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Closing the Racial Gap in Toxic Waste Exposure in Chicago: Evaluating the Effectiveness of Federal and State Environmental Justice Policy from 1990-2020

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Abstract

This study addressed whether there was a relationship between toxic waste exposure and community racial demographics in Chicago between 1990 and 2020 and evaluated how Executive Order 12898 (1994) and the 2011 Illinois Environmental Justice Act impacted the strength of this relationship. The purpose of the study was to determine the effectiveness of past environmental justice policies and inform the development of new policies. I used data from the EPA's Toxic Release Inventory and U.S. Census demographic data to analyze the mean toxic releases in Chicago zip codes with varying community demographics. I found that non-White majority zip codes have consistently faced disproportionate levels of toxic releases since 1990. There is no evidence of past environmental justice policies in the toxic release data, and the racial gap in toxic waste exposure in Chicago shows no signs of closing. Future environmental justice policies need to include enforcement mechanisms and increased specificity. Further, disproportionate investment in non-White majority communities is needed. Communities of color are suffering and environmental justice policy cannot continue to consist of empty words.

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This paper is dedicated to all the communities in Chicago that face crippling levels of environmental harm, whose voices are too frequently ignored.

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Introduction

In April 2020, Little Village, a predominantly Hispanic neighborhood in Chicago, made headlines after a smokestack imploded at the Crawford Coal Plant, leaving a cloud of dust hanging over the neighborhood and creating serious concerns about air pollution (Lowe 2022). Earlier that year, General Iron, a scrap metal shredder, applied for a permit to relocate from the North Side to the Southeast Side of Chicago. This relocation would move a major source of pollution from the mostly White, affluent neighborhood of Lincoln Park into a majority Latino community surrounded by largely Black neighborhoods. The Southeast Side communities are already vulnerable, with lower incomes, education levels, employment rates, and life expectancy than Lincoln Park (Chase 2021). After the City repeatedly delayed its decision on the permit (Chase 2022), in February 2022, Mayor Lightfoot denied General Iron the permit due to concerns about pollution. While this has been touted as a significant victory for Southside community organizers, General Iron has vowed to challenge the decision, which indicates that the fight is not over (Hawthorne 2022). Moreover, although this most recent victory is promising, it took the City over two years to arrive at the decision. In the last two years alone, Chicago has displayed its propensity to inflict the greatest levels of environmental hazard on its most disadvantaged populations on multiple occasions.

Across the United States, waste – defined as the unwanted or unusable byproducts of the industrial process – is systematically imposed upon already vulnerable populations, such that populations of color often disproportionately suffer the consequences of global consumption (Pellow 2002, 2). In the early 90s, Deeohn Ferris, a member of the Lawyers Committee for Civil

Rights, described, “We’re all in the same sinking boat, only people of color are the closest to the hole” (Eady 2007, 42). In 1987, the Commission for Racial Justice released a groundbreaking report, which argued that race is a major factor related to the presence of hazardous waste sites in residential communities in the United States (Commission for Racial Justice 1987). This report brought issues of environmental justice to the forefront of policymaking, prompting both further study of the disproportionate impact of environmental hazards and the creation of environmental justice policies.

The United States Environmental Protection Agency (EPA) officially defines environmental justice as, “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies” (Environmental Protection Agency). Chicago has more landfills per square mile than any other city in the United States, and its history as a ‘city of neighborhoods’ has only served to exacerbate environmental justice struggles, as neighborhoods have fought over the placement of waste sites, pitting already vulnerable communities of African Americans against each other (Pellow 2002, 5). Although the Commission for Racial Justice’s report brought issues of environmental injustice to the public’s attention in 1987, the most vulnerable groups in Chicago continue to face disproportionate levels of environmental hazard, as demonstrated by the smokestack that imploded in Little Village in 2020 and General Iron’s effort to relocate.

There are competing theories as to why toxic waste has historically been located in communities of color. The intentional environmental racism theory argues that there is deliberate racism involved in siting decisions, as communities of color are targeted as prime locations for toxic waste sites (Walker 2012, 91). The institutional environmental racism position instead

argues that housing markets and planning processes are riddled with racism, which ultimately leads to the placement of toxic waste facilities in communities of color, even if the racial makeup of the community is not consciously part of the decision making process (Walker 2012, 91-2). Although both these theories for why toxic waste has historically been located in communities of color center around racism, some argue that the location of waste sites is purely due to market dynamics; firms make decisions to locate waste sites in communities of color based on access to cheap land (Walker 2012, 91-2). Regardless of discriminatory intent, the historic placement of toxic waste introduces larger questions of equity and justice, as vulnerable populations are forced to bear the burden of the entire population's waste.

In order to address these environmental inequities, Clinton signed Executive Order (EO) 12898 in 1994, which required the federal EPA to make environmental justice part of its agenda (Konisky 2015). Nonetheless, more recent studies continue to confirm the Commission for Racial Justice's 1987 findings (Bullock, et al. 2018, Moore 2017). EO 12898 primarily tasked the federal EPA with implementing environmental justice policy, and there is a wide consensus in the literature that the EPA failed to deliver (Konisky 2015, xv). Although the (minimal) national impact of EO 12898 has been studied extensively, little work has been done to investigate the impact of environmental justice policy at the more local level in Chicago. For example, the Illinois Environmental Justice Act (IL EJ Act) went into effect in 2011, but little research exists evaluating its effectiveness.

In this study, I focused on Chicago industrial facilities' toxic releases, which are defined as emissions of chemicals that pose a threat to both human health and the environment. In particular, I evaluated how toxic releases have evolved over time, and I aimed to answer the following questions:

1. Was there a relationship between toxic releases and community demographics in Chicago between 1990 and 2020? If so, how can one quantify this relationship?
2. How have past environmental justice policies at the federal and state level (specifically EO 12898 in 1994 and the 2011 IL EJ Act) impacted the relationship between toxic releases and community demographics in Chicago between 1990 and 2020?

I hypothesized that toxic releases by Chicago industrial facilities would be unevenly distributed, such that communities in Chicago with larger minority populations were exposed to higher levels of toxic releases. I further hypothesized that neither EO 12898 nor the 2011 IL EJ Act made a substantial impact on this racial gap in toxic waste exposure in Chicago. Given that environmental injustice persists, a thorough evaluation of current policies is crucial to the future of environmental justice policymaking.

I utilized the EPA's Toxic Release Inventory data and U.S. Census demographic data to quantify how Chicago industrial facilities' toxic releases vary both by community demographics and over time (from 1990-2020). I used the total annual release of toxins (measured in pounds) in a community as a proxy for the level of environmental hazard. I selected Chicago zip codes as the geographic unit of analysis. First, I investigated the relationship between toxic releases and community demographics in Chicago by comparing the levels of toxic releases in Chicago zip codes with differing racial compositions. Then, I evaluated the impact of both EO 12898 (1994) and the 2011 IL EJ Act on the racial gap in toxic waste exposure in Chicago by comparing the toxic releases by industrial facilities in White majority and non-White majority Chicago zip codes before and after the implementation of each policy. I conducted preliminary regression analysis to further assess how the strength of the relationship between race and toxic waste

releases evolved over time. Finally, I computed a minority discrepancy variable to quantify the level of environmental inequality before and after the implementation of each policy.

My analysis confirmed both of my hypotheses. My findings indicated that there is no evidence of a decrease in Chicago industrial facilities' toxic waste releases since the early 1990s. Further, neither EO 12898 nor the 2011 IL EJ Act made a significant impact on the racial disparity in toxic waste exposure in Chicago. Although the mean total toxic release by Chicago industrial facilities in non-White majority Chicago zip codes plummeted between 1990 and 1993, since then the racial gap in mean total toxic release by Chicago industrial facilities in non-White majority and White majority Chicago zip codes has widened. In fact, in the five years after the implementation of the 2011 IL EJ Act, the mean total toxic release by Chicago industrial facilities in non-White majority Chicago zip codes rose significantly, while the toxic releases in White majority Chicago zip codes stayed fairly stagnant. Looking at the data, one would have no idea that an environmental justice policy was implemented in either 1994 or 2011. If the policies were effective, one would expect to see a discontinuity in the minority discrepancy variable around 1994 and 2011, as the level of environmental inequality would decrease. However, there are no discontinuities in the minority discrepancy variable in the data around these years; there was no shift in the level of environmental inequality.

Understanding the ineffectiveness of environmental justice policies such as EO 12898 and the 2011 IL EJ Act helps to explain why environmental injustices persist. While environmental justice entered the conversation around environmental policy more than thirty years ago, policy efforts have completely failed to create change. Drastic environmental justice policy reform is necessary. The most vulnerable communities are suffering, and environmental justice policy cannot continue to consist of empty promises.

Literature Review: Environmental Justice in America

A review of the environmental justice literature reveals that there are very few studies that have evaluated possible solutions to environmental injustice. For this reason, my research aims to assess the effectiveness of supposed environmental justice policy solutions in Chicago. At this point in time, it is no longer sufficient to establish the existence of environmental inequities. The objective of this study was to move beyond a mere assessment of the problem and turn to more solutions-based research, in order to inform the future of environmental justice policymaking. Nonetheless, the environmental justice literature provides a strong foundation of evidence that there is a long history of environmental inequity, which needs to be addressed.

Genesis of the Environmental Justice Movement

During the fall of 1982, protests erupted in Warren County, North Carolina, in response to the state's decision to bury 60,000 tons of Polychlorinated Biphenyls ("PCB")-contaminated soil in the community (Hoang 2007, 92). A few years prior, a commercial goods transportation company had illegally dumped PCB-contaminated soil along 270 miles of roads. When the state discovered this contamination, it decided to scrape up the soil and move it to a new hazardous waste site in Warren County, one of the most disadvantaged counties in the state (Walker 2012, 78-9). Sixty five percent of Warren County's population was African-American, rising to 75 percent in Shocco Township, where the site was located (Walker 2012, 79). Further, Warren County was so impoverished that it did not even have a hospital, which made it difficult for residents to access adequate health care (Hoang 2007, 91). The placement of a hazardous waste site in this community targeted an already vulnerable, marginalized population. Immediately, members of the community organized protests, drawing on the traditions of the civil rights movement for inspiration (Walker 2012, 79). In one protest, 414 protesters were arrested, as they

attempted to stop trucks from getting through to the waste site (Walker 2012, 79). Community leaders accused the state of environmental racism (Hoang 2007, 93). Environmental racism occurs when people of color are disproportionately impacted by environmental hazards. Prior to the protests in Warren County, communities of color had only been marginally involved in the environmental movement. Historically, the environmental movement had been centered around the White middle and upper class (Commission for Racial Justice 1987, xi). While the protests were unsuccessful in preventing the waste from being dumped in Warren County, the protests in Warren County galvanized the environmental justice movement that still exists today (Eady 2007, 43).

The decision to dump 60,000 tons of PCB-contaminated soil in one of the most disadvantaged communities in the country was neither a result of reckless oversight nor an isolated incident. North Carolina selected the site after going through an extensive selection process, which considered 93 different sites (Hoang 2007, 92). The State of North Carolina followed all of the federal and state laws regarding waste site selection, which included preparing an environmental impact report and holding a public hearing (Hoang 2007, 92). Nonetheless, the State approved the waste site selection with little difficulty. The protests in Warren County prompted extensive further study of the impact of waste facilities on disadvantaged communities, all of which confirmed that this site selection was not a unique instance of site selection in an already disadvantaged community.

Documenting Environmental Racism

After the protests in Warren County, leaders in the Congressional Black Caucus requested that the U.S. General Accounting Office (GAO) study the association between minority and low-income populations and toxic waste sites (Hoang 2007, 93). Because of the

Warren County protests, the GAO focused its study on offsite landfills in the eight southeastern states in EPA Region IV, which includes North Carolina (see Appendix A for a map of the EPA regions). In 1983, the GAO released a report with their findings, which revealed that three of the four offsite hazardous waste landfills in the region were in communities where African-Americans made up the majority of the population (United States General Accounting Office 1983). In all four communities, at least 26 percent of the population fell below the poverty line (United States General Accounting Office 1983). Warren County's cries of environmental racism were, in fact, symptomatic of a systemic problem.

Just four years later, in 1987, the Commission for Racial Justice of the United Church of Christ released a report on the relationship between toxic wastes and race, following five years of investigation. The Commission studied both commercial waste facilities and uncontrolled toxic waste sites. Commercial waste facilities are facilities that accept hazardous wastes from a third party that pays a fee (Commission for Racial Justice 1987, xii). The Commission for Racial Justice found that race was the most significant variable associated with the location of commercial waste facilities. Indeed, communities with the largest number of commercial waste facilities also had the highest percentage of racial and ethnic minorities. The average percentage of minority residents was three times larger in communities with two or more commercial waste facilities than in communities without a facility (Commission for Racial Justice 1987, xiii). Further, three out of the five largest commercial hazardous waste landfills in the country were located in predominantly Black or Hispanic communities. This amounted to 40 percent of the nation's commercial landfill capacity (Commission for Racial Justice 1987, xiv).

The Commission for Racial Justice found similar disparities in their study of uncontrolled toxic waste sites. Uncontrolled toxic waste sites are sites that have been closed or abandoned but

remain on the EPA's list of sites that pose a potential threat to human health and the environment (Commission for Racial Justice 1987, xii). The Commission for Racial Justice's investigations revealed that three out of every five Black or Hispanic Americans lived in a community with an uncontrolled toxic waste site. Further, Blacks were significantly over-represented in the populations of the cities with the largest numbers of uncontrolled toxic waste sites, such as Memphis and St. Louis (Commission for Racial Justice 1987, xiv). The findings of the Commission for Racial Justice's report inextricably linked the environmental movement to race. Evidence mounted that environmental issues disproportionately impacted communities of color. As reports accumulated, the term environmental racism became increasingly mainstream.

In 1992, the Chicago Department of Streets and Sanitation released a report revealing the unequal impact of illegally dumped garbage in Chicago. All ten of the neighborhoods with the most illegally dumped garbage were at least 60 percent African American or Hispanic. Further, 79 percent of the illegally dumped garbage in the city was located in wards where people of color made up the majority of the population (Pellow 2002, 83). A study of the locality of waste sites in Chicago in 1990 found that Hispanics were disproportionately exposed to hazardous waste. Researchers conducted an analysis of waste sites in Chicago, following a model that considered when the facility was sited, when people migrated to the area, and when people discovered that the facility was dangerous (Baden and Coursey 2002, 83). Baden and Coursey found that a disproportionate number of Hispanics lived in close proximity to waste sites. While Baden and Coursey attribute a significant portion of this to Hispanic migration that occurred after the facilities already existed, more recent waste sites have also been placed in these neighborhoods (Baden and Coursey 2002, 86). Unlike many of the studies discussed above, Baden and Coursey did not find significant evidence that African Americans in Chicago were

more likely to live in areas with hazardous waste sites (Baden and Coursey 2002, 87). Baden and Coursey's study demonstrates the level of nuance involved in analyzing environmental injustices.

Moreover, Anderton et al.'s study, frequently referred to as the Anderton study, found that environmental injustices are over-stated, or even non-existent. Anderton et al. conducted a study of treatment, storage, and disposal facilities (TSDFs) in the United States in 1992. The Anderton study found that the percentages of Blacks and Hispanics in census tracts with TSDFs were not significantly different than in tracts without these facilities (Anderton et al. 1994, 129). While there were slightly fewer Blacks and slightly more Hispanics in TSDF tracts, these differences were not statistically significant (Anderton et al. 1994, 129). Anderton et al. argue that their findings differ from previous studies, because they selected a different geographic unit of analysis. Specifically, the Anderton Study used census tracts, while the Commission for Racial Justice, for example, used zip code areas. Census tracts are significantly smaller than zip code areas (Anderton et al. 1994, 131). When Anderton et al. combined the census tracts within a 2.5-mile radius of the TSDFs, the percentage of Black residents was significantly higher (Anderton et al. 1994, 131). Consequently, the Anderton Study concluded that the evidence for environmental inequity is unclear at best. The geographic unit of analysis makes a significant difference to the findings. There is more research to be done in the field.

While existing work establishes the racist placement (or lack thereof) of waste sites, little work has been done to quantify the impact of this placement. The quantity of toxins to which a community is exposed is likely more important than the sheer number of waste sites in the community, and this is an untapped area for research. My study fills this gap in the literature, by considering both the geographical location of toxic waste-emitting industrial facilities and the

facilities' total toxic releases as quantities of interest. In this way, I quantify the racial disparity (or lack thereof) in toxic waste exposure as the difference in the total toxic releases between communities of color and White communities in Chicago (rather than as the difference in the number of waste sites between communities of color and White communities in Chicago).

