

Living in the Shadow of Danger



Poverty, Race, and Unequal Chemical Facility Hazards

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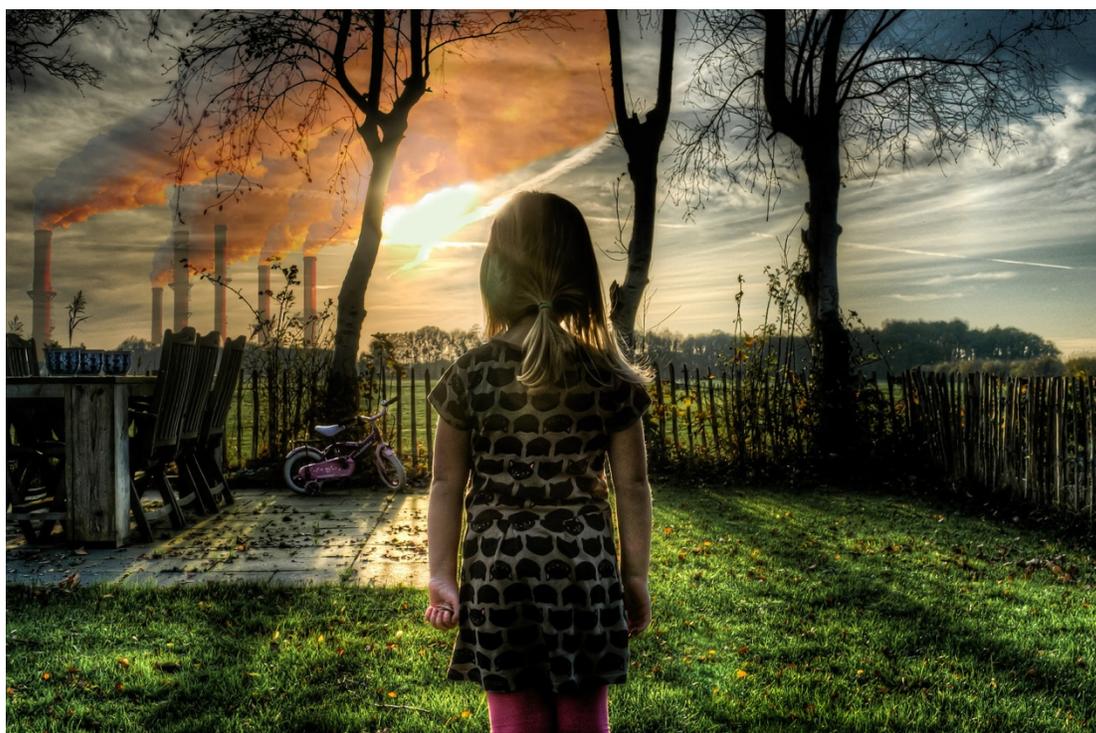
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Executive Summary

Over 12,500 facilities in the United States use or store such large quantities of extremely dangerous chemicals that they must submit a Risk Management Program (RMP) plan to the U.S. Environmental Protection Agency (EPA) for responding to chemical disasters. People living at the fenceline of these chemical facilities face the greatest dangers. **Nearly 23 million residents – 7.5 percent of the total U.S. population – live within one mile of an RMP facility.** These communities would be



hardest hit during a chemical catastrophe and would have the least amount of time to escape the dangers.

• • • Findings

People of color and people living in poverty, especially poor children of color, are significantly more likely to live in these fenceline zones than whites and people with incomes above the poverty line.

- People of color make up nearly half the population in fenceline zones (11.4 million), and *they are almost twice as likely as whites to live near dangerous chemical facilities.*
- Of particular concern is that *children of color make up almost two-thirds of the 5.7 million children who live within one mile of a high-risk chemical facility in the United States.*
- People of color living in poverty are significantly more likely to live in fenceline zones than whites not living in poverty. The greatest disparities are among poor children of color. For example, **poor black and Latino children are more than twice as likely to live in fenceline zones compared to white children who are living above the poverty line.**

Many children live and go to school near these dangerous facilities.

- *Nearly one in 10 U.S. schoolchildren (4.9 million) attends one of the 12,000 schools that are located within one mile of a dangerous chemical facility.*
- *More than one-quarter (1.6 million) of children living in fenceline zones are children under the age of five,* whose developing bodies are especially vulnerable to toxic exposure should a chemical release occur.

A disproportionate number of chemical facility incidents occur in neighborhoods that are predominately populated by people of color.

- Facilities in communities of color have **almost twice the rate of incidents** compared to those in predominately white neighborhoods – one incident per six facilities compared to one incident per 11 facilities.

Over half of U.S. states received a “D” (poor grade) or an “F” (failing grade) in this report's scorecard. These states have large proportions of people of color and poor people living or attending school within fenceline zones – and these residents are more likely to live in fenceline zones than whites and non-poor residents.

- Two states, Wisconsin and Massachusetts, received an F grade. Twenty-six states, primarily in the Southeast and Midwest, received D's.

The findings of this report reinforce results from numerous other studies that demonstrate that the health and safety of communities of color and people in poverty are severely and unequally impacted by living in close proximity to hazardous pollution sources and dangerous chemical facilities.



A disproportionate number of chemical facility incidents occur in neighborhoods that are predominately populated by people of color.

• • • • Recommendations

To reduce the dangers these communities face from chemical disasters, the Center for Effective Government recommends the following:

1. **Require use of safer chemicals and technologies when feasible.**

The most effective way to prevent deaths and injuries from chemical disasters is to *require* companies and facilities to switch to inherently safer chemicals and technologies (IST) where feasible. The EPA is currently developing revisions to its chemical facility Risk Management Program rules; they should include a requirement for chemical facilities to assess safer alternatives and adopt them where *feasible* in order to *prevent* major chemical facility incidents.

2. **Require formal assessments and mitigation plans by states, counties, or municipalities to gauge the impact of hazardous chemical facilities on fenceline communities, with an emphasis on environmental justice concerns.**

The relevant state and local environmental agencies should assess the potential impact of unplanned releases, more serious incidents, and cumulative impacts on the health of fenceline communities, with a focus on environmental justice concerns. It is imperative that government policies protect these communities, which often have the least amount of political and economic power but face the greatest threat from chemical facility incidents.

New homes and schools should not be sited near dangerous chemical plants.

