and confirm that they have the technical, financial, and managerial capacity to produce safe drinking water (Environmental Protection Agency, 2004). Moreover, all PWSs are required to prepare an annual consumer confidence report on their water, tracking violation data (Environmental Protection Agency, 2022).

These reports, delivered every year on July first, identify the exact sourcing of drinking water, detected contaminants (if any), system compliance with National Primary Drinking Water Regulations, and health educational information to enhance public awareness and empower consumers to make informed decisions regarding their drinking water. They also work with the Underground Injection Control (UIC) program to control the injection of waste into the ground. This whole operation takes place behind the provision of safe drinking water to US citizens.

As of 2022, there are over 154,000 PWSs across the U.S. (Environmental Protection Agency, 2022) that are responsible for following these guidelines and providing clean drinking water. While the SDWA provides for civil and criminal penalties, states tend to avoid using formal sanctions and instead prefer warning letters, visits, or telephone calls to enforce SDWA standards (Dennis & Tauihidar, 2009). This is reflected in the 2022 EPA data, highlighting that agencies initiated at least one formal enforcement action (civil penalties or the shutting down of facilities) at only 2,429 PWSs, while they initiated informal enforcement action at 25,923 PWSs in response to drinking water violations at PWSs (Environmental Protection Agency, 2022). PWSs push for flexibility of enforcement protocols, arguing that formal enforcement should only be used for water systems in "significant noncompliance," and that compliance provisions should reflect the analytical error associated with each contaminant (Dennis & Tauihidar, 2009). The EPA is relatively understanding of these tasks, recognizing the cumulative cost burden that SDWA regulations are placing on PWSs (Dennis & Tauihidar, 2009).

In summary, the EPA sets standards and protocols while simultaneously working in conjunction with state regulation and PWSs to attain safe drinking water. The SDWA is a command and control policy that first identifies and targets a specific environmentally harmful activity (contamination of drinkable water sources), imposes standards on that activity, and punishes any behavior that fails to comply with the imposed standards.

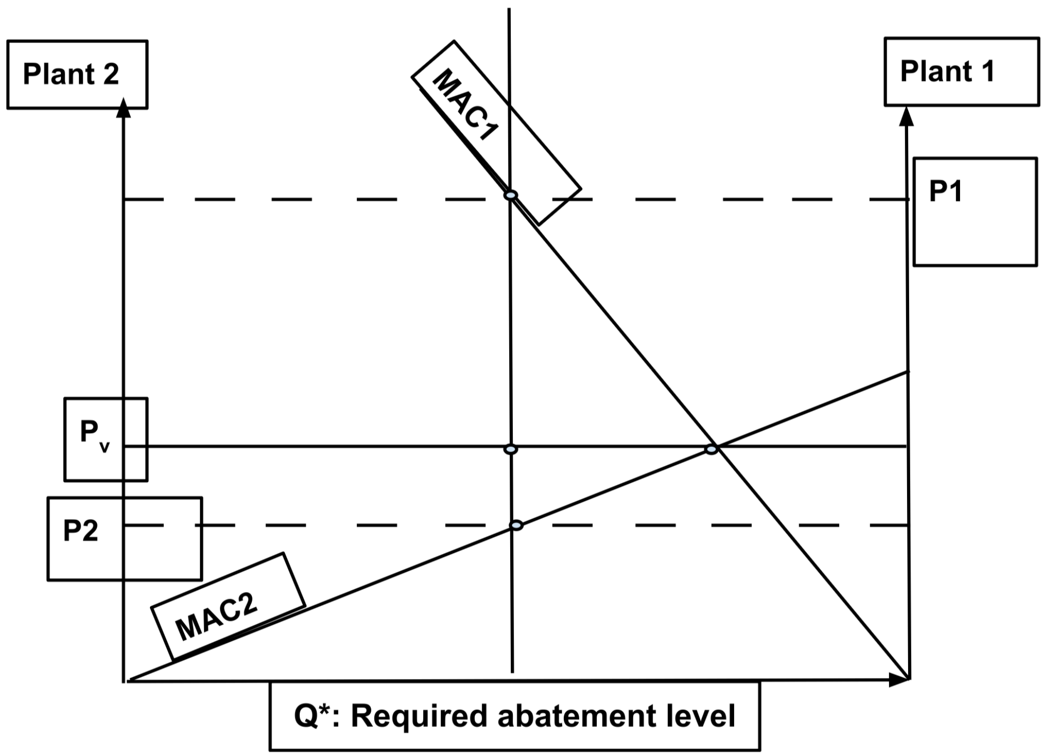
Theory: Effectiveness of the SDWA as a Command and Control Policy