Policy Responses

Although much of the literature focuses on documenting the racist placement of the waste sites, a 1992 study by staff writers from the *National Law Journal* revealed that there were also blatant inequities in the federal EPA's enforcement of its laws. In particular, the study found a huge discrepancy in the EPA's enforcement of the Resource Conservation and Recovery Act, a policy designed to require the safe handling and disposal of hazardous waste. In the areas with the greatest White population, the average penalty for failure to comply was $335,566, compared to $55,318 in the communities with the greatest minority population. This is a 506 percent disparity (Lavelle and Coyle 1992, 4). The penalties for all federal environmental laws created to protect citizens from air, water, and waste pollution were 46 percent higher in White communities than in minority communities (Lavelle and Coyle 1992, 1). Finally, the study found that it took 20 percent longer for abandoned hazardous waste sites in communities of color to be placed on the national priority action list, and historically the EPA has chosen containment over permanent treatment (which eliminates the waste) seven percent more frequently at hazardous waste sites in minority areas (Lavelle and Coyle 1992, 1). Consequently, the 1992 study indicated that environmental racism did not end at the decision of where to place waste sites. Environmental racism riddled the implementation of environmental policy as well, leaving minority populations less protected than White populations.

In the 1990s, however, there was a shift in environmental policy, as environmental justice policies started to emerge to increase the protection of vulnerable communities. In 1992, John Lewis introduced the Environmental Justice Act in Congress, which would have required the EPA to identify environmental high impact areas and then increase the environmental protection of these areas. For example, it would have been very difficult to place new sources of toxic chemicals in these areas (Konisky 2015, 36). However, the bill died in committee, and John Lewis' subsequent attempts to reintroduce the legislation fared no better (Konisky 2015, 36). Finally, in 1994, President Clinton responded to the growing environmental justice movement with Executive Order 12898, which mandated that all federal agencies "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (Exec. Order No. 12898, 1994, sec. 1-101).

The Clinton administration's work on environmental justice revolved around this executive order, as it required federal agencies to center their decisions around equity. The executive order particularly impacted the Environmental Protection Agency (EPA), as the EPA is the lead agency responsible for U.S. pollution control (Konisky 2015, 42). While EO 12898 was evidence of the environmental justice movement's quick rise to prominence, executive orders lack enforcement mechanisms, which made the impact of EO 12898 hard to predict. Environmental justice is a relatively new policy area, only emerging in the 1980s, but it has gained traction quickly. However, it remains true that the bulk of the literature documents the existence of environmental injustice, rather than evaluating the policies aimed at addressing it.

Previous Studies

The literature around environmental justice policy solutions is relatively sparse, but a few researchers have conducted studies analyzing the effectiveness of EO 12898, most of which concluded that EO 12898 failed to accomplish very much. In 2004, the EPA still had not identified the minority and low-income communities that EO 12898 aimed to help (Konisky 2015, 45). One study analyzed the influence of EO 12898 on the concentration of manufacturing facilities in EPA Region 6, which includes Arkansas, Louisiana, New Mexico, Oklahoma, Texas, and 66 Tribal Nations (see Appendix A for map of EPA regions). The study aimed to answer the question of whether or not environmental justice policy could affect waste facility location (Moore 2017, 378). Both Regional EPA offices and state environmental agencies were responsible for the implementation of EO 12898 (Moore 2017, 379). After conducting an in-depth analysis of the spatial patterns of manufacturing facilities in EPA Region 6 both pre- and post-EO 12898, researchers concluded that the effect of EO 12898 was minimal. Indeed, the areas with high concentrations of facilities prior to EO 12898 continued to have high concentrations post-EO 12898 (Moore 2017, 382). The study found that there were clusters of facilities, and these clusters remained post-EO 12898 (Moore 2017, 384). The executive order relied on its ability to influence state regulations and more local urban planning efforts. However, there was never a mechanism to make sure that agencies applied the policy consistently or to track the policy's implementation, which may have contributed to its ineffectiveness (Moore 2017, 384).

Although the results of Moore's study were very definitive, one weakness of this study was that it focused purely on the physical locations of facilities. Given the difficulty involved in moving a manufacturing facility, it may not be that surprising that facilities did not move

between 1988 and 2009 (the years in question). It might have been more substantively meaningful to investigate whether the operations of these facilities changed after the implementation of EO 12898. Further, Moore limits the scope of the study to EPA Region 6. It is not impossible that other regions implemented EO 12898 more successfully. Nonetheless, Moore's results remain a strong indication that EO 12898 did not make an impact on the clustering of manufacturing facilities, which is cause for concern.

Konisky and Reenock's analysis of EO 12898's policy effects on the Clean Air Act showed something similar. In this analysis, Konisky and Reenock examined the effect of EO 12898 on both the EPA and state enforcement of the Clean Air Act (CAA) in environmental justice communities. All active major air polluters – facilities that emit at least 100 tons per year of hazardous air pollutants – were included in the study (Konisky and Reenock 2015, 183), and environmental justice communities were defined as communities in the top decile of African-American, Hispanic, and poverty populations (Konisky and Reenock 2015, 184). Konisky and Reenock took a binary approach to measuring enforcement of the Clean Air Act; either an enforcement action was taken at a facility in a given year or it was not (Konisky and Reenock 2015, 183). Using this approach, Konisky and Reenock aimed to determine whether or not the EPA and states made more of an effort to enforce the CAA in poor and minority communities after EO 12898. Given that the goal of EO 12898 was to raise the profile of the need for environmental justice, one would hope that the enforcement of the CAA in vulnerable communities would increase in the period after the policy. However, Konisky and Reenock's study found that EO 12898 had little impact on enforcement efforts. There was no clear change in CAA enforcement efforts in the environmental justice communities (Konisky and Reenock 2015, 191). While the decision to use a binary approach to measure enforcement of the Clean Air

Act makes it impossible to determine the strength of enforcement measures, this would be much more pertinent if the study had found that there was a change in CAA enforcement efforts. Very weak enforcement efforts might not be particularly noteworthy, but these would be still be measured as an enforcement action. However, given the finding that there was a lack of enforcement actions altogether, this weakness of the study is unlikely to have impacted the results significantly. Evidently, although the Clinton administration's EO 12898 brought environmental justice to the forefront of federal policy conversations for the first time, its practical significance was minimal. A body of literature has emerged that demonstrates that the executive order accomplished little.

Given EO 12898's vague language and the EPA's use of regional offices, one might think that the effectiveness of the policy would depend on more local environmental justice actions that emerged after EO 12898 introduced environmental justice to the policy world. However, Bullock et al.'s analysis of the relationship between state environmental justice action and air pollution inequality found that inequality remained stable over time, regardless of state policy actions (Bullock et al. 2018, 483). In this study, Bullock et al. evaluated the strength of each state's environmental justice policy and assigned each state a numerical value between 0 and 4 (Bullock et al. 2018, 471). Ultimately, Bullock et al. did not find that state environmental justice action had any significant impact on pollution inequality. Indeed, from 1990 to 2009, the unequal burden of pollution suffered by African Americans did not change significantly, regardless of the presence and strength of environmental justice policy in the state (Bullock et al. 2018, 483). One of the strengths of Bullock et al.'s study is that they evaluated the policies in every state in the country. Consequently, their results do not represent a regional effect. Moreover, Bullock et al. quantified levels of pollution using facility emissions data from the

EPA's Toxic Release Inventory, which is the same data set as used in this study. Because all industrial facilities are required to report their emissions to the Toxic Release Inventory, this should provide a reasonably accurate metric for pollution levels. So, Bullock et al.'s work provides strong evidence that, not only did the EO 12898 struggle to make an impact on its own, but the state policies that came out of it also did not make a significant difference.

While Bullock et al.'s study highlights EO 12898's inability to impact state policies across the nation, little work has been done to evaluate the impact of EO 12898 at the city-level, specifically in Chicago. Further, there are numerous more recent local policies that warrant study. Bullock et al.'s study provides a sweeping overview of state environmental justice action, but it does not look closely at any individual policies. In Illinois, for example, the Environmental Justice Act went into effect in 2011. This Act recognized that certain communities in Illinois suffer disproportionately from environmental hazards and established a 24-person Commission on Environmental Justice dedicated to advising the Governor and Illinois General Assembly on environmental justice concerns (Illinois Environmental Justice Act, 2011). There is no literature examining the effectiveness of this policy. I aim to fill this gap, by evaluating Chicago industrial facilities' release of toxic waste from 1990 to 2020, specifically considering the time periods before and after the 1994 Executive Order and the 2011 Illinois Environmental Justice Act.

Theoretical Framework

Although environmental justice is still a fairly new and developing field of study, several competing theoretical frameworks have already risen to prominence to explain race-based environmental inequalities: intentional environmental racism, institutional environmental racism, and market dynamics. Broadly, the theory of environmental racism maintains that people of color are disproportionately impacted by environmental hazards. However, there are differing

views on the cause of these disparate impacts; intentional and institutional environmental racism present the two most prominent explanations. First, the intentional environmental racism theory contends that siting decisions have been riddled with racial bias. Minority races' disproportionate exposure to toxic wastes is a result of targeted waste facility siting, which deliberately placed the environmental burden on populations of color (Walker 2012, 91). Under this theoretical framework, the existence of environmental injustice is a result of calculated decision-making; the White people in power consciously opted to protect their own populations from toxic waste by imposing it on the people of color around them instead. This kind of racist intent is difficult to prove, which frequently poses a challenge for the theory of intentional environmental racism.

The institutional environmental racism theory does not require the same evidence of intent. Although this theory still maintains the idea that there is racial bias involved in siting decisions, this bias is simply baked into the entire construction of society. Pulido argues that extricating specific acts of environmental racism – such as siting decisions – from the larger social structure fails to recognize that racism plays a role in every aspect of society (Pulido 1996, 149). For example, one common argument against the intentional environmental racism theory is that siting decisions are class-based, not race-based. However, the fact that populations of color are disproportionately represented in low-income communities is no coincidence; every aspect of society has been set up to leave people of color at the bottom (Pulido 1996, 149). Further, some scholars argue that toxic waste facilities are disproportionately placed in communities with large minority populations, because both industry and government search for communities that are less likely to mount significant opposition to the facility. Poorer communities of color typically have fewer resources and less representation in government, which makes it much more difficult for them to effectively oppose the construction of a waste facility (Mohai et al. 2009, 414). Again,

although these siting decisions may not be explicitly race-based, institutional racism leaves communities of color particularly vulnerable.

In this way, the theory of institutional environmental racism is much less limiting in its conception of racism than intentional environmental racism; decisions can be racist, even if the decisionmaker was not consciously taking race into consideration. In many ways, the theory of institutional environmental racism poses a much greater challenge than intentional environmental racism. Because institutional environmental racism is not conscious, it is likely to be much more difficult to avoid. One would hope that, as social norms change, intentional environmental racism will become increasingly socially unacceptable. However, the same may not be true for institutional environmental racism. Systemic change takes much longer.

Finally, the market dynamics theory entirely diverges from the notion of race. Often considered the theory of environmental justice skeptics, this theory argues that the only consideration involved in siting decisions is economic efficiency (Walker 2012, 92). Firms are rational actors who choose to place waste sites in areas where land is cheap and operating costs are low. Further, households make decisions about where to live based on where they can afford (Walker 2012, 92). Individuals who subscribe to the market dynamics theory view poor residents who live in close proximity to waste facilities as individuals who have decided to save money on rent; environmental injustice is not even part of the equation (Noonan 2008, 1156). In essence, the market dynamics theory argues that siting decisions are based on the location of cheap land, and this may coincidentally be where poor racial minorities reside (Mohai et al. 2009, 414).

These three competing theories all offer different lenses for understanding the observed differences in toxic waste exposure across racial and class groups. Nonetheless, all three theories grapple with the reality that environmental harm is not equally distributed. This represents a

dramatic divergence from traditional environmentalism. Environmentalists frequently reference the fact that all of humanity inhabits the same planet. Consequently, a threat to the planet is a threat to everyone (Rasmussen 7). All three theories of environmental justice discussed above challenge this notion of environmentalism, as they acknowledge the fact that not everyone faces the same level of environmental threat. Indeed, contrary to common environmental rhetoric, it is not actually the case that we all breathe the same air (Rasmussen 8).

One of the challenges of environmental justice theory is that only the final product – race-based inequality – is observable. Consequently, the 'chicken or the egg' question developed into a key component of environmental justice theory. This question challenged whether poor and minority-dominated communities or hazardous waste facilities came first (Mohai et al. 2009, 413). At the heart of the discussion is the question of discriminatory intent: whether or not decisionmakers intentionally inflicted poor and minority-dominated communities with disproportionate levels of environmental hazard. Although the first wave of environmental justice studies tended to assume that the race-based disparities in toxic waste exposure were a result of blatant racism, the "minority move-in hypothesis" stipulated that minorities moved into areas where toxic waste facilities existed, rather than the other way around. If housing prices are lower in communities with toxic waste facilities, for example, this might attract already disadvantaged persons (Mohai et al. 2009, 413). The (unknowable) answer to this "chicken or the egg" question is critical to determine which theory of environmental justice is accurate. Although theorists typically define environmental racism independently of intent (Kevin 1997, 125), the cause of environmental inequality certainly impacts what responses will be most effective.

Regardless of which theory explains the inequality, the unarguable empirical result is environmental racism. Most of the existing environmental justice literature puts the theoretical frameworks aside, in favor of focusing on the empirical results. However, without a good understanding of the origins of environmental inequalities, it will be very difficult to construct effective policies to address the issue. Under the market dynamics theory, for example, it might be deemed unnecessary to implement any policy at all. Alternatively, under the intentional environmental racism theory, electing more diverse, anti-racist people into decision-making positions would be very impactful. Institutional environmental racism theory likely calls for wide-reaching, systemic policy change. If institutional environmental racism is at fault, it is likely that environmental justice policy alone will not suffice. Society would need to fundamentally change its mode of operation.

The analysis of existing environmental justice policies provides an opportunity to evaluate the competing theories discussed above. In this study, the competing theories of environmental justice inform my understanding of why policies might fail. Without knowing the root cause of a problem, it is difficult to solve it. In the case of environmental racism, the cause is unknown. When considering these three competing theories – intentional environmental racism, institutional environmental racism, and market dynamics – the baseline assumption is that any (or all) of these frameworks may contribute to the uneven distribution of environmental hazard. In fact, it is likely that different theories apply in different situations. It may be the case that one waste site was selected because the neighborhood was predominantly made up of people of color (intentional environmental racism), while another waste site was selected based on how likely the neighborhood was to argue with the siting decision (institutional environmental racism). Consequently, in this study, I used these competing theories as a lens of policy evaluation. In

order to determine how to create effective environmental justice policies in the future, it is meaningful to consider both the effectiveness of the policy and the theory of environmental justice with which the policy aligns.

Data and Methods

Data

I relied on both EPA data and U.S. Census demographic data, in order to analyze how different racial demographics' exposure to toxic waste in Chicago has evolved in the past 30 years, as new environmental justice policies have gone into effect. Primarily, I employed Toxic Release Inventory (TRI) data, which is collected by the EPA. The EPA's TRI program tracks industrial waste facilities' annual emissions of 770 potentially harmful toxic chemicals, which include chemicals that have been linked to negative human health effects and adverse environmental effects (Bullock et al. 2018, 474). I focused on the toxic releases of industrial waste facilities because these are the facilities that environmental justice policies tend to target (Bullock et al. 2018, 474). Industrial facilities tend to be targeted both because they are clear sources of contamination and because they are often viewed as part of the community (Bullock et al. 2018, 474). Industrial facilities are required to report to the TRI program, and the TRI data for every year from 1987-2020 is publicly available. In order to compare toxic release emissions over time, I utilized the facility's total annual toxic release as the primary statistic of interest.

To assess the racial demographics of the community in which each industrial facility in the TRI was located, I utilized U.S. Census demographic data. Given the knowledge that Chicago is a city of neighborhoods (Pellow 2002, 5), I determined that it was necessary to use a geographic unit of analysis that was somewhat granular. The U.S. Census provides a breakdown of demographics by zip code and the TRI also reports the facility's zip code, so I used zip codes

as the geographic unit of analysis. Unfortunately, demographic data at the zip code level is unavailable prior to the 2000 Census (the 1990 Census only has data for the entire city), and the 2020 Census data is not yet available. As a result, I matched the 2000 Census demographic data to the TRI data reported between 1990-2005 and the 2010 Census demographic data to the TRI data reported between 2006-2020. Further, the data for median income is not available by zip code in the 2010 U.S. Census data. For this reason, I used median income data from the American Community Survey (2010-2014) for the median income data for the second 15-year period. Although matching demographic data to a 15-year time span is not optimal, demographics do not tend to change drastically very suddenly. While the lack of annual demographic data should be taken into consideration when evaluating the results of my study, I do not expect that this will have a significant impact on the results.