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3. **Adopt new zoning laws or revise existing ones to prevent construction of new or expanded chemical facilities near homes and schools and prevent siting new homes and schools near dangerous chemical plants.**

Siting new chemical facilities or expanding existing facilities in close proximity to homes, schools, and playgrounds significantly increases the potential for an incident to result in a catastrophic disaster. Similarly, new homes and schools should not be sited near dangerous chemical plants. Requiring an assessment of the potential health and safety risks when siting homes, schools, and public facilities is essential. Significant “buffer zones” between dangerous facilities and places where people live and children attend school can reduce the potential impact of a major incident or release, as well as their exposure to regular chemical emissions.

4. Require large chemical facilities to continuously monitor and report their fenceline-area emissions and health hazards.

Unplanned releases of toxic chemicals into nearby communities are often a precursor to more serious incidents at chemical facilities. These releases also directly impact the health of people living in these areas. People living in fenceline communities should be able to easily access information based on continuous monitoring of the levels of toxic emissions coming from industrial facilities, as well as related health hazards.

5. Improve enforcement of existing environmental and workplace health and safety regulations.

A recent Center for Effective Government report found that just 42 percent of our nation's active chemical manufacturing plants have been inspected for compliance with environmental or workplace standards in the last three to five years. A quarter of the inspected facilities had serious environmental or workplace health and safety violations that put workers, communities, and the environment in danger. Increased funding for more inspections and better enforcement of environmental and workplace health and safety laws will help identify problems in chemical facilities *before* they lead to disasters. Better oversight and enforcement will also help agencies and the public hold companies accountable if they don't address identified hazards and toxic pollution.

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Introduction

Social inequality in the U.S. has expanded over the past several decades¹ and is linked to poor health, including one-third of deaths in the United States.² The median net worth of people of color is just 13 percent of that of whites, and their median income is 60 percent of white incomes.³ The poverty rate for blacks and Latinos is more than twice that of whites.⁴

There is also compelling evidence that increasing social inequality is linked to environmental degradation⁵ and that the health of people of color and those living in poverty is negatively impacted by being exposed to higher levels of environmental pollution than whites or people not in poverty.⁶

A previous report by the Environmental Justice and Health Alliance for Chemical Policy Reform found that a significantly greater percentage of blacks, Latinos, and people in poverty live near industrial facilities that use large quantities of toxic chemicals, compared to national averages.⁷ An earlier study found that larger, more chemical-intensive facilities tend to be located in counties with larger black populations and in counties with high levels of income inequality. It also found a greater risk of incidents at facilities in heavily black counties.⁸

This report builds on that past work and a previous report by the Center for Effective Government that examined the number of children who attend schools located within the vulnerability zones of over 3,400 high-risk chemical facilities that report to the U.S. Environmental Protection Agency's (EPA) Risk Management Program (RMP).⁹ This program encompasses the most dangerous industrial facilities that produce, use, or store significant quantities of toxic and flammable chemicals. Vulnerability zones, which are self-reported by industrial facilities, predict the maximum distance that a worst-case chemical incident could reach; they vary in size from less than one mile to as large as 40 miles.

Since communities in closest proximity to these hazardous facilities would likely suffer the greatest impacts from an explosion or chemical release – and would have the least amount of time to escape these dangers – this report focuses on the demographics of the people living within one mile (the so-called "fenceline zone") of all 12,545 facilities in the Risk Management Program.

Young children and the elderly are more susceptible to the health impacts of chemical hazards than healthy adults¹⁰

Young children and the elderly are more susceptible to the health impacts of chemical hazards than healthy adults and are least able to evacuate quickly in the event of a catastrophic incident.



and are least able to evacuate quickly in the event of a catastrophic incident. People of color and poor people face additional disadvantages when they live in close proximity to facilities that could produce chemical disasters. They live with the daily stress of worrying about potential incidents and are often exposed to hazardous emissions on a daily basis. They also have lower home values due to the proximity of chemical facilities.¹¹

Staff at the Center for Effective Government compiled state-by-state estimates of the percentage of people of color, with a focus on young children and the elderly, as well as the percentage of people in poverty living in these fenceline zones and provided comparisons with white and non-poor populations. Using these measures, we assigned grades for each state ranging from "A" to "F" based on the size of and disparities faced by these vulnerable groups in fenceline zones.

"When I heard the booms, I was scared and hid because I thought it was grenades."

Dai'lonie Fuller, age 12.¹²

On the evening of Aug. 6, 2012, residents of

Richmond, California heard a tremendous explosion at the nearby Chevron oil refinery, followed by a dark cloud visible over the facility. Residents were warned to shelter in place as a toxic cloud of smoke and particulates covered surrounding neighborhoods.

The **Chevron Richmond refinery disaster**¹³ was caused by a ruptured pipe, which released highly-flammable oil. The oil vaporized and ignited, creating a smoky plume that covered nearby neighborhoods. Six refinery employees were injured and approximately 15,000 residents sought emergency medical treatment over the next several weeks. Many complained of breathing problems, headaches, and chest pain. Twenty were admitted into the hospital to further monitor their conditions.

Richmond is majority people of color, and the neighborhoods that surround the Chevron refinery have poverty rates as high as 48 percent – several times the national average. Like in many communities across the country, Richmond's poor neighborhoods and communities of color are disproportionately impacted by chemical dangers.



• • • Addressing Chemical Facility Dangers Requires a Concerted National Effort

Efforts to address avoidable hazards from chemical facilities stretch back more than 20 years. The 1984 chemical plant disaster in Bhopal, India, which immediately killed at least 3,800 people and caused serious injury and early death for thousands more,¹⁴ served as a key impetus for requiring improvements to chemical facility safety, including the Clean Air Act Amendments of 1990.¹⁵

When the EPA began implementing these amendments, public interest organizations urged the agency to focus on *preventing* incidents by requiring chemical facilities to analyze the availability of safer chemicals and/or manufacturing processes and to implement them where feasible. Unfortunately, the EPA chose not to include such requirements when it developed the Risk Management Program.¹⁶

Meanwhile, serious incidents involving the release of toxic chemicals from industrial facilities continue to occur on a regular basis in the U.S. The EPA estimates that approximately 150 catastrophic accidents involving toxic chemical releases occur each year at industrial facilities.¹⁷