Water treatment facilities face challenges in filtering contaminants out of drinkable water due to varying costs of contaminant treatment and geographic location. This raises questions about the feasibility of treatment plants consistently removing all contaminants. However, as a command and control regulation that enforces standards for all systems to comply with, the SDWA allows us to feasibly analyze its effectiveness across individual water plant compliance cases. In order to do this, we need to consider each plant's individual contaminant abatement function. In the case of water systems, these abatement functions pertain to the amount of contaminants prevented and the costs associated. More specifically, each of these plants induces costs for abating contaminants which can be represented by heightened infrastructure costs or things of the sort. With this in mind, a plant's marginal abatement cost refers to the cost of reducing one additional unit of contaminant, essentially the cost of implementing the next incremental step of contaminant reduction. This is vital as it helps global policymakers, health professionals, and businesses identify the most cost-effective ways to achieve environmental and public health goals by comparing the costs of different abatement levels for specific firms. With this idea in mind, if we were given a marginal abatement cost function for each water treatment plant, we would have to consider the permissible level for each contaminant enforced by the EPA, in relation to each plant's cost of abatement in meeting that level.

Based on this concept, we created Figure 1 below to represent respective abatement cost situations for multiple hypothetical water treatment plants. Assume there are two treatment facilities for instance, Plant 1 and Plant 2. Plant 1 has a steep marginal abatement cost curve, MAC1, while Plant 2 can abate more cost-effectively, depicted by a flatter cost curve, MAC2. Once again the ability for a plant to abate depends on many features such as resource availability and differing geographical infrastructure costs for instance. However, each plant must still reach the required contaminant reduction level as set by the EPA, denoted by the vertical line in the middle, Q*. Again, this is enforced by the policy as a command and control regulation. We can observe that the price at which each plant intersects Q* differs As a result, the price of abatement for Plant 1, P1, is significantly higher than the price of abatement for Plant 2, P2. Importantly, the SDWA also sets a level of payment (by means of violations), Pv, which is required for plants unable to reduce contaminants by the required amount. This cost is an important tactic that allows stricter regulation on contaminants to meet requirements. For Plant 1, they are better off accepting the violation fine, rather than establishing cleaner water infrastructure because it is more costly for them to address the contaminant level (Pv < P1). Correspondingly, Plant 2 with cheaper marginal abatement costs would rather invest in cleaner infrastructure than accept the fine for violations because they pay a smaller price by addressing the contaminant level (Pv > P2). This rationale explains why structural cost differences across water treatment facilities may hinder them from meeting the required contaminant abatement levels.

Figure 1

Marginal Abatement Cost Functions for Two Hypothetical Facilities



Despite the main goal of the policy being a preventative measure for contaminants, we must note that, again, this ability differs based on individual plant circumstances. One important aim of the policy is to push systems to improve their water quality after they are in violation if this is the case. In general, water systems have an incentive to comply when facing penalties or increased oversight from regulatory authorities that will impose costs on the system (Grooms, 2015). This is primarily because of administrative orders and civil penalties (extremely hefty daily fines), legal consequences, state oversight, losses of federal funding for infrastructure projects, but most importantly, public notification and reputational damage due to transparency efforts set in stone by the SDWA. Therefore, water systems are constantly balancing compliance costs against expected penalties for noncompliance. If water systems wish to avoid the costs associated with public scrutiny, we expect to see a decrease in pollutants after a violation (Grooms, 2015). Successful SDWA policy would require issuing violation fines at prices that will cause firms to abate and reach compliance, without placing too large of a burden that would put these PWSs out of business. Reflecting back to Figure 1, if the expected penalty is greater than the cost of compliance, we expect the water systems to resolve those violations and comply. However, in situations where the expected penalty is less than the cost of compliance, firms will not comply, and high levels of contaminants will remain present. If a particular water system is in violation, the act is effective if this system successfully works towards compliance after entering violation. Specifically, firms should reach compliance within 30 days after the violation, as this is the timeframe firms have to comply before an administrator issues civil action, as established by the EPA (Munson, 1989).