Methods

First, I conducted extensive analysis of the toxic release data, specifically looking at the total toxic releases reported by each industrial facility each year. In order to examine the racial difference in toxic waste exposure in Chicago, I divided Chicago zip codes into White majority zip codes and non-White majority zip codes. Using these designations, I looked at the difference in mean toxic releases for Chicago industrial facilities in White majority zip codes and non-White majority zip codes. In order to isolate the toxic releases by industrial facilities before and after the implementation of each policy (EO 12898 and the 2011 IL EJ Act), I looked closely at the difference between toxic releases in non-White majority zip codes and White majority zip codes in the 5 year period before and after the implementation of each policy. The reason for looking at a 5 year period (rather than a single year) is that the toxic releases by industrial facilities fluctuate from year to year. So, looking at one specific year may not be representative

of larger trends. Moreover, policies can take time to be impactful. Even a very effective policy may not have any impact on the toxic releases the year after implementation.

In addition, I ran a preliminary ordinary least squares (OLS) regression analysis to look more closely at whether or not the relationship between racial composition and toxic releases changed as environmental justice policies were implemented in 1994 and 2011. I used an indicator variable for whether or not a zip code had a White majority as the explanatory variable and the mean toxic releases by an industrial facility in the zip code as the outcome variable. The population model for the OLS regression was as follows:

$$Mean\ Toxic\ Releases = \alpha + \beta\ 1[White\ Majority\ Zip\ Code] + u\ .$$

In this regression, α represents the intercept, β represents the average difference in mean toxic releases between a White majority zip code and a non-White majority zip code, and u represents the error in the model. The reason for using an indicator variable for White majority as the explanatory variable (rather than just the percentage of the population that is White, for example) is that one would not expect that the exact racial composition of a community is what matters. For instance, I would not expect that a community that is 58% White be considered differently than a community that is 59% White. Instead, there are certain thresholds that make a neighborhood considered a 'White' community, rather than a minority community. For this reason, whether or not a zip code had a White majority seems like a better choice of explanatory variable. Although it is difficult to know if 50% is exactly the right threshold to use for this, it does seem like a good starting point for considering how a community will be characterized. I ran this regression for the period before and after each policy and compared the coefficients pre- and post- policy to evaluate whether the relationship between the racial composition and toxic releases of a zip code changed after the implementation of each policy.

There is reason to be concerned about the fact that whether or not a zip code has a White majority will definitely not be the only factor contributing to the toxic releases in a zip code. For this reason, this regression will suffer from omitted variable bias. One key omitted variable is socioeconomic status. One would expect that race and socioeconomic status are highly correlated. For this reason, I also ran the regression including median income as a control for every pre- and post- policy period. The population model for this OLS regression was as follows:

$$Mean\ Toxic\ Releases = \gamma + \delta_1\ 1[White\ Majority\ Zip\ Code] +$$

$$\delta_2(Median\ Income) + \varepsilon\ .$$

In this regression, γ represents the intercept, δ_1 represents the average difference in mean toxic releases between a White majority zip code and a non-White majority zip code holding median income constant, δ_2 represents the change in mean toxic releases associated with a one unit increase in median income holding whether or not the zip code has a White majority constant, and ε represents the error in the model. Even outside of median income, there are likely to be additional omitted variables from the analysis. For example, one could imagine that a zip code's political activity or population density could impact toxic releases. Due to the scope of the data, it was not possible to include these in the regression. For this reason, this regression analysis should purely be considered as preliminary analysis and suggestive of the relationship between racial composition and toxic releases of a zip code. In order to make the regression analysis more robust, it would be necessary to gather more data to add further controls.

Finally, given that the goal of my study was to analyze the impact of environmental justice policies, it was necessary to quantify how environmental inequality changed over time. I followed Ash et al. (2013) and Bullock et al. (2018)'s method of using a minority discrepancy variable (MD) to quantify environmental inequality. Ash et al. defines the MD variable as, "the

share of the total burden of industrial air toxic releases that is borne by members of minority groups less the share of minorities in the population of the [reference] area" (Ash et al. 2013, 263). It is calculated as follows:

$$\frac{\sum_l D_{lj}^k * C_l}{\sum_l D_l * C_l} - \frac{Pop_i^k}{Pop_i} = MD_{ij}^k .$$

In this, *i* indexes the city (Chicago), *j* indexes the year, *k* indexes the subpopulation (racial/ethnic group), and *l* indexes the zip code within Chicago. Further, *D* represents the zip code-level population of the demographic group and *C* represents the total toxic releases emitted by facilities in a certain zip code. Similarly to Bullock, et al., I used the total amount (in pounds) of toxins emitted by facilities within a geographical area (Chicago zip code) as the total burden of toxic releases (Bullock et al. 2018, 476). I tracked how the MD variable evolved over time, in order to determine whether or not environmental inequality has decreased as environmental justice policies have been implemented. Specifically, my study looked at whether or not the MD variable changed significantly after EO 12898 and/or the implementation of the Illinois Environmental Justice Act in 2011. As has been done in analyses of past policies, the data was broken into pre- and post- environmental justice policies (Moore 2017, Bullock et al. 2018).

Limitations

As already noted in my discussion of the lack of availability of local demographic data, my study was limited by the constraints of the publicly available datasets. The TRI data is self-reported to the EPA by the facilities. Although participation in the program is mandatory and regulated, this self-reporting could introduce bias in the data. Furthermore, not all facilities are required to report to the TRI. For instance, if the facility does not have more than ten full-time employees or does not exceed any of the thresholds for chemicals, it is not required to report. Starting in 1995, facilities with "low annual reportable amounts" could submit a different form

(Form A rather than Form R), which merely requires the facility to report the category of the chemical it releases, as opposed to the quantity released (see Appendix B for TRI Forms). The EPA defines "low annual reportable amounts" as less than 500 pounds. While this may be considered low for an individual facility, if there are many facilities in a community all releasing "low annual reportable amounts," this could amount to a significant release of toxins, which cannot be quantified in the data. Finally, as discussed by Anderton et al. (1994), the geographic unit of analysis can make a significant difference to the results of environmental inequality analysis. I selected the zip code as the unit of analysis, but it is possible that selecting a different unit would yield different results.

Findings

Despite the limitations of the data, my combined analysis of the TRI data and the U.S. Census data yielded very conclusive results. I aimed to use the data to address the following two-pronged research question:

1. Was there a relationship between toxic releases and community demographics in Chicago between 1990 and 2020? If so, how can one quantify this relationship?
2. How have past environmental justice policies at the federal and state level (specifically EO 12898 in 1994 and the 2011 IL EJ Act) impacted the relationship between toxic releases and community demographics in Chicago between 1990 and 2020?

My analysis of the TRI data revealed the extent to which toxic waste facilities in Chicago disproportionately impact predominantly minority communities and provided significant insight into the effectiveness of past federal and state environmental justice policies. The release of toxic

waste remains an environmental justice problem that the city of Chicago needs to contend with, and past policy efforts have been completely inadequate.

As seen in Figure 1 below, Chicago industrial facilities' mean total release of toxic waste plummeted in the early 1990s, but since then it has largely trended upwards. In 2018, Chicago industrial facilities emitted more toxic waste, on average, than Chicago facilities had in close to 20 years. Although environmental justice policies specifically target the discrepancy between the environmental burden that different groups bear, the first step in reducing environmental injustice is to reduce the total level of environmental hazard that the population has to endure. As Figure 1 shows, there is no evidence that progress has been made in reducing Chicago industrial facilities' release of toxic waste since the early 1990s.

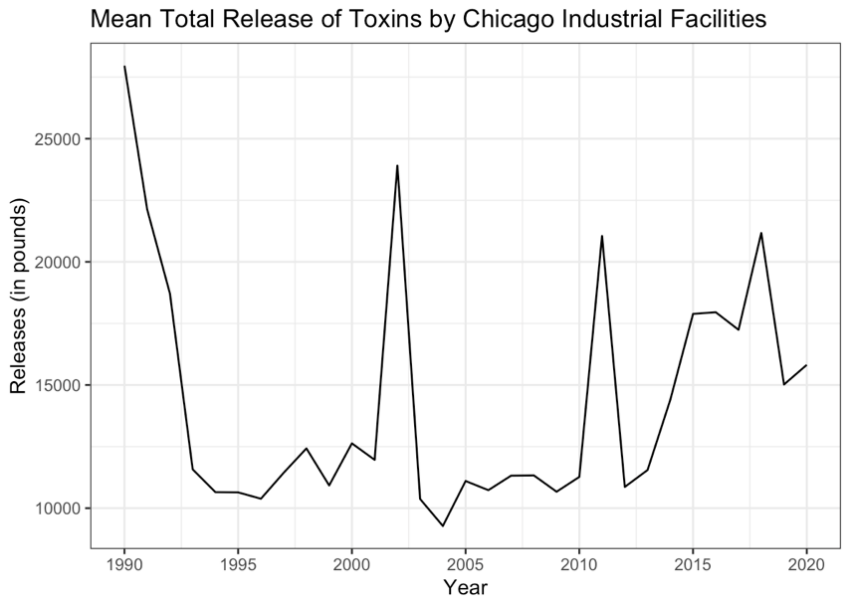


Figure 1: Mean Release of Toxins by Chicago Industrial Facilities by Year from 1990-2020

Finding 1: Data Confirms a Strong Relationship Between Race and Toxic Waste Exposure

Moreover, the TRI data indicates that there is a significant racial gap in toxic waste exposure, which is only increasing. Communities of color in Chicago have borne the burden of

industrial facilities' toxic wastes for the past 30 years (see Figure 2 below). Since 1990, there have only been three years in which, on average, facilities in White majority Chicago zip codes released more toxic waste than facilities in non-White majority zip codes: 1993, 1994, and 1995. Although there is some annual fluctuation, the mean toxic release of Chicago industrial facilities in White majority Chicago zip codes has trended downwards since 1990. In contrast, the mean toxic release of Chicago industrial facilities in Chicago zip codes with majority populations of color has trended upwards since 1995. Indeed, as is evident in Figure 2, the average total toxic releases by Chicago industrial facilities in White majority zip codes and non-White majority zip codes have diverged since about 2002. The evidence points to a widening gap between the mean total toxic releases in non-White majority and White majority Chicago zip codes.

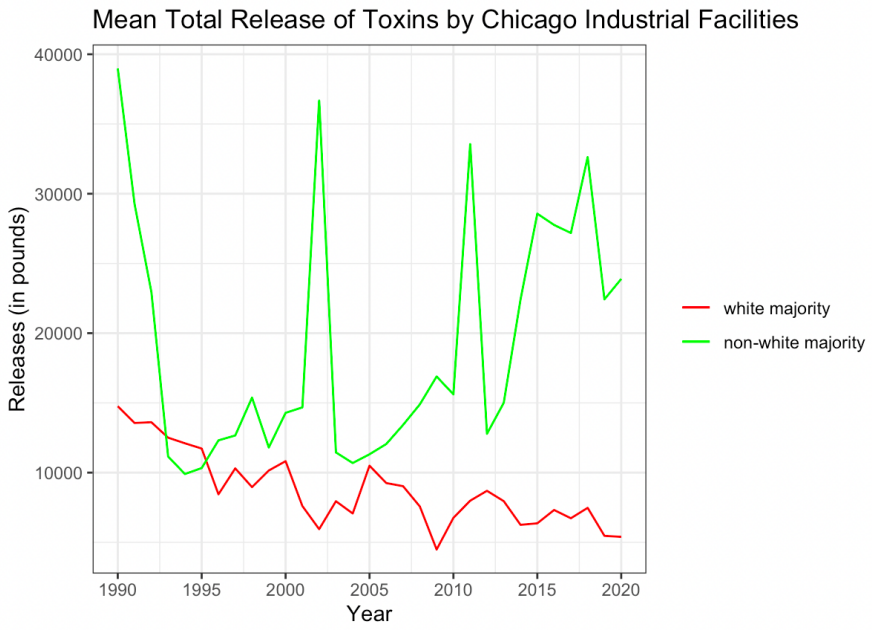


Figure 2: Mean Release of Toxins by Chicago Industrial Facilities by Year in White Majority and Non-White Majority Zip Codes

In order to assess the policy implications of the racial gap in toxic releases in Chicago, I conducted more focused analysis on the years before and after significant environmental justice policy changes. Environmental justice policies specifically target the reduction of environmental

hazards experienced by already disadvantaged communities (such as racial minorities), but their efficacy remains in question.

Finding 2: EO 12898 (1994) Had No Impact On Toxic Waste Releases in Chicago

First, I conducted an evaluation of the toxic releases by Chicago industrial facilities before and after EO 12898 was instituted, and I found EO 12898 to have no impact on the total toxic waste release or the toxic waste release distribution in Chicago. Figure 3 below displays the mean total toxic release by Chicago industrial facilities in the five years before and after the executive order (1990-1999).

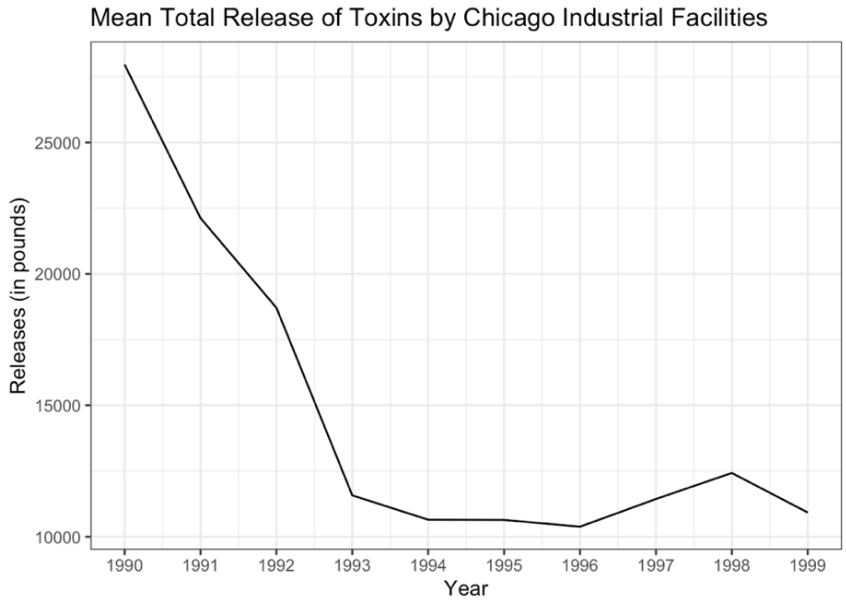


Figure 3: Mean Release of Toxins by Chicago Industrial Facilities in the 5 Years Pre- and Post- the Implementation of EO 12898

The mean toxic releases by Chicago industrial facilities fell steeply from 1990 to 1993. In 1990, the mean total toxic release by a Chicago industrial facility was 27, 964.14 pounds. By 1993, this number had fallen to 11, 575.15 pounds. However, between 1993 and 1999, the mean total toxic release by a Chicago industrial facility stagnated. The highest mean total toxic release between 1993 and 1999 was 12, 425.85 pounds (in 1998). Notably, the fall in mean total toxic release did not occur after 1994, the year in which Clinton issued EO 12898. If EO 12898 had made a

significant impact on the mean toxic release, one would expect a discontinuity in the mean toxic releases after 1994. Instead, there is a smooth drop between 1990 and 1993. This suggests that the sharp drop in toxic releases by Chicago industrial facilities in the early 1990s was independent of the environmental justice policy change. While it may be true that the state of environmental justice improved in the early 1990s, if anything it appears that EO 12898 may have been a response to this improvement, rather than the cause of it.

My analysis of the relationship between the toxic release data and demographic data further supports the conclusion that EO 12898 was ineffective. Between 1990 and 1993, the mean toxic release by Chicago industrial facilities in non-White majority Chicago zip codes plummeted. In fact, the graphs indicate that the decrease in toxic releases by Chicago industrial facilities in non-White majority Chicago zip codes drove the large total decrease seen in the graph above. However, after 1994, the year in which EO 12898 was instituted, the mean total toxic release by Chicago industrial facilities in non-White majority Chicago zip codes started to rise again, while the mean total toxic release by Chicago industrial facilities in White majority Chicago zip codes stagnated and then dropped (see Figure 4 below).