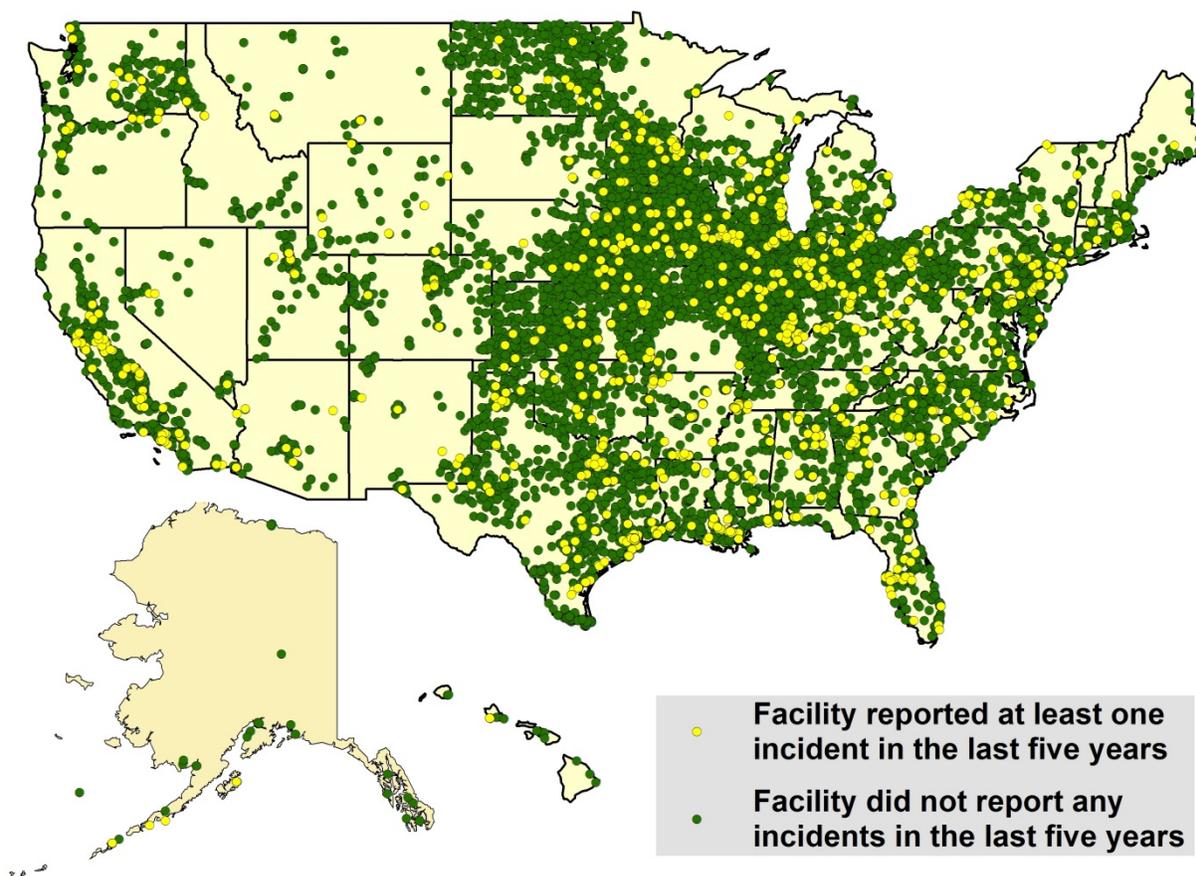
It took the devastating 2013 fertilizer plant explosion in West, Texas, which killed 15 people and injured 200,¹⁸ to spur government action. Following the tragedy, President Obama issued an executive order instructing key federal agencies, including the EPA, the Occupational Safety and Health Administration (OSHA), and the Department of Homeland Security, to improve chemical plant safety through modernizing regulations and guidelines, among other strategies.¹⁹

The EPA is expected to propose revisions to its Risk Management Program regulations in early 2016. It is essential that these standards include requirements for facilities to adopt prevention strategies such as using safer chemicals and manufacturing processes wherever feasible. Only then can we hope to prevent chemical releases and bring some measure of safety and justice to nearby fenceline communities.

Findings: People Living in the Shadow of Chemical Facilities Face Unequal Dangers

• • • National Analysis: Who Lives at the Fenceline?

There are over 12,500 hazardous chemical facilities in the U.S. reporting to the Environmental Protection Agency's (EPA) Risk Management Program (RMP). These facilities use or store high enough quantities of extremely dangerous chemicals that they must submit a risk plan for responding to chemical disasters. Some facilities are so dangerous that a major incident could impact communities several miles away.²⁰



RMP facilities in the U.S. Yellow dots indicate facilities that reported at least one RMP incident over a five-year period (2010 to 2014). Access the interactive map at <http://arcg.is/1Nfjh7z>.

However, those living near chemical facilities face the greatest dangers. **Nearly 23 million U.S. residents – 7.5 percent of the total population – live within one mile of an RMP facility.** These fenceline communities would be hardest hit during a chemical catastrophe and would have the least amount of time to escape.

Who lives in these “fenceline zones”? They include people of all demographics – young and old, people of color and white,²¹ poor and non-poor – across all 50 states. **However, people of color and people living in poverty are the hardest hit.** Nationwide, people in both groups are much more likely to live at the fenceline of a hazardous facility than white populations or people with incomes above the poverty line, respectively.

As one digs deeper, the findings become even more startling:

- Nearly half of the people living in fenceline zones (11.4 million) are people of color. This includes 3.6 million children of color.
- Nationwide, 10 percent of all people of color live within one mile of a hazardous chemical facility – compared to six percent of white residents. This means that people of color are 1.7 times more likely to live in fenceline zones than white residents.
- One-fifth of all people living in these fenceline communities (4.8 million) are in poverty. Of this group, two-thirds (3.2 million) are poor people of color.
- Nationwide, 10 percent of all people in poverty live in fenceline zones, compared to seven percent of people not in poverty – making poor people 1.4 times more likely to live in fenceline zones.

The greatest disparities, however, are among poor children of color. For example, poor black and Latino children are more than twice as likely to live in fenceline zones compared to white children who are living above the poverty line.

Our state and federal chemical policies are not adequately protecting communities nor addressing these racial and income inequities. Many states and localities have allowed industrial facilities to be sited near predominately poor neighborhoods, communities of color, or even schools. Poor residents may be especially unable to move to safer neighborhoods and must live with the daily fear of a chemical catastrophe.

• • • • **Children in the Shadow of Dangerous Chemical Facilities**

No parent or child should live in fear of a chemical disaster. **Yet over 12,000 U.S. schools are located within one mile of an RMP facility, with 4.9 million children (nearly one in 10 schoolchildren) attending them.** A chemical explosion or release that occurs during school hours would be unimaginable, with teachers and administrators struggling to shelter or evacuate children from danger.