In addition to the duration of violation, effectiveness must also factor in overall levels of compliance as we alluded to earlier in the paper. Professor Richard Weinmeyer argues that the SDWA itself is effective if "more than 90 percent of water customers enjoy drinking water that meets the standards all the time," (Weinmeyer et al., 2017). In other words, water systems in compliance reach more than 90% of consumers even while some consumers might face violations. However, we believe further specification is necessary for a complete understanding of SDWA effectiveness. Specifically, understanding what causes 10% of consumers to lack access to consistently clean drinking water is integral to assessing the policy's effectiveness. If this 10% is attributed to accidents and these violations are resolved quickly (within 30 days), then we deem the SDWA effective. This 90% threshold leaves room for error, while still denoting that clean drinking water is provided consistently. However, under the SDWA, if 90% of consumers receive clean drinking water, yet the other 10% of the population receives substandard drinking water from PWSs in longer-term noncompliance (over 30 days), then the SDWA is not effective, as this 10% is a persistent issue, rather than a temporary accident. Extended periods of violation imply that firms are not actively working to return to compliance, providing unclean drinking water to their consumers over a substantial period. These are not minor accidents, they are structural issues with the SDWA and PWS's ability to abate. In summary, we believe that the SDWA is effective if 90% of consumers are provided with water that meets the required standards for PWS contaminant levels as long as public water systems in non-compliance are also returning to compliance within 30 days of violation.

Policy Evaluation of Effectiveness

A study conducted by a team of research institutions, including the NRDC, Coming Clean, and the EJHA, found that between 2016 and 2019 there were 170,959 violations of the SDWA (Fedinick et al., 2019, p. 19). To put this into context, over 120 million people, or nearly 40% of the U.S. population obtained their water from drinking water systems that violated SDWA guidelines during this span. Additionally, the study found that of the 170,959 violations, 23,040 of these were health-based violations–the most severe violations–combined to serve 44,980,846 people. These violations represent unlawful traces of the most harmful contaminants which can cause cancer, compromised fertility, developmental effects, and gastrointestinal disease.

Grooms (2015) evaluates the effectiveness of the SDWA by measuring firms' compliance behavior after violating SDWA guidelines. This study combines data on drinking water contaminants in California from 2000-2012 with data on official violations to empirically measure the reactions of water systems to violations. In other words, this study answers the question: do SDWA violations motivate water systems to produce safer drinking water (fewer future violations)? California's 8,000 PWSs serve around 33 million people, providing a large scope and diverse sample for this study across counties and water systems. In particular, this study focuses on the effect of violations of arsenic and nitrate levels in water systems, both of which are harmful to human health, even at very low doses. Under the EPA, the permissive levels of nitrate in water were established to be 10 mg/L and 10 μg/L for arsenic. Following a violation, PWSs can take various courses of action in an attempt to re-achieve compliance; these strategies include supplying an alternative water source, implementing additional monitorization to identify and address the source of contamination, installing new treatment facilities, and issuing boil water notices. Eventually, after significant periods of noncompliance, the EPA can penalize the water systems of up to $25,000 for each day of violation (Grooms, 2015). The California Department of Public Health (CDPH) has the power to issue these fines, however, the number of fines that have been issued is relatively small when taking the number of MCL violations into context most likely based on the fact that there are working cooperative relationships between firms and regulators discussed in previous sections.

Moreover, the data gathered from this study suggests that violations do not trigger a decrease in contaminant levels post-violation of arsenic and nitrate. The study reports data using up to seven quarters before and after a violation between the years previously identified in the study. As a matter of fact, water systems "do not reduce these metal contaminant levels for all seven quarters following the violation as they occurred in the study." For nitrate, a confidence interval plot reveals that nitrate contaminant concentration levels remain relatively flat prior to a violation period, spike right after the violation, and remain constantly greater for all seven quarters following the violation. Realistically, this opposes the desired effect of contaminant enforcement tactics. Additionally, nitrate contaminant levels significantly increase when averaged across all quarters. These findings are also coherent with arsenic levels in the same fashion. Furthermore, the persistence of violations over time is also supported by a probability coefficient regression which highlights that an arsenic violation one quarter prior has a statistically significant and positive effect on the probability of being in violation during the current quarter. For nitrates, this effect is even greater with significance for a violation two quarters prior, indicating a stronger persistence of violation status with this contaminant. Therefore, violating systems are found to not lower contaminant levels to return to compliance in the periods following a violation. Additionally, findings indicate that while public scrutiny may deter systems from violating, once they are in violation, the public notification rule is not effective at encouraging them to revert to compliance (Grooms, 2015). This analysis suggests that violation status is persistent– that is, firms that are in violation are generally not recovering back to compliance. This worrying data stipulates that the SDWA is not effective in California, as the imposed violations are not enough to motivate the water systems to reduce the contaminant levels.