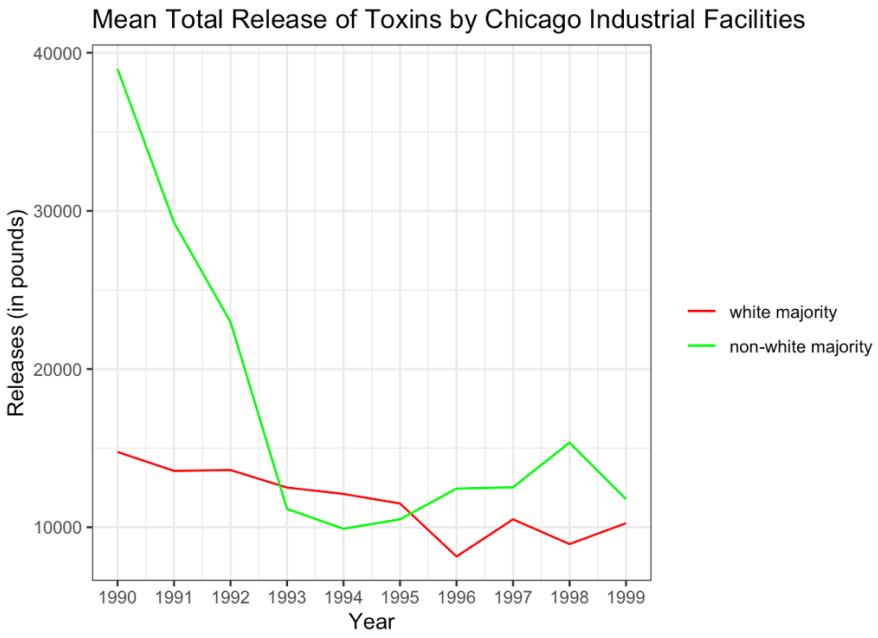


Figure 4: Mean Release of Toxins by Chicago Industrial Facilities in White Majority and Non-White Majority Zip Codes in the 5 Years Pre- and Post- the Implementation of EO 12898

Since 1993, the mean total toxic release by Chicago industrial facilities in non-White majority Chicago zip codes has not reached even close to the level it was at in 1990. In 1990, the mean total toxic release by Chicago industrial facilities in non-White majority Chicago zip codes was 38, 979.913 pounds. Since 1993, the highest mean total toxic release by Chicago industrial facilities in non-White majority Chicago zip codes was 15, 350.081 pounds (in 1998). In 1998, the difference between the mean total toxic release in non-White majority Chicago zip codes and the mean total toxic release in White majority Chicago zip codes was 6417.0443 pounds, compared to 24, 220.2890 pounds in 1990. However, this drastic reduction in the gap between non-White majority and White majority Chicago zip codes does not appear to be related to the implementation of EO 12898 in 1994; the change occurred prior to the institution of the policy. Looking at the data, one would have no idea that an environmental justice policy was implemented in 1994.

Finding 3: The Illinois Environmental Justice Act (2011) Had No Impact

My analysis of the 2011 Illinois Environmental Justice Act (2011), a state level policy implemented 17 years after Clinton's EO 12898, suggests that it was similarly ineffective. Figure 5 below displays the mean total toxic release by Chicago industrial facilities in the five years before and after the 2011 IL EJ Act (2007-2016). There is no sign that Chicago industrial facilities reduced their toxic releases after the implementation of the 2011 IL EJ Act. On the contrary, the mean total release of toxins by Chicago industrial facilities grew every year in the five years after the implementation of the policy.

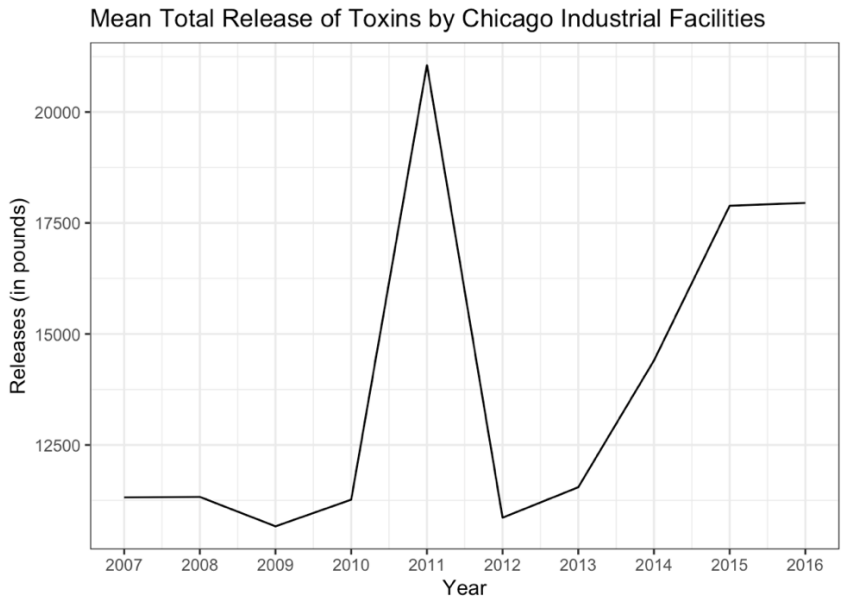


Figure 5: Mean Release of Toxins by Chicago Industrial Facilities in the 5 Years Pre- and Post- the Implementation of IL EJ Act

The large spike in mean total toxic release by Chicago industrial facilities in 2011 is due to the uncharacteristically high total release of zinc compounds by a single facility: H. Kramer & Co. H. Kramer & Co. is a manufacturer of copper-based alloys. In 2011, it reported releasing 2,098,200 pounds of zinc compounds. This was an outlier in the data and led the mean total toxic release in 2011 to increase from 12,384.98 pounds to 21,051.94 pounds. It is unclear what the

cause of H. Kramer & Co.'s high release of zinc compounds in 2011 was. While it is possible that this number was misreported, there is insufficient reason to conclude this. As such, I conducted preliminary analysis of the toxic release by Chicago industrial facilities before and after the 2011 IL EJ Act both including and excluding the H. Kramer & Co. release data. Figure 6 below displays the mean total toxic release by Chicago industrial facilities between 2007 and 2016, excluding the 2011 data for H. Kramer & Co.

Figure 6: Mean Release of Toxins by Chicago Industrial Facilities in the 5 Years Pre- and Post- the Implementation of IL EJ Act Excluding Obvious Outliers

Removing H. Kramer & Co.'s 2011 release data does not impact the overall trajectory of the mean total toxic release by Chicago industrial facilities between 2007 and 2016. Both Figure 5 and Figure 6 show that the mean toxic release by Chicago industrial facilities has been increasing since 2012. While the mean total toxic release level stayed relatively stagnant between 2007 and 2011 (the five years before the 2011 IL EJ Act was instituted), there was a dramatic rise in mean toxic release in the five years after the policy was instituted. The mean toxic release jumped from 11,548.07 pounds to 17,888.96 pounds between 2013 and 2015 alone.

There is no evidence that the 2011 IL EJ Act did anything to reduce the mean toxic release by Chicago industrial facilities.

My race-based analysis of the mean toxic releases by Chicago industrial facilities between 2007 and 2016 further substantiates the idea that the 2011 IL EJ Act failed to make an impact. Figures 7 and 8 below present the mean toxic releases by Chicago industrial facilities in White majority and non-White majority Chicago zip codes, both including and excluding H. Kramer & Co.'s 2011 release data.

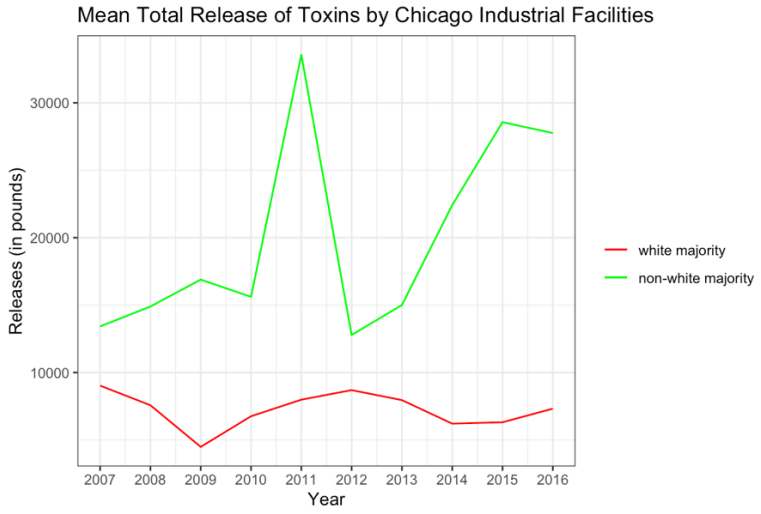


Figure 7: Mean Release of Toxins by Chicago Industrial Facilities in White Majority and Non-White Majority Zip Codes in the 5 Years Pre- and Post- the Implementation of the 2011 IL EJ Act

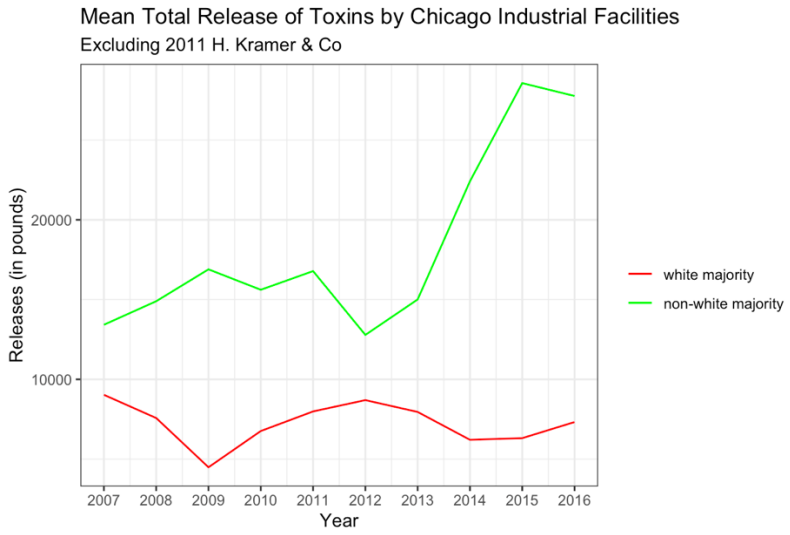


Figure 8: Mean Release of Toxins by Chicago Industrial Facilities in White Majority and Non-White Majority Zip Codes in the 5 Years Pre- and Post- the Implementation of the 2011 IL EJ Act, Excluding Outliers

Regardless of whether or not one includes the 2011 H. Kramer & Co. data, the mean toxic release by Chicago industrial facilities in non-White majority zip codes is significantly higher than in White majority zip codes between 2007 and 2016. Further, H. Kramer & Co.'s data only impacts the data for the non-White majority zip codes. The large spike in zinc release by the facility in 2011 occurred in a community of color, which further contributes to the idea that communities of color are at a higher risk of dangerous toxic waste exposure.

Although the mean toxic release by industrial facilities in White majority Chicago zip codes fluctuated somewhat from year to year, it stayed within a range of 4541.243 pounds. Graphically, the red line in Figures 7 and 8 stays fairly flat. In comparison, the range of mean toxic release by facilities in non-White majority zip codes was either 20,769.48 pounds or 15,784.42 pounds, depending on whether or not H. Kramer & Co.'s 2011 data is included. This wide range is largely a result of increasing toxic waste releases in non-White majority zip codes. While the mean toxic waste release in White-majority zip codes remained fairly stagnant

between 2007 and 2016, the mean toxic waste release in non-White majority zip codes started to rise dramatically in 2012.

If the 2011 IL EJ Act were effective, one would expect the mean toxic waste release in White majority and non-White majority zip codes to converge after 2011. However, the data shows the opposite. As seen in Figures 7 and 8, the mean toxic waste releases in White majority and non-White majority zip codes diverge after 2011.The gap between the mean total toxic release by industrial facilities in White majority Chicago zip codes and the mean total toxic release by industrial facilities in non-White majority Chicago zip codes did not narrow in the five years after the implementation of the 2011 IL EJ Act. In 2012, the racial gap in mean total toxic releases was 4087.975 pounds. In 2016, this gap was 20,440.34 pounds; the racial gap grew by 16,352.365 pounds in the five years after the implementation of the policy. Consequently, all of the data points to the complete ineffectiveness of the 2011 IL EJ Act. As with EO 12898, one would not know that an environmental justice policy was instituted in 2011 by looking at Chicago toxic waste release data.

Finding 4: Preliminary Regression Analysis Highlights that Policy Changes Did Not Reduce the Relationship Between Racial Composition of a Zip Code and Toxic Releases

Preliminary regression analysis confirms the fact that neither EO 12898 nor the 2011 IL EJ Act helped to close the racial gap in toxic waste exposure. I regressed the mean toxic releases by an industrial facility in a zip code on an indicator variable for whether or not a zip code had a White majority both before and after the implementation of each policy. If the policies were effective, one would expect that the coefficient on the indicator variable for White majority would get closer to zero after the implementation of the policy. This would suggest that the

impact of a zip code having a White majority decreased after the environmental justice policy was instituted.

Table 1 below reveals the regression results for the five years prior to EO 12898 (1990-1994). The OLS model with no controls estimates that, if a zip code has a White majority, the mean toxic waste release by industrial facilities in the zip code will be 14,292.800 pounds lower than the mean toxic waste release by industrial facilities in zip codes with non-White majorities. This estimate is statistically significant at the 5% level. Further, practically speaking, a difference of 14,292.800 pounds of toxic waste is a very drastic difference. The mean toxic waste release by an industrial facility in any zip code during this five year period was 18,143.020 pounds, so 14,292.800 pounds is almost 80 percent of this.

In contrast, the regression for the five years after the implementation of EO 12898 (1995-1999) finds a much smaller difference in the toxic releases of White majority and non-White majority zip codes (see Table 2 below). Specifically, the OLS model with no controls estimates that, if a zip code has a White majority, the mean toxic waste release by industrial facilities in the zip code will be only 3,245.390 pounds lower than the mean toxic waste release by industrial facilities in zip codes with non-White majorities. In addition, this estimate is no longer statistically significant. Upon first glance, one might think this drastic increase in the coefficient on the White majority indicator variable from the 1990-1994 regression to the 1995-1999 regression suggests that EO 12898 was very effective at reducing the racial gap in toxic waste exposure in Chicago.

Table 1: Pre-EO 12898 (1990-1994)

	Dependent variable:	
	Mean Zipcode Release	
	(1)	(2)
white_majority	-14,292.800**	-16,646.080**
	(5,706.527)	(7,544.049)
median_income		0.173
		(0.357)
Constant	24,608.810***	18,804.070
	(3,838.169)	(12,621.110)
Observations	42	42
R^2	0.136	0.141
Adjusted R^2	0.114	0.097
Residual Std. Error	18,407.210 (df = 40)	18,586.140 (df = 39)
F Statistic	6.273** (df = 1; 40)	3.193* (df = 2; 39)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 2: Post-EO 12898 (1995-1999)

	Dependent variable:	
	Mean Zipcode Release	
	(1)	(2)
white_majority	-3,245.390	-2,200.038
	(2,923.834)	(3,882.932)
median_income		-0.074
		(0.179)
Constant	10,429.640***	12,952.330**
	(1,887.327)	(6,358.397)
Observations	36	36
R^2	0.035	0.040
Adjusted R^2	0.007	-0.018
Residual Std. Error	8,648.817 (df = 34)	8,755.956 (df = 33)
F Statistic	1.232 (df = 1; 34)	0.688 (df = 2; 33)
Note:		*p<0.1; **p<0.05; ***p<0.01

However, given my prior analysis of the toxic release data (most notably Figure 4), I was unconvinced that these results were really picking up the effect of the policy. For this reason, I ran the same regression using 1993 as the cut-off, instead of 1994. If the 1994 policy change is driving the change in coefficient, one would not expect to see this change with a cut-off of 1993. However, the regression results are nearly identical. The OLS model with no controls for 1990-1993 (see Table 3) estimates that, if a zip code has a White majority, the mean toxic waste release by industrial facilities in the zip code will be 15,488.860 pounds lower than the mean toxic waste release by industrial facilities in zip codes with non-White majorities. This estimate is statistically significant at the 5% level. Further, this estimate is easily within one standard error of the estimated coefficient on White majority in the regression for 1990-1994 (Table 1). Moreover, the OLS model with no control for 1994-1999 (see Table 4) estimates that, if a zip code has a White majority, the mean toxic waste release by industrial facilities in the zip code will be 3,133.128 pounds lower than the mean toxic waste release by industrial facilities in zip codes with non-White majorities. Similarly to the regression for 1995-1999, this coefficient is not statistically significant. Again, this estimate is easily within one standard error of the estimated coefficient on White majority in the regression for 1995-1999 (Table 2). In fact, including 1994 in this period brings the estimated coefficient even closer to zero. This indicates that EO 12898 was not the reason that the difference between toxic releases for non-White majority and White majority zip codes dramatically decreased over this period. Indeed, the dramatic decrease occurred prior to the policy's implementation in 1994.