Additionally, many children do not escape these hazards at home. **5.7 million U.S. children live within one mile of a chemical facility.** Almost two-thirds (3.6 million) are children of color. Over one quarter (1.6 million) are children under the age of five, whose developing bodies are especially vulnerable to toxic chemical exposure.

Children of color are almost twice as likely to live in fenceline zones compared to white children. Nationally, more than 10 percent of children of color live in these areas, compared to less than six percent of white children. This may be the result of a history of companies building toxic, dangerous facilities in and near communities of color.²²

Similarly, poor children are 1.5 times more likely to live in fenceline zones compared to those living above the poverty line. Nearly 11 percent of poor children live in these areas, compared to seven percent of children not living in poverty. Families living in poverty have fewer housing options, and some end up living right up against dangerous chemical facilities, where they are exposed not only to the risk of a chemical disaster but, in some cases, daily toxic emissions.



A school near West, Texas that was destroyed when an ammonium nitrate explosion occurred. Fortunately, school was not in session at the time of the disaster. A chemical explosion or release that occurs during school hours would be unimaginable.

Being poor *and* a child of color increases this likelihood even more. For example, more than 13 percent of poor Latino and almost 12 percent of poor black children live in fenceline zones, compared to just over five percent of white children not living in poverty – meaning they are more than twice as likely to reside in these areas. Poor children of color already face financial and racial disadvantages; living alongside hazardous chemical facilities is an additional burden that may also expose them to toxic emissions on a daily basis.

• • • Incidents are Occurring Frequently – Especially in Neighborhoods of Color

These dangers are real. There have been at least 1,300 reported incidents²³ at active RMP facilities. About a third of these occurred in neighborhoods that are majority people of color. Facilities in communities of color experience one incident per six facilities compared to one incident per eleven facilities in predominantly white neighborhoods – almost twice the rate of incidents.²⁴

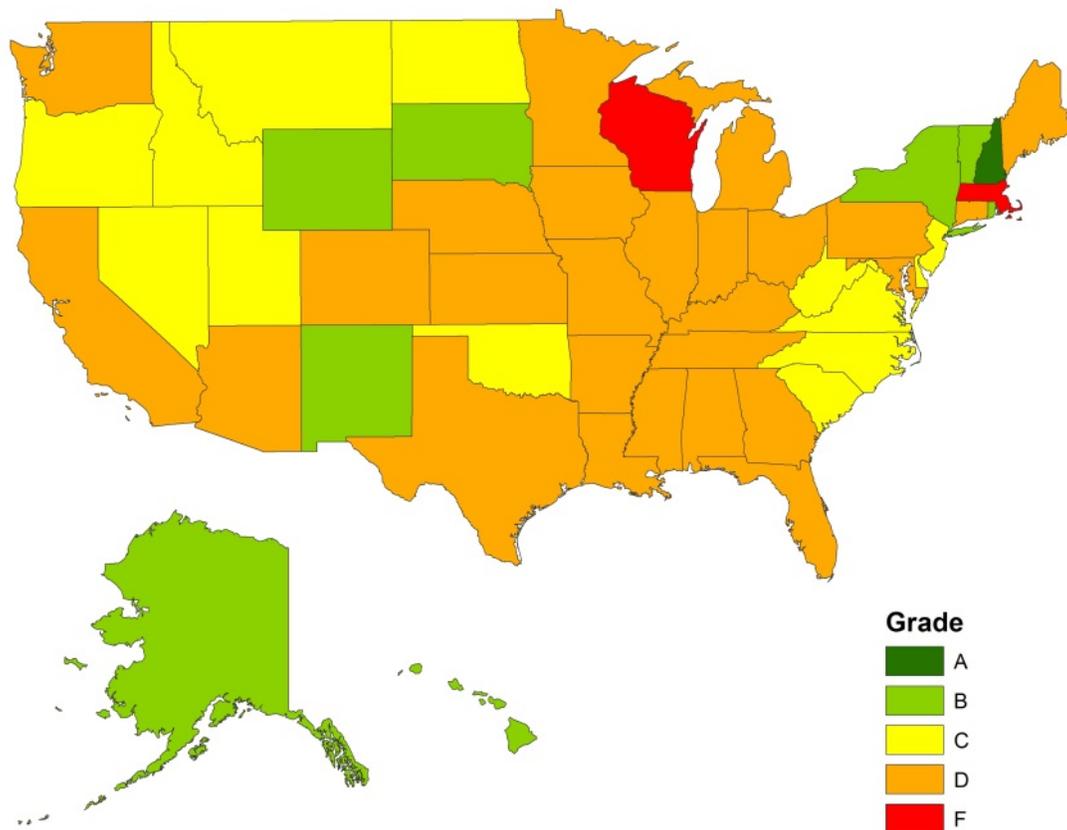
Crumbling private infrastructure, facility staff cutbacks, and insufficient investment in preventative maintenance and technologies all contribute to these incidents. Frequent incidents will continue to occur as long as facilities continue to use dangerous chemicals rather than switching to safer alternatives.

Chemical manufacturing facilities seem to have the greatest number of incidents – at least 430 since RMP reporting began in 1999. Some hold more than a million pounds of chemicals onsite, and a major chemical release would be devastating to surrounding neighborhoods. Additionally, they transport chemicals to and from their facilities by rail or by truck, putting additional communities in harm’s way.

Food manufacturing facilities have had at least 270 incidents. Many report to RMP because they use anhydrous ammonia in their refrigeration systems, a deadly gas that can travel several miles from its source. Fortunately, facilities can switch to carbon dioxide refrigeration systems that would eliminate this danger to surrounding communities, but many continue to rely on deadly chemicals.

Environmental Justice Scorecard

• • • • Over Half of U.S. States Received a Below-average or Failing Grade



Grades were based on an extensive set of metrics that measured the overall percentage of people in each state who live in fenceline zones and disparities among the groups of people who live in those zones. (For a full explanation, see the Methodology section on page 19).

Twenty-eight states received a D or an F in our environmental justice scorecard. These states have a large percentage of their total population living in fenceline zones and/or are places where people of color and those in poverty are much more likely to live in danger.

States receiving F's (in red): Massachusetts, Wisconsin

States receiving D's (in orange): Alabama, Arkansas, Arizona, California, Colorado, Connecticut, Florida, Georgia, Iowa, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maine, Maryland, Michigan, Minnesota, Missouri, Mississippi, Nebraska, Ohio, Pennsylvania, Tennessee, Texas, Washington

Not surprisingly, many southeastern states that have a long history of social and economic inequality scored D's. People of color in these states are much more likely to live in fenceline zones compared to white populations. This region also suffers poverty rates above the national average, leading to a high proportion of people in poverty in danger of a major chemical disaster.