We also explore a case study from Connecticut that focuses on the duration of noncompliance and why current understandings of PWS enforcement actions are unclear. This study uses data from all 25,412 active water system violations between 1981 and 2017 in the state of Connecticut. More specifically, it focuses on 2949 Maximum Contaminant Level (MCL) violation cases across 2487 PWSs after excluding those which do not correspond to an active water system, have unique ownership types, and are missing timely data. The study finds that, following violations, Community Water Systems (CWS) receive the most formal enforcement actions which consist of consent orders and agreements followed by Transient Non-Community Systems (TNC) which serve people for short periods of time (typically in recreational manners). However, Non-Transient Non-Community Systems (NTNC) like schools that provide their own water, hotels, resorts, and hospitals received the fewest formal enforcement actions by far, yet "violations associated with these enforcement actions had the longest median duration of 460 days," (Kirchoff et al., 2019). NTNC systems routinely serve vulnerable populations like children in schools and elderly individuals in senior care facilities, leaving the utmost importance of more support to return these particular systems to compliance much more quickly. Moreover, despite identified issues with violation lengths and different water systems, when considering all MCL violations across the study, the median length of violation is 69 days regardless of enforcement type. We do recognize that this number could be skewed by specific violation cases involving metals like arsenic, LCR, and radionuclides which have much higher median violation lengths of 396, 351, and 343 days respectively. Yet, when looking at it from a holistic lens, the study finds that violation lengths across all kinds of PWSs, including their specific MCL violations, average 330 days (Kirchoff et al., 2019). This data clearly suggests that there must be a change in regulation that drastically shortens the length of compliance periods and doesn't undermine the danger of certain metals in drinking water sources. The persistence of various contaminant levels beyond the 30-day limit set by the EPA suggests that the PWSs of Connecticut are not taking sufficient action to return to compliance. This paper makes for a strong claim as they require data from every water system in Connecticut. Therefore, the length of violation, types of contaminants, along with other information are reliable.

As the evidence above suggests, the SDWA is not effective under the conditions that we have laid out. Although they may succeed in providing 90% of consumers with clean drinking water, PWSs across the country fail to improve the quality standards within 30 days. Further research is needed to explore different enforcement actions in order to yield actions that are more urgent, yet effective.

Theory: Racial Disparities in SDWA Violations

We also evaluate the SDWA based on racial equality. We define racial equity as equal levels of exposure to contaminants regardless of race and ethnicity. While the SDWA aims to improve water quality across the U.S., different regions and municipalities face unique challenges in providing clean drinking water to their communities (Vanwalker, 2012). The SDWA is racially equitable if there are equal levels of exposure to contaminants for all races. We can identify disparities in exposure to contaminants by comparing localized racial demographics with general compliance data and the length of time PWSs remain in violation. If we see a gap in exposure to contaminants between racial groups, through general compliance data or length of time in violation, then the SDWA is not racially equitable. With this, we measure the existence of such disparities by analyzing multiple factors within nationwide county geographical data such as demographic, cultural, and other socioeconomic implications across multiple literature sources.

Policy Evaluation of Racial Equity

Bae and Lynch (2022) examine how social and economic factors affect the distribution of SDWA violations at the county level between 2016-2018. The regression model found that the percentage of Hispanics was a significant predictor of SDWA violations, with the highest rates of violation across the American Southwest, in parts of Southern California, Arizona, New Mexico, and Northeastern Texas. This finding was linked with proximity to agricultural contamination of source waters, as many agricultural communities have higher Hispanic populations and drinking water is often polluted by agricultural processes without the necessary wastewater treatment utilities (Bae & Lynch, 2022). Furthermore, this finding concurs with previous literature, like McDonald and Jones (2018) which observed that the proportion of Hispanics in a community had a significant and positive relationship with repeat violations.