Table 3: 1990-1993

	Dependent variable:	
	Mean Zipcode Release	
	(1)	(2)
white_majority	-15,488.860**	-18,394.510**
	(6,148.866)	(8,121.198)
median_income		0.213
		(0.385)
Constant	26,300.130***	19,132.910
	(4,135.682)	(13,586.670)
Observations	42	42
R^2	0.137	0.144
Adjusted R^2	0.115	0.100
Residual Std. Error	19,834.030 (df = 40)	20,008.050 (df = 39)
F Statistic	6.345** (df = 1; 40)	3.271** (df = 2; 39)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 4: 1994-1999

	Dependent variable:	
	Mean Zipcode Release	
	(1)	(2)
white_majority	-3,133.128	-1,896.236
	(2,786.808)	(3,711.128)
median_income		-0.088
		(0.172)
Constant	10,802.320***	13,783.460**
	(1,774.401)	(6,093.795)
Observations	37	37
R^2	0.035	0.042
Adjusted R^2	0.007	-0.014
Residual Std. Error	8,322.678 (df = 35)	8,411.833 (df = 34)
F Statistic	1.264 (df = 1; 35)	0.750 (df = 2; 34)
Note:		*p<0.1; **p<0.05; ***p<0.01

The regression results for the five years before and after the 2011 IL EJ Act similarly confirm the idea that the policy did not reduce the racial gap in toxic releases in Chicago. As shown in Table 5, the OLS model with no controls for the five years prior to the 2011 IL EJ Act (2007-2011) estimates that, if a zip code has a White majority, the mean toxic waste release by industrial facilities in the zip code will be 10,148.760 pounds lower than the mean toxic waste release by industrial facilities in non-White majority zip codes. This estimate is statistically significant at the 5% level. The OLS model with no controls for the five years after the 2011 IL EJ Act (see Table 6) estimates a much larger difference in the mean toxic waste releases between White majority zip codes and non-White majority zip codes. Specifically, the model estimates that, if a zip code has a White majority, the mean toxic waste release by industrial facilities in the zip code will be 24,445.190 pounds lower than the mean toxic waste release by industrial facilities in non-White majority zip codes. This estimate is also statistically significant at the 5% level. These results are the opposite of what one would expect if the 2011 IL EJ Act effectively decreased environmental injustice. Indeed, this regression analysis finds that whether or not a zip code has a White majority is associated with a much larger difference in toxic releases after the policy than before the implementation of the policy. The 2011 IL EJ Act certainly did not lead to a reduction in the racial gap in toxic waste exposure.

Table 5: Pre- IL EJ Act (2007-2011)

	Dependent variable:	
	Mean Zipcode Release	
	(1)	(2)
white_majority	-10,148.760**	-10,059.470
	(3,682.795)	(6,252.535)
median_income		-0.003
		(0.144)
Constant	14,509.060***	14,595.610**
	(2,689.533)	(5,569.575)
Observations	30	30
R^2	0.213	0.213
Adjusted R^2	0.185	0.155
Residual Std. Error	10,063.310 (df = 28)	10,247.920 (df = 27)
F Statistic	7.594** (df = 1; 28)	3.662** (df = 2; 27)
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 6: Post- IL EJ Act (2012-2016)

	Dependent variable:	
	Mean Zipcode Release	
	(1)	(2)
white_majority	-24,445.190**	-23,783.200
	(11,843.000)	(19,878.170)
median_income		-0.019
		(0.465)
Constant	27,887.620***	28,547.460
	(8,631.994)	(18,042.050)
Observations	32	32
R^2	0.124	0.124
Adjusted R^2	0.095	0.064
Residual Std. Error	33,431.570 (df = 30)	34,002.060 (df = 29)
F Statistic	4.261** (df = 1; 30)	2.060 (df = 2; 29)
Note:		*p<0.1; **p<0.05; ***p<0.01

As discussed in the methods section, this regression analysis only provides very preliminary analysis. Although the coefficients on the White majority indicator variable are statistically significant and indicate a relationship between whether or not a zip code has a White majority and the zip code's toxic releases, it is important not to interpret these results causally. Further, the R-squared values are very low, because whether or not a zip code has a White majority is by no means the only factor that explains the level of toxic releases in the zip code. Although the low R-squared values mean that the regression model would not accurately predict toxic releases, because the model was not used to generate predictions, this is not such an area for concern. There are almost definitely omitted variables in the regression of mean toxic releases in a zip code on the indicator variable for White majority, which will be biasing the coefficient on White majority. For this reason, one should not put too much weight on the numeric values of the coefficients. When I included median income as a control in the model, the coefficients for all the models (Tables 1-6) changed. Except for in the model for the five years before EO 12898 (Table 1), the estimates lost statistical significance. However, the general trend in all the estimates persisted. In order to develop a more robust model that precisely estimates the effect of a community's racial composition on toxic releases, one would need to acquire additional data, in order to include further controls. This could be an area of future research.

The likely reason that the coefficient on White majority loses statistical significance once median income is included as a control is that the indicator variable for White majority is highly correlated with median income in Chicago. It is overarchingly the case that the Chicago communities with the largest populations of color are also the poorest communities. So, it is near impossible to isolate the effect of race from the effect of class on toxic releases. While this poses a challenge to regression analysis, this is unlikely to have significant policy implications.

Whether the underlying reason for disproportionate environmental hazard is race or class, it is the same communities that need help. As such, it is impossible for effective environmental justice policies to target the right populations, without targeting communities that are both racial minorities and of lower socioeconomic status; in Chicago, these communities are by and large the same.

Consequently, preliminary regression analysis of mean toxic releases on the indicator variable for whether or not a zip code has a White majority substantiates my empirical analysis of the raw data. There is no evidence that either EO 12898 or the 2011 IL EJ Act shrunk the association between the racial composition of a zip code and its toxic releases. The estimated coefficient on White majority does not start to move towards zero after the implementation of either policy. Further research to create a more refined model would be necessary to more accurately quantify the impact of having a White majority on toxic release levels. However, this is not necessary to merely evaluate whether or not the environmental justice policies were effective at addressing racial disparities in toxic releases.

Finding 5: No Discontinuities in the Minority Discrepancy Variable Around 1994 or 2011

The minority discrepancy variable provides another lens through which to analyze the impact of environmental justice policy, and it similarly demonstrates that both EO 12898 and the 2011 IL EJ Act were entirely ineffective. The minority discrepancy (MD) variable quantifies the degree to which pollution is evenly disbursed within the city. A value exactly at zero indicates that the group's share of the city's toxic waste exposure is exactly equal to their share of the city population (Bullock et al. 2018, 476). A positive value indicates that the group faces a disproportionately high share of the city's toxic waste (Bullock et al. 2018, 476). Conversely, a negative value indicates that the group faces a disproportionately low share of the city's toxic

waste (Bullock et al. 2018, 476). Figure 9 below displays the MD variable for Asians, Blacks, Hispanics, Whites, and Other races every year between 1990 and 2020. The 'Other' categorization encompasses those who racially identify as American Indian/Alaska Native, Native Hawaiian/Pacific Islander, Other, or two or more races.

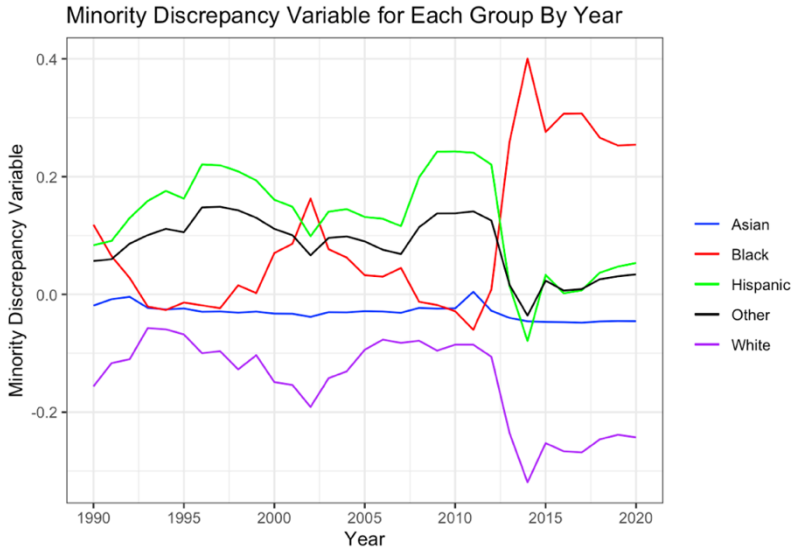


Figure 9: Minority Discrepancy Variable for Each Race/Ethnicity Group, 1990-2020

See Appendix C for a complete table of all of the MD variable values for each race/ethnicity group for each year between 1990 and 2020.

Evidently, the only race with an MD variable consistently near zero is Asian. The Asian MD variable stays just under zero for the entire thirty-year period, which indicates that Asians have consistently been exposed to slightly less than their share of the toxic waste in the city. The MD variable for all the other groups fluctuates greatly between 1990-2020. Both the MD variable for the Hispanic ethnic group and the MD variable for the 'Other' racial group sit significantly above zero for a lot of the time period, which illustrates the fact that these groups have historically borne much more than their share of toxic waste in Chicago. However, both the Hispanic group's and the 'Other' group's MD variable dropped significantly in 2014. While both MD variables have risen some since 2014, the MD variables have stayed significantly below the

pre-2014 level. Although the MD variable for Hispanics and for 'Other' were only below zero in 2014, before rising back up above zero, the overall drop indicates that both the Hispanic group and the 'Other' group have had to bear less of the burden of toxic waste exposure in the last few years than they had in the past.

Perhaps most notably, the MD variable for Blacks appears to almost mirror the MD variable for Whites, with the MD variable for Whites consistently below zero and the MD variable for Blacks consistently above zero. For example, when the MD variable for Blacks spikes up in 2014, the MD variable for Whites similarly spikes down. This pattern holds for the entire thirty-year period. This suggests that there is a direct trade-off relationship here; when Whites bear less than their share of the toxic waste, the Black population is forced to pick up the extra burden.

The MD variable for Whites is below zero for the entire thirty-year period; since 1990, Whites in Chicago have never been exposed to their share of the toxic waste in the city. In contrast, apart from a few years of reprieve from 1993-1997 and 2008-2011, the MD variable for Blacks is consistently above zero. Interestingly, these two periods of reprieve coincide with the implementation of environmental justice policies: EO 12898 in 1994 and the IL EJ Act in 2011. However, the MD variable for Blacks only hovers around zero briefly before rising again. There is no sustained change. Furthermore, the dips in the MD variable occur as part of a smooth trajectory in the data. If either EO 12898 or the 2011 IL EJ Act were driving changes in the MD variable, one would expect to see discontinuity in the MD variable around 1994 or 2011. This is not the case. As such, despite the fact that the places where the MD variable dips below zero coincides with the environmental justice policies, there is no reason to believe that environmental justice policy caused the dip.

The fact that there is no sustained change in the MD variable around 1994 or 2011 indicates that neither EO 12898 or the 2011 IL EJ Act was effective at addressing the disproportionate burden of toxic waste exposure that communities of color face in Chicago. If the policies effectively decreased environmental inequality, the MD variable for all races would converge to zero after the implementation of the policies. This is not the case. The gap between the MD variables for Blacks and Whites in 2020 was as large as ever. This confirms the previous findings that neither EO 12898 nor the 2011 IL EJ Act was effective at reducing the racial gap in toxic waste exposure in Chicago.

Finding 6: Disproportionate Release of Carcinogens in White Neighborhoods

Although all of my analysis points to the fact that communities of color in Chicago have been disproportionately exposed to toxic waste releases for the past 30 years, closer inspection of these toxic waste releases finds that White majority zip codes have faced higher releases of carcinogens. As such, the racial distribution of toxic waste exposure is more complex than it may initially seem. Figure 10 below displays the mean release of carcinogens by Chicago industrial facilities in both White majority and non-White majority zip codes between 1990 and 2020.

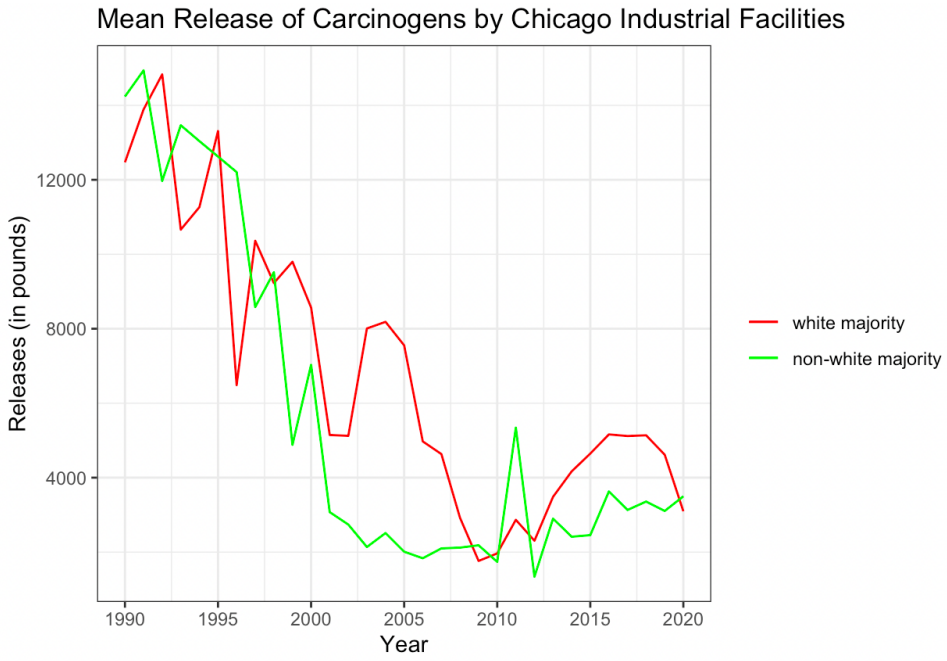


Figure 10: Mean Release of Carcinogens by Chicago Industrial Facilities in White Majority and Non-White Majority Zip Codes, 1990-2020

For a lot of the thirty-year period between 1990 and 2020, the mean release of carcinogens by industrial facilities in White majority and non-White majority zip codes was fairly similar. Unlike the graphs of mean total toxic releases by Chicago industrial facilities, the red and green lines in Figure 10 are fairly intertwined. However, there are significant periods, namely between 2001 and 2009 and between 2011 and 2020, in which industrial facilities in White majority zip codes released significantly more carcinogens, on average, than industrial facilities in non-White majority zip codes. Given the known health risks associated with exposure to carcinogens, one could argue that this suggests that environmental justice concerns are overblown.

However, exposure to carcinogens is certainly not the only concern surrounding exposure to toxic waste, and this finding does nothing to minimize the grave implications of the fact that communities of color in Chicago continue to face disproportionate exposure to toxic wastes. Instead, it indicates that there are subtleties involved in toxic release exposure. Although White majority zip codes do not face the same level of toxic waste exposure as communities of color, it

seems that they still face considerable environmental hazard from carcinogens. It is an oversimplification to say that communities of color are disproportionately exposed to all types of toxic releases. Consequently, this finding informs future discussion about environmental justice policy. Neither EO 12898 nor the 2011 IL EJ Act makes any attempt to target a specific type of toxic waste release.