All states in the Upper Midwest scored D's or F's. This region has perhaps the highest concentration of RMP facilities in the country, which include fertilizer distributors and food processing plants that are reflective of agricultural economies. This means a large portion of the total population lives in fenceline zones, which contributed to the bad scores. Additionally, people of color and those in poverty are more likely to live near facilities than white people or those living above poverty, respectively.

States like California and Texas also scored poorly. These states have a high concentration of chemical-intensive facilities, including oil refineries and fertilizer plants. They also have above-average poverty rates and large populations of people of color, both of whom are more likely to live in fenceline zones.

Finally, there are a few outlier states like Massachusetts – one of only two F's – Maine, and Connecticut. As in other New England states, a relatively small proportion of the total population lives in fenceline zones in Maine and Connecticut. However, people of color in these states are more than twice as likely to live close to dangerous facilities compared to white residents, and people in poverty are also much more likely than those not in poverty to live in these areas.

A higher-than-average proportion of Massachusetts residents live in fenceline zones compared to the rest of New England. People of color and poor residents are also much more likely to be in danger than whites and those with incomes above the poverty line. This may be the result of facilities being built near major population centers.

• • • • Fewer than Half the States Received an Average or Above-average Grade

States receiving C's (in yellow): Delaware, Idaho, Montana, North Carolina, North Dakota, New Jersey, Nevada, Oklahoma, Oregon, South Carolina, Utah, Virginia, West Virginia

States receiving B's (in light green): Alaska, Hawaii, New Mexico, New York, Rhode Island, South Dakota, Vermont, Wyoming

States receiving A's (in dark green): New Hampshire

Many states that received C's or above have a smaller concentration of RMP facilities compared to other regions; this includes regions such as the Rockies and New England. Additionally, many facilities in these states are located in rural or suburban areas rather than in large cities. Both of these factors contribute to a relatively low proportion of the total population living in fenceline zones.

Additionally, in these states, people of color and those in poverty face roughly the same likelihood of living in fenceline zones as the rest of the population. Similar factors contributed to New Mexico, Wyoming, and South Dakota receiving B's.

Some states received average scores if they performed poorly in one measure and average or even above-average in another. People of color in the Virginias and Carolinas, for example, are not significantly more likely to live in fenceline zones compared to whites. However, these states scored poorly in poverty measures. The result is an average grade of a C.

Overall, states with fewer hazardous facilities – and those lacking facilities in major population centers – tended to receive the best scores.

• • • • States Where People of Color are in Danger

The environmental justice movement has long documented how dangerous, polluting facilities are often located in communities of color or neighborhoods that are predominately poor²⁵. This may be due to discriminatory planning decisions aimed at keeping dangerous facilities out of white, affluent communities.²⁶ Additionally, marginalized communities may lack the political clout needed to keep such facilities out of their neighborhoods.

The greatest racial disparities are in the Southeast, where people of color are up to two-and-a-half times more likely to live in fenceline zones compared to white residents. However, similar disparities occur even in some New England states. Children of color in Maine and Connecticut – both predominately white states – are much more likely to attend schools in fenceline zones than white children.

Midwestern states have some of the largest concentrations of RMP facilities in the country. It is not surprising, therefore, that states like Iowa and Wisconsin scored badly for the percentage of people of

color living in fenceline zones since a large portion of all people in these states live near these dangerous plants.

States like Nebraska and North Dakota are especially concerning for students of color. In both states, a large portion of children of color attend schools within one mile of a hazardous facility.

Table 1. States that Scored the Worst on Each People of Color Measure

Percentage of people of color who live in fenceline	Iowa, Wisconsin, Nebraska
Likelihood of people of color to live in fenceline (compared to whites)	Tennessee, Alabama, Arkansas
Percentage of children of color under 12 who live in fenceline	Iowa, Wisconsin, Nebraska
Likelihood of children of color under 12 to live in fenceline (compared to white children under 12)	Tennessee, Alabama, Arkansas
Percentage of children of color who attend public schools in fenceline	Nebraska, North Dakota, Iowa
Likelihood of children of color to attend public schools in fenceline (compared to white children)	Maine, Mississippi, Connecticut
Percentage of elderly people of color who live in fenceline	Iowa, Indiana, Illinois
Likelihood of elderly people of color to live in fenceline (compared to elderly whites)	Tennessee, Alabama, Kentucky

• • • States Where People in Poverty are in Danger

Hazardous chemical facilities are also unequally located near poor communities, which often have less political and economic power and whose residents have fewer means to move to safer neighborhoods.²⁷

States where poor people are most likely to live in fenceline zones include Maryland, Connecticut, and Massachusetts. Each has poverty rates below the national average. However, it appears that chemical facilities are more often located in poor communities than near middle-class or wealthy communities. The high concentration of facilities surrounding central cities and their poor neighborhoods may also be a factor.

Tennessee and Alabama are among the worst-scoring states for the likelihood of children in poverty under 12 to live near a facility. These states already have high poverty rates, and it appears that many of their facilities are located near predominately poor neighborhoods.

Midwestern and Great Plains states have the highest percentage of people in poverty living in fenceline zones. Once again, the large number of facilities in these states likely contributed to their bad grades. Additionally, North Dakota, Iowa, and Nebraska are the three worst-scoring states for the percentage of children receiving free lunch from the National School Lunch Program who attend schools near hazardous facilities.

Table 2. States that Scored the Worst on Each Poverty Measure

Percentage of people in poverty who live in fenceline	Iowa, North Dakota, Illinois
Likelihood of people in poverty to live in fenceline (compared to those not in poverty)	Maryland, Massachusetts, Tennessee
Percentage of children under 12 in poverty who live in fenceline	Iowa, Wisconsin, Massachusetts
Likelihood of children under 12 in poverty to live in fenceline (compared to children under 12 not in poverty)	Massachusetts, Tennessee, Alabama
Percentage of children receiving free lunch who attend schools in fenceline	North Dakota, Iowa, Nebraska
Likelihood of children receiving free lunch to attend schools in fenceline	Connecticut, Massachusetts, Maryland
Percentage of elderly people in poverty who live in fenceline	Texas, Illinois, Iowa
Likelihood of elderly people in poverty to live in fenceline (compared to elderly people not in poverty)	Nevada, Massachusetts, Maryland

Factsheets for each state that contain additional data and information on fenceline populations and facilities are available at <http://www.foreffectivegov.org/shadow-of-danger-factsheets>.