Bae and Lynch (2022) rely on empirical data on SDWA violations and county census data to formulate conclusions about the injustices of clean drinking water under SDWA guidelines. We find the results of this study to be fully credible, as they use various control variables including median household income (to account for economic disparities), population density data (to control for urban/rural disparity), county typology codes (to control for built environments), and political party affiliation/voter turnout rate (to account for political backlash) to successfully isolate race/ethnicity as an independent variable. Regardless of these strong controls, limitations of this study still exist. By conducting the study on a county-level basis, the authors fail to account for identifying the exact location of non-compliant water systems and the affected households. This lack of precision could minorly skew the results, as we are unable to pinpoint who exactly (demographically) is drinking water from a given source. Despite this limitation, we still maintain that the findings of Bae and Lynch are sufficient and credible as they isolate the effects of the independent variable well by controlling for numerous other factors, and concur with multitudes of previous empirical literature sources.

Furthermore, Fedinick, Taylor, and Roberts (2019) highlight water quality injustices across the nation. Their analysis found that "race, ethnicity or language spoken had the strongest relationship to slow and inadequate enforcement of the SDWA of any sociodemographic characteristic analyzed" (Fedinick et al., 2019, p. 4). The results also indicated disparities in the length of time to return to compliance, with the authors noting that "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" (Fedinick et al., 2019, p. 7). Vulnerability, in this context, is "the degree to which a population, individual, or organization is unable to anticipate, cope with, resist and recover from the impacts of disasters," (Fedinick et al., 2019, p. 4). Notably, vulnerability arises out of social and economic circumstances and is the consequence of underlying factors like racism. This study compiled drinking water data from the EPA and census data on the county level as a basis for its findings. We trust the results of this study as its evidence stems from the credible sources listed above, and the study itself was conducted by environmental institutions.

For the SDWA to be racially equitable, all communities should experience equal levels of exposure to contaminants in drinking water, regardless of their race or ethnicity. It is clear with the evidence presented above that the SDWA does not meet our criteria for racial equity. Stricter regulation of PWSs in violation that serve communities of color could help narrow disparities in water quality, however, increased enforcement must be executed with caution, as suspending operations at certain PWSs could result in greater water quality complications. If violations and corresponding enforcement actions push water systems towards abatement, then the policy will also begin to function on greater racial equitability, narrowing the gap in violations between majority Hispanic counties and non-Hispanic counties.

Conclusion

In summary, while the vast majority of Americans receive clean drinking water, there are critical shortcomings of the SDWA and vast room for improvement. In California, violations of the SDWA did not improve future water quality as firms remained in noncompliance for longer than 30 days. Similarly in Connecticut, they also fail to reach the MCL for certain contaminants in the given time. Despite the MCL established by the EPA under the SDWA, many firms, due to their respective inability to afford clean water infrastructure changes, ignore reducing contaminant levels. Increased governmental intervention, greater regulatory oversight, and differing enforcement methods must be implemented to help curb violation lengths and progress the system toward a healthier and more equitable alternative. We would hope that since clean drinking water is widely viewed as a human right, water treatment systems would all take the necessary measures to filter out contaminants. However, the EPA still has to reconcile the costs it places on treatment systems, for if compliance costs are too high, risks of systems going out of business would pose tremendous dangers to water quality and public health. For future research, we would aim to implement a geographical focus that singles out specific concentrations of contaminants as well as differing costs of technology and abatement for firms, in different locations across the U.S. By understanding geographic trends of firms across the nation in reducing the amounts of dangerous contaminants, we can pinpoint certain locales that might be facing heavier costs or differing location-specific regulations and target possible governmental programs to aid these areas in developing the necessary clean water infrastructure. With this, more funding for these operations would be highly beneficial for the policy's effectiveness and equitability. While we have illustrated that the SDWA does not meet our criteria for effectiveness and racial justice, we recognize that it has been a critical step in the right direction for monitoring and improving water quality and the prevalence of associated health issues.