Discussion

My analysis of the toxic release data for Chicago industrial facilities from 1990-2020 illustrates that Chicago faces serious environmental justice challenges, which past policies have completely failed to address. I used three methodologies to assess the impact of EO 12898 and the 2011 IL EJ Act: descriptive analysis of raw data, preliminary regression analysis, and computation of the minority discrepancy variable. All three methodologies provided strong evidence that industrial facilities located in communities of color continue to release significantly greater mean toxic releases than industrial facilities in predominantly White communities. As a result, already disadvantaged groups face disproportionate exposure to toxic chemicals across the city. There is a strong relationship between race and toxic waste exposure, which has not improved over time. While both the federal government and the Illinois state government have made attempts to implement environmental justice policies to reduce unequal exposure to environmental hazard, these policies are entirely invisible in the Chicago toxic release data. The toxic waste releases in Chicago appear unchanged after EO 12898 (1994) and the 2011 IL EJ Act, both in terms of the total toxic releases and the distribution of these releases across different racial groups.

Consequently, my analysis highlights the fact that environmental justice continues to pose an unaddressed challenge. Although there is a strong body of evidence that environmental

justice is a problem – as evidenced by the disproportionate release of toxic waste in communities of color – past policy efforts have failed to achieve anything. Neither EO 12898 nor the 2011 IL EJ Act made any impact on the relationship between race and toxic waste exposure. It is twenty-eight years since Clinton first issued EO 12898, introducing environmental justice as a priority for all federal agencies, and nothing has changed. The 2011 IL EJ Act, which was instituted seventeen years after Clinton's executive order, failed just as badly as EO 12898. The mere existence of these policies suggests that policymakers have not subscribed to the market dynamics theory. There is a recognition that racism needs to be at the center of the discussion around environmental inequality. However, the data suggests that environmental justice policy merely consists of empty words, both at the federal level and at the state level in Illinois. Current policy efforts have attempted to address intentional environmental racism by requiring that environmental justice concerns are taken into consideration. Nonetheless, as it stands, environmental justice policy has accomplished nothing, which suggests that the creation of these policies was just a waste of resources.

In order to build a future in which environmental hazard is both minimized and spread equally across society, serious environmental justice policy reform is needed immediately. The failure of past policies indicates that environmental justice policies need to mandate institutional change, and thus align with the theory of institutional environmental racism. Environmental justice solutions require more than a surface-level consideration of race; racism is baked into the operation of society. Substantive environmental justice policy that forces change needs to be a priority. Within this, the fact that White majority zip codes in Chicago have frequently faced higher mean releases of carcinogens than non-White majority zip codes, despite the overall lower levels of toxic releases, indicates that serious consideration of the nuances of environmental

justice policy is needed. In order to craft effective environmental justice, policymakers need to consider which toxic releases need to be targeted. A policy aimed at reducing the release of carcinogens, for example, is unlikely to decrease the disproportionate exposure of toxic waste releases faced by communities of color.

Limitations

The fact that all of the data used in my analysis was self-reported may have introduced error into my analysis. The accuracy of the TRI data relies on industrial facilities to accurately and honestly report their toxic waste releases, which may not always occur. In addition to the possibility of inaccurate reporting, it is entirely possible that there are industrial facilities in Chicago that failed to report their toxic waste releases entirely. There is quite a lot of year-to-year fluctuation in the toxic releases reported, which indicates that the data is likely quite noisy. Similarly, my analysis of the demographic characteristics of the zip codes in which the industrial facilities are located relied heavily on U.S. Census data. Since the U.S. Census only occurs every ten years, the demographic data for any given year in my dataset will not have been perfectly accurate.

In addition, this was an observational study that relied on historical data, rather than a randomized control trial. As a result, it is impossible to conclude causality. There may have been factors other than the implementation of the environmental justice policy that changed between the periods before and after each policy. While my analysis concluded that both EO 12898 and the 2011 IL EJ Act were ineffective, it is not impossible that one (or both) of these policies was somewhat effective, but other factors changed that would have worsened the environmental injustice in the absence of the policy. There is no way to know what the world would have looked like, if the policy were not implemented. However, the fact that my analysis looked at a

relatively tight time period around the implementation of each policy ought to limit the likelihood that other factors could have changed drastically enough to significantly impact the level of environmental injustice present. There is no reason to believe that external factors would have significantly impacted the toxic waste releases by industrial facilities in Chicago before or after the implementation of EO 12898 in 1994 or the IL EJ Act in 2011. So, while it is true that there may be confounding factors that my analysis could not account for, it is unlikely that these factors would drastically change the findings.

These limitations in the data will likely have affected the exact numbers in my analysis, but it is unlikely that the data was sufficiently inaccurate to change the general trends. My findings were entirely unambiguous; nothing in the data provided any indication that EO 12898 or the 2011 IL EJ Act made any impact on the total toxic waste releases or the distribution of toxic waste releases in Chicago. Furthermore, despite the challenges introduced by the fact that the data was self-reported, my analysis was strengthened by the fact that both the TRI data and the U.S. Census data contains data for the entire population. My analysis did not rely on a sample, which may or may not be representative of the population. Instead, I was able to compute the true mean toxic release by Chicago industrial facilities for any zip code for any year, for example. Although the limitations of the data are valid, the strength of my findings makes it unlikely that these limitations made a significant impact on the results of the study.

Policy Recommendations

Based on my findings, it is clear that current environmental justice policies, both at the federal and at the state level, have failed in Chicago. The racial gap in toxic waste exposure appears to have been unaffected by both EO 12898 and the 2011 IL EJ Act. Significant environmental justice policy reform is needed. My findings give rise to several recommendations

for future environmental justice policies. First, future environmental justice policies need to include both enforcement mechanisms and targeted, specific regulations. Without these things, it is too easy for the policies to be pushed aside. Moreover, I recommend that policies require disproportionate investment in transitioning to clean energy in minority communities and require more stringent environmental impact assessment standards. In order to achieve environmental equity, environmental justice policies need to specifically address the high levels of environmental hazard in minority communities.

Recommendation 1: Introduce Enforcement Mechanisms

My findings suggest that future environmental justice policies need to include enforcement mechanisms. There need to be stakes attached to making changes. Neither EO 12898 nor the 2011 IL EJ Act include a mechanism to ensure that the policies are implemented effectively and change is made, which has allowed these policies to remain wholly ineffective. EO 12898 requires that federal agencies make environmental justice a central part of their missions, but there is no evaluation process or penalty in place for agencies that fail to do so. As a result, there is very little incentive for federal agencies to prioritize environmental justice in practice. EO 12898 made no impact on the racial disparity in toxic waste exposure in Chicago, as evidenced by the fact that the minority discrepancy variable for Whites decreased from -0.0593 in 1994 to -0.1273 in 1998. The White population bore less and less of their share of toxic waste exposure in Chicago in the five years following the implementation of the policy. Evidently, federal agencies will not change their practices unless they are forced to.

Similarly, while the Commission on Environmental Justice established by the 2011 IL EJ Act was created to advise the Governor and General Assembly (Illinois Environmental Justice Act, 2011), there is nothing in the policy that mandates that the Governor and General Assembly

respond to the Commission's findings. The policy fails to require any real action. The 2011 IL EJ Act was just as ineffective as EO 12898. In fact, the minority discrepancy variable for Whites jumped from -0.1059 in 2012 to -0.2350 in 2013, which indicates that the White population bore significantly less of their share of toxic waste exposure in Chicago two years after the implementation of the policy than it had done before. The ineffectiveness of both EO 12898 and the 2011 IL EJ Act reveals that policy cannot rely on voluntary compliance. The failure of these policies was that they did nothing at all. For this reason, environmental justice policies need to include enforcement mechanisms, such as penalties for failure to comply. Otherwise, environmental justice policies will continue to be ignored.

In particular, environmental justice policies should delineate specific responsibilities for newly created oversight groups and create protocols for these groups to follow. Both EO 12898 and the 2011 IL EJ Act include the creation of a new group that will be responsible for environmental justice concerns. Similar to the Commission on Environmental Justice established by the 2011 IL EJ Act, EO 12898 established an Interagency Working Group on environmental justice, which was chaired by the EPA Administrator and included the heads of 11 federal agencies (Exec. Order No. 12898, 1994). However, creating a group does not accomplish anything in and of itself, as the ineffectiveness of the two policies highlights. I recommend, for example, that environmental justice policies mandate how frequently the oversight group should convene. Further, environmental justice policies should require that oversight groups propose a minimum number of improvements to address environmental justice concerns each year. In order for the establishment of smaller groups responsible for environmental justice to be effective, policies need to lay out clear, enforceable expectations for the oversight groups.

The inclusion of enforcement mechanisms in environmental justice policy may make it more difficult for environmental justice legislation to pass. Often times, politicians are more willing to support policies without enforcement mechanisms, because the politicians know that the policy can easily be ignored if compliance proves difficult. Nonetheless, without an enforcement mechanism, there is no reason to believe that change will occur. Moreover, the inclusion of enforcement mechanisms may require government agencies to hire additional personnel, which is costly. In order for a group (such as the Commission on Environmental Justice in Illinois) to meet regularly and be effective, members of the group need to have the time and the resources to devote a lot of energy to the work. It is unlikely that many current employees have the capacity to simply add this work to whatever else they are responsible for.

Regardless of the implementation challenges, it is only worth pursuing enforceable environmental justice policies. Establishing groups to address environmental justice concerns, for instance, does nothing if the groups do not actually enact change. Even if oversight groups convene regularly, this will not necessarily mean that they put in sufficient effort to generate high-quality proposals. It is very difficult for a policy to control the quality of the ideas that emerge. However, enforcing that groups designated to address environmental justice concerns are actually meeting and engaging is the first step. The creation of unenforceable environmental justice policies drains resources without any payoff. There is no point in creating policies that look good on paper, if there is no substance behind the name.

Recommendation 2: Conduct the Necessary Research to Include Targeted, Specific Regulations

In order for the introduction of enforcement mechanisms to be effective, future environmental justice policies need to include more targeted, specific regulations. As it stands, environmental justice policies lack enforcement mechanisms, but they also lack anything

tangible to enforce. Specifically, both EO 12898 and the 2011 IL EJ Act require that environmental justice concerns are taken into consideration and prioritized, but neither policy contains any explanation of what this means in practice. My findings indicate that neither EO 12898 nor the 2011 IL EJ Act resulted in any change; the toxic waste releases in non-White majority Chicago zip codes and White majority Chicago zip codes did not even begin to converge after the implementation of either policy. Clearly, neither policy led to true prioritization of environmental justice concerns. However, what does prioritizing environmental justice look like? Future environmental justice policies need to outline specific benchmarks and standards for change. As it stands, the vague language employed in environmental justice policies renders these policies useless. Environmental justice policies need to directly regulate the levels of toxic waste release in communities of color.

The creation of effective, tangible environmental justice policies will likely require significant thought and research. For example, if a policy were to regulate the level of toxic waste release in communities of color, policymakers would need to conduct substantial research to determine what the acceptable level of toxic release should be. In particular, research is necessary to determine what toxic release level will minimize the harm to community members, while allowing some level of industry to continue in a sustainable way. Research requires funding, which may pose a challenge. However, Mayor Lightfoot included $200 million for climate mitigation and environmental justice projects in Chicago's FY2022 budget (Harris and Simba 2022). This suggests that there are funds available. The challenge is convincing politicians to spend them on the necessary environmental justice research.

The fact that the industrial facilities are brick-and-mortar institutions poses an additional implementation challenge. It is not easy for industrial facilities to move into new neighborhoods,

which makes it harder to introduce regulations specifically targeting minority communities. In particular, industrial facilities are unlikely to be receptive to relocating into wealthier, White neighborhoods, where operation costs are likely to be higher. Similarly, wealthier, White neighborhoods are unlikely to accept new industrial facilities without significant protest. While the institutionalized nature of the problem makes it difficult to create new, community-specific regulations, this does not mean that it is acceptable to circumvent the problem by utilizing vague, meaningless language in environmental justice policies. Instead, it is necessary to fund research to develop creative solutions.

The effectiveness of including targeted, specific regulations in environmental justice policies will be entirely dependent on how successful researchers are at developing these regulations. There may be a period of trial and error, before it is clear what the right toxic release thresholds to impose are. This is not an exact science. As a result, it is necessary that policymakers continue to invest in developing effective policies, even if initial regulations prove ineffective. Environmental justice policy research needs to be persistent and ongoing. The well-being of already disadvantaged, vulnerable populations is well worth the time and research needed to create tangible, effective regulations for the toxic waste releases of industrial facilities in the long-term.

Recommendation 3: Disproportionately Invest in Transitioning to Clean Energy in Minority Communities

Given the difficulty in relocating industrial facilities out of communities of color, I recommend disproportionately investing in reducing emissions and transitioning to clean energy in minority communities. While the first two policy recommendations provide general recommendations for the necessary components of a successful environmental justice policy, this

recommendation aims to directly address the problem that my findings present: non-White majority Chicago zip codes continue to face disproportionately high toxic waste releases. In September 2021, Illinois' Governor Pritzker signed the Climate and Equitable Jobs Act, which requires Illinois to phase out fossil fuels and transition to a 100% zero-emissions power sector by 2045 (Kibbey 2021). Moreover, the policy commits to growing renewable energy generation in the state more than five-fold (Kibbey 2021). The state has already committed to decreasing emissions and shifting towards clean energy. On a more local level, part of Chicago's Green Recovery Plan, which was announced in April 2021, advanced a Climate Action Plan to reduce emissions (Mayor's Press Office 2021). If these policies are well-implemented, the framework is already there to reduce toxic waste releases overall.

In order to specifically reduce the racial gap in toxic waste exposure in Chicago, the implementation of Illinois' Climate and Equitable Jobs Act and Chicago's Green Recovery Plan needs to be concentrated in the communities of color in Chicago. In 2020, the mean toxic release of industrial facilities in White majority Chicago zip codes was 5393.593 pounds, while the mean toxic release of industrial facilities in non-White majority Chicago zip codes was 23,888.605 pounds (see Figure 2 above). This represents a racial gap in toxic waste exposure which has shown no signs of closing, despite past environmental justice policies. For this reason, implementing Illinois' Climate and Equitable Jobs Act and Chicago's Green Recovery Plan equally across White majority and non-White majority Chicago zip codes will not solve the problem. While reducing toxic releases everywhere is certainly beneficial and has merit, this will not reduce the racial disparity in toxic waste releases. For this reason, it is necessary to invest more effort and more money in reducing the environmental harm created by industrial facilities in minority communities. Both the state and the city need to prioritize phasing out fossil fuels

and shifting to renewable energy sources in the industrial facilities located in communities of color.

Efforts to disproportionately reduce emissions and transition to clean energy in industrial facilities in minority communities will likely generate significant backlash, which will pose an implementation challenge. Disproportionate investment in communities of color will inevitably be unpopular in White communities. No community wants to be exposed to toxic releases. However, this is a challenge that must be faced to accomplish environmental equity. It is not possible to reduce the racial gap in toxic waste exposure without disproportionately decreasing toxic waste releases in non-White majority zip codes, relative to White majority zip codes. One way to frame this disproportionate investment in a more politically palatable way might be to emphasize the current disparities in toxic waste exposure across Chicago, which are rooted in environmental racism. The reason for disproportionately investing in clean energy and emissions reductions in industrial facilities in minority communities is that these are the communities that are suffering the most. Although there is no way around the fact that some White communities will never agree with concentrating resources in communities of color, the fact that Chicago tends to lean left politically makes it more likely that a policy requiring disproportionate investment in minority communities could be viable. Moreover, the fact that Mayor Lightfoot recently declined General Iron's permit to relocate the facility to the Southeast Side, which marked a significant victory for Southside environmental justice activists, suggests that the political climate right now may be receptive to disproportionate investment in minority communities. It is worth fighting for this disproportionate investment, in order to achieve a more just future.

Recommendation 4: More Stringent Environmental Impact Assessment Standards

Finally, I recommend the implementation of more stringent environmental impact assessment standards prior to the opening of new industrial facilities. Although the mean toxic releases in non-White majority Chicago zip codes did fall between 2018 and 2019, the overall trend in the data between 2012 and 2020 was a divergence between the mean toxic releases in non-White majority Chicago zip codes and mean toxic releases in White majority Chicago zip codes. The ultimate goal is to eliminate the racial disparity in toxic waste exposure entirely, but preventing the gap from growing is the first step in accomplishing this. For this reason, it is critical to make sure that new polluting industrial facilities do not open in non-White majority Chicago zip codes. Requiring that all industrial facilities planning to open in minority communities get a comprehensive environmental impact assessment prior to opening is one way to do this.