Reducing our reliance on hazardous chemicals *and* incorporating environmental justice into state and federal chemical policies are essential steps toward protecting **all** residents from chemical disasters.

Recommendations: Addressing Chemical Facility Dangers Requires a Concerted National Effort

The findings of this report reinforce results from numerous other studies and reports that find that the health and safety of communities of color and people in poverty are disproportionately impacted by living near hazardous pollution sources and dangerous chemical facilities. To reduce the risks to these communities from the potential devastation a chemical disaster would bring, the Center for Effective Government recommends the following:

1. **Require use of safer chemicals and technologies when feasible.**

The most effective way to prevent deaths and injuries from chemical disasters is to *require* companies and facilities to switch to inherently safer chemicals and technologies (IST) where feasible. Companies like Clorox have already shifted their bleach manufacturing facilities to safer alternatives,²⁸ as have hundreds of water treatment plants,²⁹ but other corporations and facilities have not made similar moves.

Many of the facilities in rural areas that endanger fenceline communities store and supply agricultural chemicals, primarily anhydrous ammonia for use as fertilizer. Safer alternatives to anhydrous ammonia include liquid nitrogen or dry urea fertilizer, and these alternatives have been used by numerous facilities for more than a decade.

Chemical manufacturing and other heavy industries like plastics manufacturing and food production and processing are often found in urban and suburban communities. They can also switch to safer chemicals or alternatives. For example, a Cargill facility in Memphis switched from using dangerous sulfur dioxide to sodium bisulfite for use in wet corn milling. The Minn-Dak Farmers Cooperative in Wahpeton, North Dakota, shifted from having sulfur dioxide shipped to the facility to generating sulfur chemicals onsite for use in beet-sugar processing.³⁰

The U.S. Environmental Protection Agency (EPA) is currently developing revisions to its chemical facility Risk Management Program (RMP) rules. Including a requirement for chemical facilities to assess safer alternatives and adopt this approach where feasible to *prevent* major chemical facility incidents would make those revisions more effective and protective.

A policy requiring facilities to adopt safer technologies where feasible is already in place on the county level in California. Since 1998, Contra Costa County has required oil refineries to evaluate and implement inherently safer technologies where possible.³¹ Such a requirement can and should be expanded to *all* high-risk chemical facilities across the nation and be incorporated into federal policy.

The American public strongly supports requiring companies to use safer alternatives to toxic chemicals. A recent poll found strong support among Democrats, Republicans, and Independents for policies that would eliminate catastrophic hazards. Overall, 79 percent of respondents support revising the EPA rule to require chemical facilities to use safer chemicals and processes when they are effective, available, and affordable.³²

2. Require formal assessments and mitigation plans by states, counties, or municipalities to gauge the impact of hazardous chemical facilities on fenceline communities, with an emphasis on environmental justice concerns.

The Manchester neighborhood in Houston, Texas; Kanawha County, West Virginia; and Mossville, Louisiana are just a few examples of the many communities across the United States where a high concentration of oil refineries, chemical and pesticide manufacturing plants, and other polluting industries directly impact the health and welfare of fenceline residents. These communities are typically characterized by a disproportionate number of people of color and people living in poverty.³³

Relevant state and local environmental agencies should assess the potential impact of unplanned releases, more serious incidents, and cumulative impacts on the health of fenceline communities with a focus on environmental justice concerns. Agencies and elected officials should provide communities with the tools and resources they need to fully engage in the assessment process, and these hazard assessments should be reviewed by the federal EPA.

It is imperative that these communities, with the least political power but who face the greatest threat from chemical facility incidents, are protected by government policies, including strict permitting requirements and adequate inspection and enforcement of these requirements. Where state and local governments have limited resources or no political will to provide these protections due to industry influence or ideological views, it is essential that the EPA step up to defend these communities' right to a safe environment and a healthy community.

3. Adopt new zoning laws or revise existing ones to prevent construction of new or expanded chemical facilities near homes and schools and prevent siting new homes and schools near dangerous chemical plants.

Siting new chemical facilities or expanding existing ones in close proximity to homes, schools, and playgrounds significantly increases the potential that an incident will result in a catastrophic disaster. Similarly, new homes and schools should not be sited near dangerous chemical plants. Requiring an assessment of the potential health and safety risks when siting homes, schools, and public facilities is essential. Significant "buffer zones" between these dangerous facilities and where people live and children go to school can both reduce the potential impact of a major incident or release, as well as exposure to regular chemical emissions.

California, for example, requires that potential school sites be evaluated for proximity to chemical plants and oil refineries, among other sources of toxic substances. The state Department of Education will not approve a school site unless an assessment has been conducted and there is a finding of no significant health risk. Schools also cannot be located within a quarter of a mile of potential sources of hazardous air pollution unless there is a finding that these exposures will not endanger public health.³⁴

4. Require large chemical facilities to continuously monitor and report their fenceline-area emissions and health hazards.

Unplanned releases of toxic chemicals into nearby communities are often a precursor to more serious incidents at chemical facilities. These releases also directly impact the health of people living in these fenceline communities.

A 2014 review by the California Interagency Working Group on Refinery Safety noted that “people living near refineries generally have limited or no access to immediate data on toxic air contaminant levels in the community or information on associated health risks.” The working group recommended that more comprehensive and timely information on health hazards be made available on the Internet, and more data relevant to refinery safety be made publicly available to allow residents to independently review information pertinent to health and safety.³⁵ The U.S. EPA recently issued a rule requiring oil refineries to monitor fenceline levels of benzene and will require public access to this information.³⁶

People living in fenceline areas should be able to easily access information based on continuous monitoring of the levels of toxic emissions coming from industrial facilities, as well as related health hazards. Using this information, communities and activists can advocate for safer chemical requirements, push companies to act more responsibly and produce less toxic pollution, alert and educate friends, family members, and community members, and encourage the media to investigate bad-actor facilities in their areas.

5. Improve enforcement of existing environmental and workplace health and safety regulations.

A recent Center for Effective Government report, *Blowing Smoke*, examined chemical facility compliance and enforcement records and found that just 42 percent of our nation’s active chemical manufacturing plants have been inspected in the last three to five years. A quarter of the inspected facilities had serious environmental or workplace health and safety violations that put workers, communities, and the environment in danger.³⁷

Increased funding for inspections and better enforcement of environmental and workplace health and safety laws will help identify problems in chemical facilities before they lead to disasters. Better oversight and enforcement will also help agencies and the public hold companies accountable if they don’t address identified hazards and toxic pollution.