References

Bae, J., & Lynch, M. H. (2023). Ethnicity, poverty, race, and the unequal distribution of US Safe Drinking Water Act violations, 2016–2018. The Sociological Quarterly, 64(2). https://doi.org/10.1080/00380253.2022.2096148

Baum, R., Amjad, U., Luh, J., & Bartram, J. (2015). An examination of the potential added value of water safety plans to the United States national drinking water legislation. International Journal of Hygiene and Environmental Health, 218(8). https://www.sciencedirect.com/science/article/abs/pii/S1438463915000036

Bondy, S. C., & Campbell, A. (2018). Water quality and brain function. International Journal of Environmental Research and Public Health, 15(1), 2. https://doi.org/10.3390/ijerph15010002

Calabrese, E. J., Gilbert, C. E., & Pastides, H. (2018). Safe Drinking Water Act: Amendments, regulations, and standards. CRC Press.

Clark, R. M., Adams, J. Q., Sethi, V., & Sivaganesan, M. (1998). Control of microbial contaminants and disinfection by-products for drinking water in the US: Cost and performance. Journal of Water Supply: Research and Technology–Aqua, 1. https://doi.org/10.2166/aqua.1998.30

Congress.gov. (1996, August 6). S.1316-104th Congress (1995-1996): Safe Drinking Water Act Amendments of 1996. https://www.congress.gov/bill/104th-congress/senate-bill/1316

Denchak, M. (2023, January). Water pollution: Everything you need to know. NRDC. https://www.nrdc.org/stories/water-pollution-everything-you-need-know#whatis

Dennis, C., & Tauihidar, R. (2009). Environmental justice and enforcement of the Safe Drinking Water Act: The Arizona arsenic experience. Ecological Economics, 68(6), 1825–1837. https://doi.org/10.1016/j.ecolecon.2008.12.010

Dignam, T., Kaufmann, R. B., LeStourgen, L., & Brown, M. J. (2019). Control of lead sources in the United States, 1970–2017: Public health progress and current challenges to eliminating lead exposure. Journal of Public Health Management and Practice, 25(Suppl 1), S13–S22. https://doi.org/10.1097/PHH.0000000000000889

Environmental Protection Agency. (2022). Providing safe drinking water in America: National public water systems compliance report. https://www.epa.gov/compliance/providing-safe-drinking-water-america-national-public-water-systems-compliance-report

Environmental Protection Agency. (2004, June). Understanding the Safe Drinking Water Act. https://www.epa.gov/sdwa/overview-safe-drinking-water-act

Fedinick, K., Taylor, S., & Roberts, M. (2019). Watered down justice. NRDC, Coming Clean, Environmental Justice Health Alliance. https://www.nrdc.org/sites/default/files/watered-down-justice-report.pdf

Grooms, K. K. (2016). Does water quality improve when a Safe Drinking Water Act violation is issued? A study of the effectiveness of the SDWA in California. The B.E. Journal of Economic Analysis & Policy, 16(1), 1–23. https://doi.org/10.1515/bejeap-2014-0205

Kirchhoff, C. J., Flagg, J. A., & Zhuang, Y. (2019). Understanding and improving enforcement and compliance with drinking water standards. Water Resource Management, 33, 1647–1663. https://doi.org/10.1007/s11269-019-2189-4

Minnesota Department of Health. (2023, April). Guidance values and standards for contaminants in drinking water. https://www.health.state.mn.us/communities/environment/risk/guidance/gw/index.html#:~:text=Maximum%20Contaminant%20Levels%20(MCLs)&text=MCLs%20are%20established%20through%20a,for%20prevention%20and%2For%20treatment

Munson, M. A. (1989). Enforcement of the Safe Drinking Water Act in Virginia. The Colonial Lawyer, 18. https://heinonline.org/HOL/Page?handle=hein.journals/colaw18&id=39&collection=journals&index=journals/colaw

Vanwalker, A. (2012). Water and environmental justice. In A Twenty-First Century U.S. Water Policy.

Weinmeyer, R., Norling, A., Kawarski, M., & Higgins, E. (2017). The Safe Drinking Water Act of 1974 and its role in providing access to safe drinking water in the United States. AMA Journal of Ethics. https://doi.org/10.1001/journalofethics.2017.19.10.hlaw1-1710

McDonald, Y. J., & Jones, N. E. (2018). Drinking water violations and environmental justice in the United States, 2011–2015. American Journal of Public Health, 108(10). https://doi.org/10.2105/AJPH.2018.304621