As it stands, very few projects require an Environmental Impact Statement. Most projects either receive a categorical exemption from environmental assessment entirely, or the preliminary environmental assessment is deemed sufficient to determine that the project will not make a significant impact (U.S. EPA 2012). Given the disproportionate harm that minority communities are already suffering from industrial facilities, it is crucial to make sure that no projects are approved that will increase toxic waste releases in these communities. For this reason, all proposals for new industrial facilities should automatically require an Environmental Impact Statement. Further, even after an Environmental Impact Statement is produced, there are no standards to determine whether or not the results of the assessment should mean that the project can move forward (U.S. EPA 2012). For this reason, I recommend the introduction of specific, stringent standards for industrial facilities proposing to open in non-White majority zip

codes in Chicago. It needs to be impossible for decisionmakers to make their own determinations about what level of environmental harm matters. This opens the door for continued environmental racism, particularly given that decisionmakers have historically failed to prioritize the well-being of minority communities.

Stricter Environmental Impact Assessment standards are likely to be extremely unpopular in the private sector. For private companies operating the industrial facilities, stricter standards will create additional barriers to entry and likely decrease profits. As a result, one can expect that policymakers trying to institute more stringent environmental impact standards will encounter considerable opposition. The private sector's priorities are fundamentally at odds with justice; it will not be possible to simultaneously prioritize private companies' profits and close the racial gap in toxic waste releases in Chicago. For this reason, while policymakers will need to work with representatives of the private sector to arrive at a piece of legislation that can pass, they cannot fold to the opposition. In addition, the fact that environmental assessment procedures are already established and entrenched in layers of bureaucracy will likely make it difficult to impose stricter Environmental Impact Assessment standards. In order to amend current procedures, policymakers will face significant inertia, as the current system has been operating for years. It will require both persistence and time to impose stricter Environmental Impact Assessment standards, and policymakers need to be willing to jump through the necessary hoops to do so. At the end of the day, policymakers need to be prepared to fight for environmental justice.

Plan for Policy Evaluation

As evidenced by the complete failure of both EO 12898 and the 2011 IL EJ Act, policies need to undergo a serious evaluation process in order to optimize the chance that they are

effective. For this reason, I propose a number of evaluative steps for each of the recommendations discussed above. My first two recommendations specifically address what the key components that need to be included in an environmental justice policy are. In order to ensure that these components are included, I recommend the establishment of an independent review board to assess all environmental justice policies before they are formally proposed. An independent review board could identify whether or not a policy included enforcement mechanisms and specific, tangible regulations. If these components were missing, policymakers could then have the opportunity to amend the policy prior to its proposal. By intervening in the early stages of policymaking, this kind of policy review process would guarantee that environmental justice policies without teeth are not implemented in the first place.

In order to evaluate the success of recommendations 3 and 4 (listed above), there needs to be an evaluation process in place after implementation. Specifically, I recommend a biannual assessment both of what proportion of funds have been spent on transitioning to clean energy in minority communities and of how the technology actually used by industrial facilities in minority communities has shifted. Disproportionate investment in transitioning to clean energy in minority communities will not necessarily immediately translate into results. For this reason, I recommend a biannual assessment, rather than more frequent assessments. If the policy is successfully implemented, significantly more funds should be devoted to the minority communities than to the predominantly White communities. If this is not the case, changes need to be made. Finally, in order to determine how the industrial facilities' operations are actually changing, I recommend using the measure of total toxic releases. If industrial facilities are transitioning to cleaner energy, the total toxic releases should decrease. This shift to clean energy may take more time. So, the key marker in the first biannual assessment will be whether or not

funds are disproportionately invested in minority communities. More emphasis will be placed on the absolute measure of total toxic releases in minority communities starting in the second biannual assessment. Finally, to evaluate the implementation of my fourth policy recommendation, I suggest an annual audit of all industrial facilities in non-White majority neighborhoods. These audits would track the total number of facilities in non-White majority neighborhoods and measure the toxic releases of any new facilities.

Admittedly, these policy evaluation processes will increase the cost of policy implementation. Forming an independent review board, conducting biannual assessments of investment in transitioning to clean energy, and conducting annual audits of industrial facilities in non-White majority neighborhoods will all generate significant costs. However, it is a greater waste of resources to continue implementing policies that continue to fail. So, while there might be an increased upfront cost, these additional evaluation processes would prevent ineffective, substance-less policies from dominating the environmental justice policy space. A plan for policy evaluation is critical to the success of environmental justice policy reform.

Conclusion

In this study, I used Chicago as a case study to evaluate the effectiveness of federal and state environmental justice policy, specifically EO 12898 and the 2011 IL EJ Act. Clinton made headlines in 1994 when he issued EO 12898, as it was the first environmental justice policy at the federal level. Since then, many states have instituted environmental justice policies at the more local level. In Illinois, this took the form of the 2011 IL EJ Act. However, the existence of policies is meaningless if that does not translate to increased equality in practice. The aim of this study was to address whether or not the existence of environmental justice policies has actually decreased the inequities in environmental harm in the past 30 years.

Environmental justice is a relatively new field of study, and the bulk of the literature on the topic focuses on identifying the problem – already disadvantaged, vulnerable populations often suffer from disproportionate environmental harm – rather than proposed solutions. Although a few studies have examined the general effectiveness of EO 12898, none of these studies examined the effect of the policy in Chicago, a city that historically has struggled with racial justice. Moreover, no studies have evaluated the impact of more recent, more local environmental justice policies, such as the 2011 IL EJ Act. This study fills this gap in the literature. Environmental justice entered policy discussions close to thirty years ago, and the research needs to reflect this. Rather than focusing on the problem-side, I evaluated whether past efforts to address the problem have worked in Chicago. I conclusively found that the current environmental justice policies cannot be considered a solution.

I used exposure to toxic releases from industrial facilities as a proxy for the level of environmental harm that a community experiences. Using this metric, all of my analysis indicated that there is a significant racial gap in toxic waste exposure in Chicago, and neither federal nor state environmental justice policy has done anything to mitigate this. I evaluated the racial disparity in toxic release exposure in Chicago before and after the implementation of EO 12898 and the 2011 IL EJ Act using three forms of analysis: empirical review of the raw toxic release data, preliminary regression analysis, and computation of the minority discrepancy variable. All three analyses definitively demonstrated that non-White majority zip codes in Chicago have historically faced and continue to experience drastically higher toxic releases than White majority zip codes, and neither EO 12898 in 1994 nor the 2011 IL EJ Act reduced the racial gap in toxic waste exposure. While further research, for example utilizing a different

geographic unit of analysis, could be done to back up these findings, the evidence is very strong that past environmental justice policies have failed to achieve anything in Chicago.

It was more than 30 years ago that Deeohn Ferris, a member of the Lawyers Committee for Civil Rights, was quoted saying, "We're all in the same sinking boat, only people of color are the closest to the hole" (Eady 2007, 42). However, this could just as well have been said yesterday. Nearly forty years after the Warren County demonstration caught national attention in 1982, communities of color in Chicago continue to face disproportionately high levels of toxic releases by industrial facilities. After the Commission for Racial Justice released its report in 1987, there was a marked shift in discussions around environmentalism and environmental policy. Indeed, environmental justice became a subject of national attention for the first time and that remains true to this day. My analysis clearly shows, however, that this has failed to translate into substantive environmental justice policies. My assessment of EO 12898 and the 2011 IL EJ Act revealed that these policies have not reduced the burden of toxic releases that Chicago communities of color bear. Looking at Chicago toxic release data, one would not even know that any environmental justice policies were implemented.

My findings give a clear view of the current status of environmental justice policy, through the lens of Chicago. The policies on the books, both at the federal level and in Illinois, lack substance and, consequently, effectiveness. Neither EO 12898 nor the 2011 IL EJ Act include specific measures to address environmental justice concerns. Consequently, the biggest takeaway from my findings is that policies that merely introduce environmental justice as a concern to think about are completely inadequate. In order to create a future in which populations of color are not consistently forced to bear the brunt of environmental harm, environmental justice cannot continue to be a buzz word that legislators include in policies just

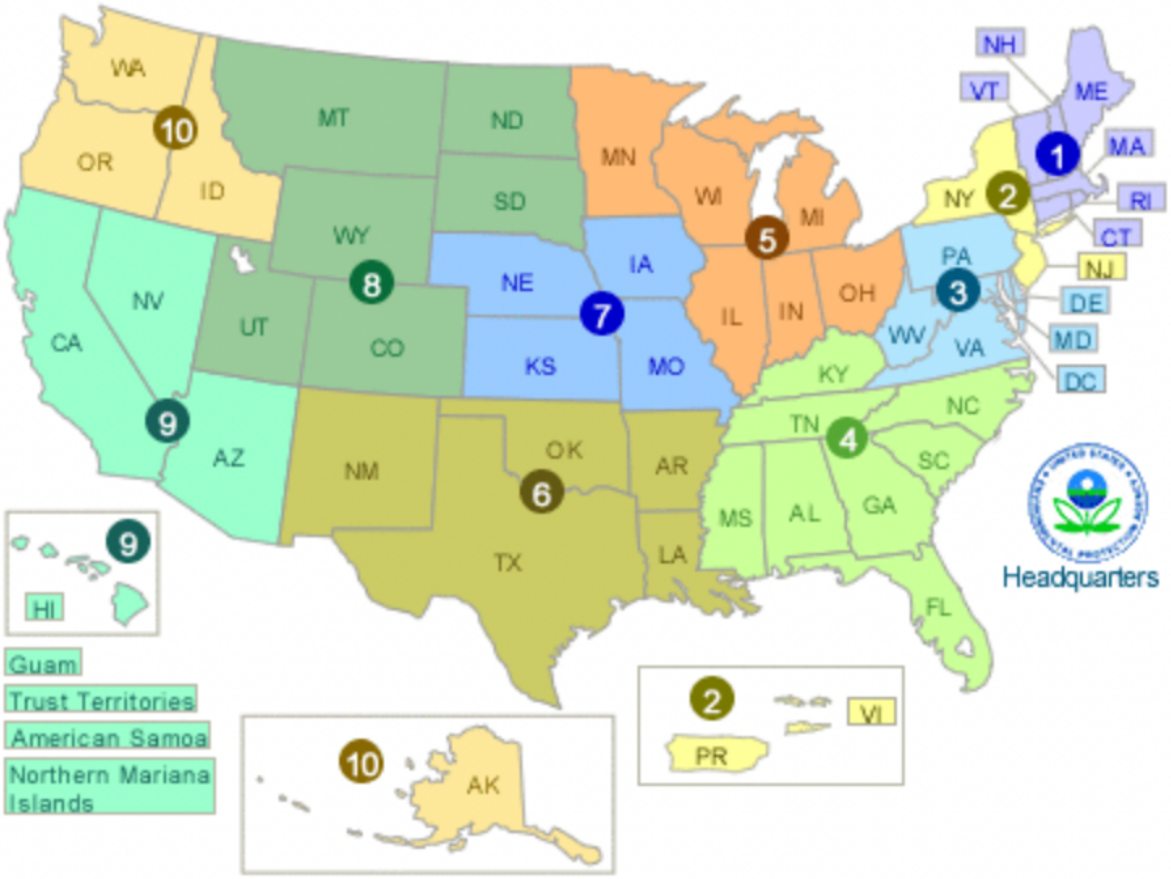
to appease the movement. When Clinton first announced EO 12898, the creation of an environmental justice policy was an accomplishment in itself. The standards for environmental justice cannot continue to be this low. Any claim that existing environmental justice policies offer a solution to the racial gap in toxic waste exposure in Chicago is fallacious. Future environmental justice policies need to include enforcement mechanisms and targeted, specific regulations, despite the fact that this will require additional research. Moreover, I recommend that future policies specifically require disproportionate investment in transitioning to clean energy in minority communities and implement stricter environmental impact assessment standards. More than anything else, future policies need to mandate change; it cannot continue to be an option to keep the status quo.

After George Floyd's murder in 2020, the Black Lives Matter movement quickly rose to prominence and people across the country started talking about the systemic racism that has gripped the United States for decades. The environmental justice movement was already bringing systemic racism to light in the 1980s. However, policymakers failed to adequately engage with the issue, leading to completely inadequate environmental justice policies. Environmental justice concerns need to be a salient part of the conversation about systemic racism in this country. While disproportionate toxic waste exposure may not have the same ability to captivate a nation as the brutal murder of a Black man by the police, the actual effect is the same: communities of color are suffering as a result of a long history of racist practices. With the rise in race consciousness across the United States, there is a real opportunity to leverage the momentum of the Black Lives Matter movement to finally address the environmental injustice that has plagued the United States for decades. In order for policymakers to successfully create policies that address environmental justice concerns, resources need to be devoted to developing

real solutions to environmental justice concerns. It is not easy to develop toxic waste release regulations, and it will continue to be impossible if researchers are not provided with the funding to do so.

Environmental injustice may not often grace the front page of newspapers, but addressing the systemic racism in this country will require developing effective environmental justice policies to eliminate the racial gap in toxic waste exposure. While people of color are forced to live amidst disproportionately high levels of toxins, racial equality is not possible. Policymakers cannot continue to put halfhearted attempts in the books. The time is now to put an end to environmental inequality.

Appendix A: Map of EPA regions (Source: U.S. EPA)



Appendix B: TRI Forms

TRI Form A

Form Approved OMB Number: 2070-0212
Approval Expires: 03/31/2024 **Page 1 of 2**

EPA United States Environmental Protection Agency

TOXICS RELEASE INVENTORY FORM A

Complete form online via TRI-MEweb. For a trade secret submission, send completed forms to TRI Reporting Center, P. O. Box 10163, Fairfax, VA 22038. The annual public burden related to the Form A is estimated to average 21.96 hours per response for a facility filing a report on one chemical. See the Reporting Forms and Instructions for more information on submissions and the Paperwork Reduction Act.

TRI Facility ID Number

This section only applies if you are revising or withdrawing a previously submitted form, otherwise leave blank.

Revision (Enter up to two code(s)) Text

Withdrawal (Enter up to two code(s))

IMPORTANT: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR _____

SECTION 2. TRADE SECRET INFORMATION

2.1 Are you claiming the toxic chemical identified on page 2 as a trade secret?
☐ Yes (Answer question 2.2; attach substantiation forms) ☐ No (Do not answer 2.2; go to Section 3)

2.2 Is this copy ☐ Sanitized ☐ Unsanitized (Answer only if "Yes" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that to the best of my knowledge and belief, for each toxic chemical listed in this statement, the annual reportable amount as defined in 40 CFR 372.27(a), did not exceed 500 pounds for this reporting year and that the chemical was manufactured, processed, or otherwise used in an amount not exceeding 1 million pounds during this reporting year.

Name and official title of owner/operator or senior management official:	Signature:	Date signed:

SECTION 4. FACILITY IDENTIFICATION

4.1	Facility or Establishment Name	TRI Facility ID Number	BIA Code
	Physical Street Address	Mailing Address (if different from physical street address)	
	City/County/State/ZIP Code	City/State/ZIP Code	Country (Non-US)

4.2 This report contains information for: (Important: Check c or d if applicable) c. ☐ A Federal Facility d. ☐ GOCO

4.3	Technical Contact Name		Telephone Number (include area code and ext.)
	Email Address		
4.4	Public Contact Name		Telephone Number (include area code and ext.)
	Email Address		

4.5	NAICS Code(s) (6 digits)	Primary a.	b.	c.	d.	e.	f.
4.6	Dun & Bradstreet Number(s) (9 digits)	a.					
		b.					

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of U.S. Parent Company (for TRI Reporting purposes)		No U.S. Parent Company (for TRI Reporting purposes) ☐
5.2	Parent Company's Dun & Bradstreet Number	NA ☐	

Form Approved OMB Number: 2070-0212
Approval Expires: 3/31/2024

EPA FORM A
PART II. CHEMICAL IDENTIFICATION

Do not use this form for reporting PBT chemicals, including Dioxin and Dioxin-like Compounds*

TRI Facility ID Number

SECTION 1. TOXIC CHEMICAL IDENTITY **Report____of ___**

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.)
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.)
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.)

SECTION 2. MIXTURE COMPONENT IDENTITY (Important: DO NOT complete this section if you completed Section 1 above)

2.1	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.)

SECTION 9.2. OPTIONAL POLLUTION PREVENTION AND ADDITIONAL INFORMATION FOR THIS TOXIC CHEMICAL

9.2	If you wish to provide optional chemical specific pollution prevention or additional information, provide it here.

SECTION 1. TOXIC CHEMICAL IDENTITY **Report____of ___**

1.1	CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.)
1.2	Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.)
1.3	Generic Chemical Name (Important: Complete only if Part 1, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.)