Appendix: Methodology

Facilities in this analysis report to the U.S. Environmental Protection Agency's (EPA) Risk Management Program (RMP). Facilities that produce, handle, process, distribute, or store large amounts of certain toxic or flammable chemicals must submit a risk management plan to the EPA at least every five years.

The people who live or work near RMP facilities are at risk of serious harm from chemical explosions, fires, and releases. Actual impacts may vary widely due to the type and amount of chemicals involved, weather patterns, distance from the facility, and other factors.

In a previous report, *Kids in Danger Zones*, we used facility-reported "vulnerability zone" data. Facilities use EPA-approved software to assess the maximum distance from a facility that could be affected by a "worst case" chemical release. Vulnerability zones can range from under one mile to 40 miles or more. *Kids in Danger Zones* looked at roughly one-quarter of all RMP facility vulnerability zones (3,429 facilities in total).

Many of these facilities have since submitted updated plans to the EPA, and our previous dataset is no longer up-to-date. Given the barriers to accessing vulnerability zone information,³⁸ we used one-mile "fenceline zones" around *all* 12,545 RMP facilities. This is a conservative estimate of potential danger because the majority of vulnerability zones in our previous report ranged between one and five miles.

Thus, for many facilities in our report, the area in danger from a chemical incident possibly extends far beyond the one-mile fenceline zone. However, those who reside closest to the facilities face the greatest threats from fires, toxic releases, and explosions.

• • • Data Collection, Mapping, and Population Estimates

We obtained RMP submissions through a Freedom of Information Act request to the EPA, and the data reflects information current as of Dec. 31, 2014. We used facilities' self-reported latitude-longitude data to establish facility locations and mapped them using Geographic Information System (GIS) software (ESRI ArcGIS Desktop Advanced 10.2.1). We corrected the location data for a handful of facilities that were obviously inaccurate (e.g., plotted in the ocean or in Canada) but otherwise used the facilities' self-reported latitude-longitude coordinates.

We used the U.S. Census Bureau's American Community Survey (ACS) to provide demographic information on the populations living near RMP facilities. The ACS data were used to determine the total population and the number of people of color, persons below the poverty line, children, and the elderly who live in fenceline zones of RMP facilities. Updated Census data for certain communities are added annually and are summarized into one-, three-, and five-year spans. Because this report is national in scope and analyzes data at the census tract level, we used five-year estimates, which span 2009 to 2013.

We calculated the demographics for each one-mile area using the areal apportionment method.³⁹ We merged overlapping zones when calculating state totals to avoid over-counting populations living close to more than one facility. Therefore, individual facility population totals cannot be added to get state totals.

We obtained public school data from the Common Core of Data (CCD), a program of the U.S. Department of Education's National Center for Education Statistics. The data are collected annually, and the source is considered to be a comprehensive statistical database of these schools. It includes location data for schools and the number of students by age and ethnicity (using U.S. Census racial categories). The data in this report cover the 2012-2013 school year.

The private school data come from the Private School Universe Survey (PSS) for the 2012-2013 school year. The PSS data are also collected annually and cover private schools (i.e., schools for which public funding is not their primary means of support). Home-school organizations that don't offer classroom teaching are not included. The PSS database includes locations of schools and the number of students by grade and the number of students by race, but not by grade and race together. Additionally, the database does not use U.S. Census racial categories. Therefore, we were unable to combine it with the public school database. We still included private schools on our map but not in the state rankings, which focus only on children attending public schools.

For both school databases, we included all schools that were operational during the 2012-2013 school year and had currently enrolled students. As with the facility data, we relied on self-reported latitude-longitude pairs for the public schools. The private schools were mapped using the street addresses since latitude-longitude pairs are not provided. We did not attempt to correct any school locations.

• • • Calculating the Relative Likelihood of Living Near Facilities

A key goal of this project was to measure the disproportionate impacts of chemical dangers on vulnerable populations, including people of color, those in poverty, children, and the elderly. To do so, we used a basic probability equation, whereby we took the percentage of people in danger (i.e., living in fenceline zones) in one group and divided it by the percentage of people in danger in another. To illustrate: 10 percent of people of color in the U.S. live within one mile of an RMP facility, compared to six percent of the white not Hispanic population. We divided the percentage of residents of color in danger by the percentage of white residents in danger ($10 / 6 = 1.7$). This means that people of color are 1.7 times more likely to live in fenceline zones than non-Hispanic whites. (Conversely, white residents are 1.7 times *less likely* to live in these areas.)

When the two percentages were roughly equal (quotient of less than 1.1), we determined that the probability of danger was equal. We used this same approach throughout to calculate the probability of danger based on poverty status.

• • • • Scoring and Grading Measures

In order to determine a score for each state, we aggregated the demographic data at the state level and created a set of sixteen metrics (listed below). Half of these metrics look at percentages for various categories of people in poverty and people of color living or attending school within one mile of facilities. The other half calculate the likelihood of these vulnerable populations living or attending school near a facility compared to a person not in that group. For each state, using natural breaks among all states,⁴⁰ we assigned a letter grade from "A" to "F" in each one of the 16 categories. We calculated a grade for both the race and poverty categories, then an overall grade, for each state.

For example, after aggregating the data, we found that just over 15 percent of people in poverty in Nebraska live within a mile of at least one facility. Using natural breaks across all state data, this percentage put them in the “worst” group (which includes all states with a poverty rate over 15 percent), and Nebraska received an F in that category. Furthermore, a person in poverty in Nebraska is almost 1.4 times more likely to live near a facility than a person not in poverty. Again, using natural breaks, any state in which persons in poverty are between 1.25 and 1.4 times more likely than those not in poverty to live near a facility belongs to the middle group, which meant that Nebraska (and all other states in that range) received a C in that category. This analysis was done for each metric, and the grades were then averaged to get an overall grade.

Rather than assigning an equal number of A to F grades for a certain category or setting a floor for a certain grade, the natural breaks method assigns grades in ways that naturally group the data together. Thus, it is possible for few or many states to receive an A or an F for a specific category. An A grade, therefore, is not necessarily an indication that few people live in fenceline zones or that vulnerable populations are not disproportionately in danger. Natural breaks nevertheless provide a useful way of comparing states on the magnitude and relative likelihood that various vulnerable populations live in fenceline zones.

Factsheets for each state that contain additional data and information on fenceline populations and facilities are available at <http://www.foreffectivegov.org/shadow-of-danger-factsheets>.

Access the interactive map at <http://arcg.is/1Nfjh7z>.

See the tables for the grading ranges for each metric.

•••• Race Inequities

Percentage of People of Color Who Live in Fenceline	
Percent	Grade
1.2% to 3.8%	A
4.3% to 7.2%	B
7.4% to 10.9%	C
12.3% to 15%	D
> 16%	F

Likelihood of People of Color to Live in Fenceline (compared to whites)	
Likelihood	Grade
< 1.1 times as likely	A
1.19 to 1.46 times more likely	B
1.49 to 1.74 times more likely	C
1.77 to 2.05 times more likely	D
> 2.1 times more likely	F

Percentage of Children of Color Under 12 Who Live in Fenceline	
Percent	Grade
1% to 3.9%	A
5.1% to 6.8%	B
7.6% to 10.9%	C
11.3% to 15.1%	D
> 15.5%	F

Likelihood of Children of Color Under 12 to Live in Fenceline (compared to white children under 12)	
Likelihood	Grade
< 1.07 times as likely	A
1.22 to 1.56 times more likely	B
1.64 to 1.79 times more likely	C
1.86 to 2.2 times more likely	D
> 2.3 times more likely	F

Percentage of Children of Color Who Attend Public Schools in Fenceline	
Percent	Grade
2% to 5%	A
5.4% to 8.2%	B
8.5% to 11.5%	C
12.5% to 15.9%	D
> 17%	F

Likelihood of Children of Color to Attend Public Schools in Fenceline (compared to white children)	
Likelihood	Grade
< 0.9 times as likely	A
0.9 to 1.17 times more likely	B
1.23 to 1.51 times more likely	C
1.54 to 1.87 times more likely	D
> 2.2 times more likely	F

Percentage of Elderly of Color Who Live in Fenceline	
Percent	Grade
0.8% to 2.9%	A
3.8% to 6.7%	B
7.3% to 9.8%	C
10.8% to 13.7%	D
> 14%	F

Likelihood of Elderly of Color to Live in Fenceline (compared to elderly whites)	
Likelihood	Grade
< 0.93 times as likely	A
0.93 to 1.35 times more likely	B
1.36 to 1.77 times more likely	C
1.78 to 2.25 times more likely	D
> 2.26 times more likely	F

• • • • Income (Poverty) Inequities

Percentage of Poor People Who Live in Fenceline	
Percent	Grade
<4%	A
4% to 7%	B
7.3% to 10%	C
11.9% to 14.5%	D
> 15%	F

Likelihood of Poor People to Live in Fenceline (compared to those not in poverty)	
Likelihood	Grade
< 0.9 times as likely	A
1 to 1.22 times more likely	B
1.28 to 1.4 times more likely	C
1.41 to 1.67 times more likely	D
> 1.7 times more likely	F

Percentage of Poor Children Under 12 Who Live in Fenceline	
Percent	Grade
<5%	A
5% to 7.3%	B
8% to 10.6%	C
11% to 13.9%	D
> 14%	F

Likelihood of Poor Children Under 12 to Live in Fenceline (compared to children under 12 not in poverty)	
Likelihood	Grade
< 1 times as likely	A
1 to 1.37 times more likely	B
1.4 to 1.6 times more likely	C
1.6 to 1.8 times more likely	D
> 2 times more likely	F

Percentage of Children Receiving Free Lunch Who Attend Schools in Fenceline	
Percent	Grade
1.4% to 4.9%	A
5.3% to 7.9%	B
8.4% to 10.9%	C
12.5% to 15.9%	D
> 20%	F

Likelihood of Children Receiving Free Lunch to Attend Schools in Fenceline (compared to children not receiving free lunch)	
Likelihood	Grade
< 0.8 times as likely	A
0.83 to 1.05 times more likely	B
1.1 to 1.31 times more likely	C
1.35 to 1.55 times more likely	D
> 2 times more likely	F

Percentage of Elderly Poor People Who Live in Fenceline	
Percent	Grade
1.3% to 2.6%	A
3.6% to 5.3%	B
5.8% to 8.1%	C
8.5% to 10.9%	D
> 11%	F

Likelihood of Elderly Poor People to Live in Fenceline (compared to elderly people not in poverty)	
Likelihood	Grade
< 1.03 times as likely	A
1.05 to 1.22 times more likely	B
1.27 to 1.42 times more likely	C
1.48 to 1.64 times more likely	D
> 1.66 times more likely	F

• • • Grades by State

State	Race Grade	Poverty Grade	Overall Grade	State	Race Grade	Poverty Grade	Overall Grade
Alabama	D	D	D	Montana	B	C	C
Alaska	B	B	B	Nebraska	D	D	D
Arizona	D	D	D	Nevada	C	C	C
Arkansas	F	D	D	New Hampshire	A	A	A
California	D	D	D	New Jersey	C	C	C
Colorado	D	D	D	New Mexico	B	B	B
Connecticut	D	D	D	New York	A	B	B
Delaware	D	C	C	North Carolina	C	C	C
Florida	D	D	D	North Dakota	C	D	C
Georgia	D	D	D	Ohio	D	D	D
Hawaii	B	B	B	Oklahoma	C	C	C
Idaho	C	C	C	Oregon	C	C	C
Illinois	F	D	D	Pennsylvania	D	D	D
Indiana	D	D	D	Rhode Island	B	B	B
Iowa	D	D	D	South Carolina	C	C	C
Kansas	D	D	D	South Dakota	B	B	B
Kentucky	F	C	D	Tennessee	F	D	D
Louisiana	D	D	D	Texas	D	D	D
Maine	D	C	D	Utah	C	C	C
Maryland	D	F	D	Vermont	A	B	B
Massachusetts	F	F	F	Virginia	B	C	C
Michigan	D	D	D	Washington	C	D	D
Minnesota	D	D	D	West Virginia	C	C	C
Mississippi	D	C	D	Wisconsin	F	F	F
Missouri	D	D	D	Wyoming	B	C	B

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- ³⁹ See Mohai, P. and Saha, R.. Which came first, people or pollution? A review of theory and evidence from longitudinal environmental justice studies. *Environmental Research Letters*; 2015. Available at <http://iopscience.iop.org/article/10.1088/1748-9326/10/12/125011%20>.
- ⁴⁰ "Natural breaks" is a data classification method which classifies data by minimum differences within a class and maximum differences between classes. See Jenks, George F. *The Data Model Concept in Statistical Mapping*, International Yearbook of Cartography; 1967.



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