SECTION 2. MIXTURE COMPONENT IDENTITY (Important: DO NOT complete this section if you completed Section 1 above)

2.1	Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.)

SECTION 9.2. OPTIONAL POLLUTION PREVENTION AND ADDITIONAL INFORMATION FOR THIS TOXIC CHEMICAL

9.2	If you wish to provide optional chemical specific pollution prevention or additional information, provide it here.

*See the TRI Reporting Forms and Instructions manual for the list of PBT Chemicals (including Dioxin and Dioxin-like Compounds)

TRI Form R

Form Approved OMB Number: 2070-0212
Approval Expires: 03/31/2024 **Page 1 of 6**

EPA United States Environmental Protection Agency

FORM R

Section 313 of the Emergency Planning and Community Right-to-Know Act of 1986, also Known as Title III of the Superfund Amendments and Reauthorization Act

TRI Facility ID Number

Toxic Chemical, Category, or Generic Name

Complete form online via TRI-MEweb. For a trade secret submission, send completed forms to TRI Reporting Center, P. O. Box 10163, Fairfax, VA 22038. The annual public burden related to the Form R is estimated to average 35.71 hours per response for a facility filing a report on one chemical. See the Reporting Forms and Instructions for more information on submissions and the Paperwork Reduction Act.

This section only applies if you are revising or withdrawing a previously submitted form, otherwise leave blank.	**Revision (Enter up to two code(s))**	**Withdrawal (Enter up to two code(s))**

IMPORTANT: See instructions to determine when "Not Applicable (NA)" boxes should be checked.

PART I. FACILITY IDENTIFICATION INFORMATION

SECTION 1. REPORTING YEAR _____

SECTION 2. TRADE SECRET INFORMATION

2.1	Are you claiming the toxic chemical identified on page 2 as a trade secret? ☐ Yes (Answer question 2.2; attach substantiation forms) ☐ No (Do not answer 2.2; go to Section 3)	**2.2**	Is this copy ☐ Sanitized ☐ Unsanitized (Answer only if "Yes" in 2.1)

SECTION 3. CERTIFICATION (Important: Read and sign after completing all form sections.)

I hereby certify that I have reviewed the attached documents and that, to the best of my knowledge and belief, the submitted information is true and complete and that the amounts and values in this report are accurate based on reasonable estimates using data available to the preparers of this report.

Name and official title of owner/operator or senior management official:	Signature:	Date signed:

SECTION 4. FACILITY IDENTIFICATION

	Facility or Establishment Name		TRI Facility ID Number		BIA Code	
4.1	Physical Street Address		Mailing Address (if different from physical street address)			
	City/County/State/ZIP Code		City/State/ZIP Code		Country (Non-US)	
4.2	This report contains information for: (Important: Check a or b; check c or d if applicable)	a. ☐ An entire facility	b. ☐ Part of a facility	c. ☐ A federal facility	d. ☐ GOCO	
4.3	Technical Contact Name				Telephone Number (include area code and ext.)	
	Email Address					
4.4	Public Contact Name				Telephone Number (include area code and ext.)	
	Email Address					
4.5	NAICS Code(s) (6 digits)	Primary a.	b.	c.	d.	e. f.
4.6	Dun & Bradstreet Number(s) (9 digits)	a.				
		b.				

SECTION 5. PARENT COMPANY INFORMATION

5.1	Name of U.S. Parent Company (for TRI Reporting purposes)		No U.S. Parent Company (for TRI Reporting purposes) ☐
5.2	Parent Company's Dun & Bradstreet Number	**NA** ☐	

EPA Form 9350 -1 (Rev. 07/2020). Previous editions are obsolete.

Form Approved OMB Number: 2070-0212
Approval Expires: 03/31/2024

FORM R

Part II. CHEMICAL-SPECIFIC INFORMATION

TRI Facility ID Number

Toxic Chemical, Category, or Generic Name

SECTION 1. TOXIC CHEMICAL IDENTITY

(Important: DO NOT complete this section if you are reporting a mixture component in Section 2 below.)

1.1 CAS Number (Important: Enter only one number exactly as it appears on the Section 313 list. Enter category code if reporting a chemical category.)

1.2 Toxic Chemical or Chemical Category Name (Important: Enter only one name exactly as it appears on the Section 313 list.)

1.3 Generic Chemical Name (Important: Complete only if Part I, Section 2.1 is checked "Yes". Generic Name must be structurally descriptive.)

SECTION 2. MIXTURE COMPONENT IDENTITY

(Important: DO NOT complete this section if you completed Section 1.)

2.1 Generic Chemical Name Provided by Supplier (Important: Maximum of 70 characters, including numbers, letters, spaces, and punctuation.)

SECTION 3. ACTIVITIES AND USES OF THE TOXIC CHEMICAL AT THE FACILITY

(Important: Check all that apply.)

3.1 Manufacture the toxic chemical:

a. ☐ Produce b. ☐ Import

If Produce or Import
c. ☐ For on-site use/processing
d. ☐ For sale/distribution
e. ☐ As a byproduct
f. ☐ As an impurity

3.2 Process the toxic chemical:

a. ☐ As a reactant
b. ☐ As a formulation component
c. ☐ As an article component
d. ☐ Repackaging
e. ☐ As an impurity
f. ☐ Recycling

Enter 4-digit code(s) from instruction package

3.3 Otherwise use the toxic chemical:

a. ☐ As a chemical processing aid
b. ☐ As a manufacturing aid
c. ☐ Ancillary or other use

Enter 4-digit code(s) from instruction package

SECTION 4. MAXIMUM AMOUNT OF THE TOXIC CHEMICAL ON-SITE AT ANY TIME DURING THE CALENDAR YEAR

4.1 ☐ (Enter two-digit code from instruction package.)

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ON-SITE

			A. Total Release (pounds/year*) (Enter a range code** or estimate)	B. Basis of Estimate (Enter code)	C. Percent from Stormwater
5.1	Fugitive or non-point air emissions	NA ☐			
5.2	Stack or point air emissions	NA ☐			
5.3	Discharges to receiving streams or water bodies (Enter one name per box)	NA ☐			
	Stream or Water Body Name	Reach Code (optional)			
5.3.1					
5.3.2					

If additional pages of Part II, Section 3.2 and 3.3 are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 3.2 and 3.3 page number in this box. ☐ (Example: 1, 2, 3, etc.)
If additional pages of Part II, Section 5.3 are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 5.3 page number in this box. ☐ (Example: 1, 2, 3, etc.)

*For Dioxin or Dioxin-like compounds, report in grams/year.
**Range Codes: A= 1-10 pounds; B= 11-499 pounds; C= 500-999 pounds.

FORM R

Part II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
Toxic Chemical, Category, or Generic Name

SECTION 5. QUANTITY OF THE TOXIC CHEMICAL ENTERING EACH ENVIRONMENTAL MEDIUM ON-SITE (continued)

		NA	A. Total Release (pounds/year*) (Enter a range code** or estimate)	B. Basis of Estimate (Enter code)
5.4-5.5	Disposal to land on-site			
5.4.1	Class I Underground Injection Wells	☐		
5.4.2	Class II-V Underground Injection Wells	☐		
5.5.1A	RCRA Subtitle C landfills	☐		
5.5.1B	Other landfills	☐		
5.5.2	Land treatment/application farming	☐		
5.5.3A	RCRA Subtitle C surface impoundments	☐		
5.5.3B	Other surface impoundments	☐		
5.5.4	Other disposal	☐		

Optional Waste Rock Piles Information
You may check this box if your Section 5.5 quantities include "waste rock piles." ☐ Enter quantity of "waste rock piles" (pounds/year*)

SECTION 6. TRANSFER(S) OF THE TOXIC CHEMICAL IN WASTES TO OFF-SITE LOCATIONS

6.1 DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS (POTWs) **NA** ☐

6.1.___	POTW Name						
POTW Address							
City		County		State		ZIP	

A. Quantity Transferred to this POTW (pounds/year*) (Enter range code**or estimate)	B. Basis of Estimate (Enter code)	C. Disposal/Treatment (Enter code)
1.	**1.**	**1. P**
2.	**2.**	**2. P**
3.	**3.**	**3. P**

If additional pages of Part II, Section 6.1 are attached, indicate the total number of pages in this box ☐
and indicate the Part II, Section 6.1 page number in this box. ☐ (Example: 1, 2, 3, etc.)

SECTION 6.2 TRANSFERS TO OTHER OFF-SITE LOCATIONS **NA** ☐

6.2.___	Off-Site EPA Identification Number (RCRA ID No.)								
Off-Site Location Name:									
Off-Site Address:									
City		County		State		ZIP		Country (non-US)	

Is this location under control of reporting facility or parent company? ☐ Yes ☐ No

*For Dioxin or Dioxin-like compounds, report in grams/year.
**Range Codes: A= 1-10 pounds; B= 11-499 pounds; C= 500-999 pounds.

FORM R

Part II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number

Toxic Chemical, Category, or Generic Name

SECTION 6.2. TRANSFERS TO OTHER OFF-SITE LOCATION (CONTINUED)

A. Total Transfer (pounds/year*) (Enter a range code** or estimate)	**B. Basis of Estimate** (Enter code)	**C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery** (Enter code)
1.	**1.**	**1. M**
2.	**2.**	**2. M**
3.	**3.**	**3. M**

6.2____ Off-Site EPA Identification Number (RCRA ID No.)

Off-Site Location Name:

Off-Site Address:

City | County | State | ZIP | Country (non-US)

Is this location under control of reporting facility or parent company? ☐ Yes ☐ No

A. Total Transfer (pounds/year*) (Enter a range code** or estimate)	**B. Basis of Estimate** (Enter code)	**C. Type of Waste Treatment/Disposal/ Recycling/Energy Recovery** (Enter code)
1.	**1.**	**1. M**
2.	**2.**	**2. M**
3.	**3.**	**3. M**

SECTION 7A. ON-SITE WASTE TREATMENT METHODS AND EFFICIENCY

☐ Not Applicable (NA) - Check here if no on-site waste treatment method is applied to any waste stream containing the toxic chemical or chemical category.

a. General Waste Stream (Enter code)	b. Waste Treatment Method(s) Sequence (Enter 3- or 4-character code(s))						c. Waste Treatment Efficiency (Enter 2 character code)
7A.1a	**7A.1b**	1		2			**7A.1c**
	3		4		5		
	6		7		8		
7A.2a	**7A.2b**	1		2			**7A.2c**
	3		4		5		
	6		7		8		
7A.3a	**7A.3b**	1		2			**7A.3c**
	3		4		5		
	6		7		8		
7A.4a	**7A.4b**	1		2			**7A.4c**
	3		4		5		
	6		7		8		
7A.5a	**7A.5b**	1		2			**7A.5c**
	3		4		5		
	6		7		8		

If additional pages of Part II, Section 6.2/7.A are attached, indicate the total number of pages in this ☐ box and indicate the Part II, Section 6.2/7.A page number in this box. ☐ (Example: 1, 2, 3, etc.)

EPA form 9350 -1 (Rev. 07/2020). Previous editions are obsolete.

*For Dioxin or Dioxin-like compounds, report in grams/year.
**Range Codes: A= 1-10 pounds; B= 11-499 pounds; C= 500-999 pounds.

FORM R

Part II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number

Toxic Chemical, Category, or Generic Name

SECTION 7B. ON-SITE ENERGY RECOVERY PROCESSES

☐ NA Check here if no on-site energy recovery is applied to any waste stream containing the toxic chemical or chemical category.

Energy Recovery Methods (Enter 3-character code(s))

1 ☐ 2 ☐ 3 ☐

SECTION 7C. ON-SITE RECYLING PROCESSES

☐ NA Check here if no on-site recycling is applied to any waste stream containing the toxic chemical or chemical category.

Recycling Methods (Enter 3-character code(s))

1. ☐ 2. ☐ 3. ☐

SECTION 8. SOURCE REDUCTION AND WASTE MANAGEMENT

		Column A Prior Year (pounds/year*)	Column B Current Reporting Year (pounds/year*)	Column C Following Year (pounds/year*)	Column D Second Following Year (pounds/year*)
8.1 – 8.7 Production-Related Waste Managed					
8.1a	Total on-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills				
8.1b	Total other on-site disposal or other releases				
8.1c	Total off-site disposal to Class I Underground Injection Wells, RCRA Subtitle C landfills, and other landfills				
8.1d	Total other off-site disposal or other releases				
8.2	Quantity used for energy recovery on-site				
8.3	Quantity used for energy recovery off-site				
8.4	Quantity recycled on-site				
8.5	Quantity recycled off-site				
8.6	Quantity treated on-site				
8.7	Quantity treated off-site				
8.8	Non-Production-Related Waste Managed**				
8.9	☐ Production ratio or ☐ Activity ratio (select one and enter value to the right)				
8.10	Did your facility engage in any newly implemented source reduction activities for this chemical during the reporting year? If so, complete the following section; if not, check NA. **NA** ☐				

	Source Reduction Activities (Enter code(s))	Methods to Identify Activity (Enter code(s))			Estimated annual reduction (Enter code(s)) (optional)
8.10.1		**a.**	**b.**	**c.**	**d.**
8.10.2		**a.**	**b.**	**c.**	**d.**
8.10.3		**a.**	**b.**	**c.**	**d.**
8.10.4		**a.**	**b.**	**c.**	**d.**

*For Dioxin or Dioxin-like compounds, report in grams/year.

**Includes quantities released to the environment or transferred off-site as a result of remedial actions, catastrophic events, or other one-time events not associated with production processes

FORM R

Part II. CHEMICAL-SPECIFIC INFORMATION (CONTINUED)

TRI Facility ID Number
Toxic Chemical, Category, or Generic Name

SECTION 8.11. DISPOSAL OR OTHER RELEASES, SOURCE REDUCTION, AND RECYCLING ACTIVITIES

8.11	If you wish to submit additional optional information on source reduction, recycling, or pollution control activities, provide it here.

SECTION 9. MISCELLANEOUS INFORMATION

9.1	If you wish to submit any miscellaneous, additional, or optional information regarding your Form R submission, provide it here.

Appendix C: Minority Discrepancy Variable for Each Race/Ethnicity

Year	Asian	Black	Other	White	Hispanic
1990	-0.0188	0.1182	0.0566	-0.1560	0.0835
1991	-0.0081	0.0649	0.0599	-0.1166	0.0909
1992	-0.0042	0.0280	0.0862	-0.1100	0.1298
1993	-0.0228	-0.0208	0.1007	-0.0571	0.1588
1994	-0.0256	-0.0265	0.1113	-0.0593	0.1756
1995	-0.0239	-0.0136	0.1056	-0.0680	0.1626
1996	-0.0295	-0.0185	0.1477	-0.0997	0.2208
1997	-0.0290	-0.0234	0.1488	-0.0963	0.2192
1998	-0.0309	0.0154	0.1428	-0.1273	0.2089
1999	-0.0292	0.0023	0.1301	-0.1032	0.1934
2000	-0.0325	0.0702	0.1112	-0.1490	0.1607
2001	-0.0328	0.0860	0.1005	-0.1537	0.1487
2002	-0.0380	0.1627	0.0664	-0.1912	0.0988
2003	-0.0302	0.0766	0.0958	-0.1423	0.1405
2004	-0.0304	0.0627	0.0984	-0.1306	0.1448
2005	-0.0285	0.0325	0.0900	-0.0939	0.1314
2006	-0.0291	0.0301	0.0757	-0.0768	0.1283
2007	-0.0312	0.0449	0.0686	-0.0823	0.1160
2008	-0.0230	-0.0124	0.1140	-0.0786	0.1987
2009	-0.0242	-0.0179	0.1375	-0.0954	0.2424
2010	-0.0237	-0.0286	0.1376	-0.0853	0.2428
2011	0.0044	-0.0560	0.1410	-0.0854	0.2407
2012	-0.0277	0.0081	0.1255	-0.1059	0.2204
2013	-0.0398	0.2583	0.0164	-0.2350	0.0147
2014	-0.0457	0.4006	-0.0359	-0.3190	-0.0790
2015	-0.0466	0.2757	0.0233	-0.2524	0.0332
2016	-0.0471	0.3069	0.0065	-0.2663	0.0021
2017	-0.0480	0.3072	0.0090	-0.2682	0.0070
2018	-0.0458	0.2660	0.0259	-0.2460	0.0370
2019	-0.0452	0.2528	0.0307	-0.2383	0.0473
2020	-0.0454	0.2542	0.0340	-0.2427	0.0533

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