Wasting Our Waterways 2012

Toxic Industrial Pollution and the Unfulfilled Promise of the Clean Water Act

Environment New York Research & Policy Center

Frontier Group

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Executive Summary

Industrial facilities continue to dump millions of pounds of toxic chemicals into America's rivers, streams, lakes and ocean waters each year—threatening both the environment and human health. According to the U.S. Environmental Protection Agency (EPA), pollution from industrial facilities is responsible for threatening or fouling water quality in more than 14,000 miles of rivers and streams, more than 220,000 acres of lakes, ponds and estuaries nationwide.

The continued release of large volumes of toxic chemicals into the nation's waterways shows that the nation needs to do more to reduce the threat posed by toxic chemicals to our environment and our health and to ensure that our waterways are fully protected against harmful pollution.

Industrial facilities dumped 226 million pounds of toxic chemicals into American waterways in 2010, according to the federal government's Toxic Release Inventory.

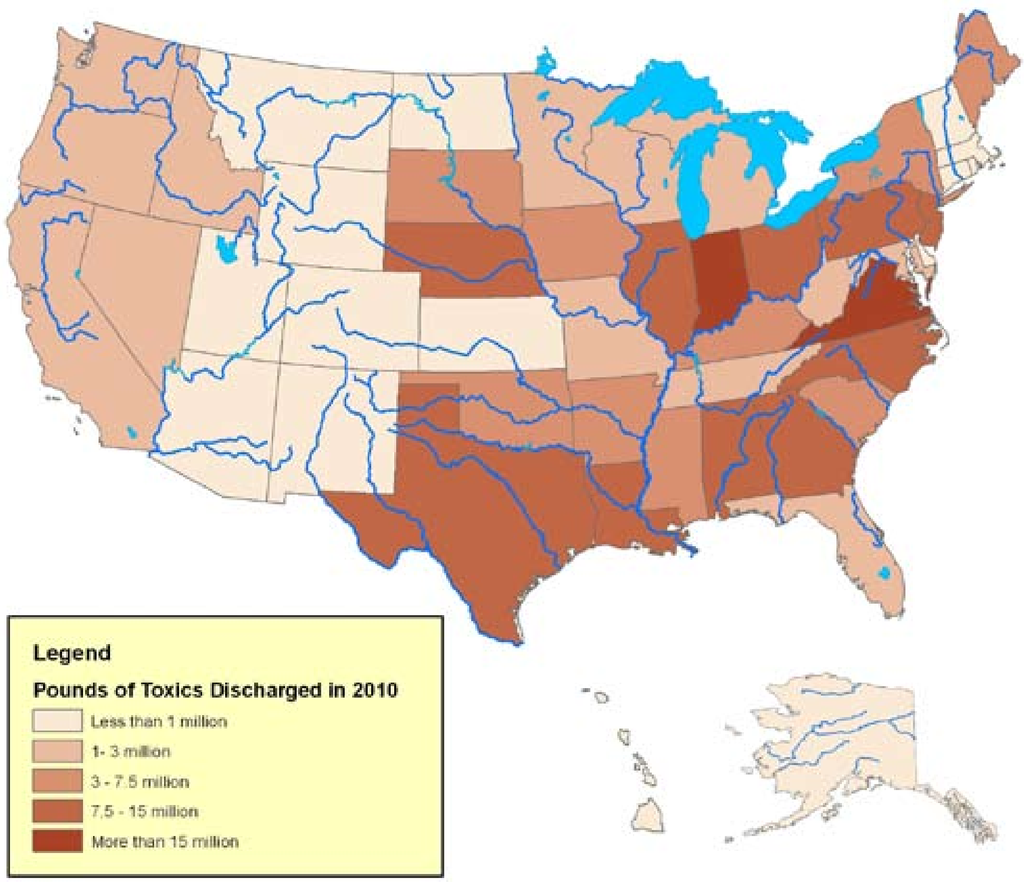
- Toxic chemicals were discharged to more than 1,900 waterways in all 50 states. The Ohio River ranked first for toxic discharges in 2010, followed by the Mississippi River and the New River in Virginia and North Carolina.

- This represents a small (2.6 percent) decrease in the overall volume of toxic releases since the previous edition of this report, released in 2009 and based on data from 2007.

- Nitrate compounds—which can cause serious health problems in infants if found in drinking water and which contribute to oxygen-depleted "dead zones" in waterways—were by far the largest toxic releases in terms of overall volume.

- Small as well as large waterways received heavy doses of toxics. Because of a single, large release of arsenic and metal compounds from a Nevada gold mine into three small creeks, the combined discharges of developmental toxicants in those creeks were larger than the discharges of such toxicants to the Ohio and Mississippi Rivers combined.

Figure ES-1. Industrial Discharges of Toxic Chemicals to Waterways by State



- Toxic releases continued in already damaged waterways. The Calumet River system in Indiana and Illinois—home to five different Superfund toxic waste sites, and at one time so polluted that not even sludge worms could live there—ranked high on the list of developmental and reproductive toxic releases due to ongoing discharges from steel mills and an oil refinery.

Toxic chemicals linked to serious health effects were released in large amounts to America's waterways in 2010.

- Industrial facilities discharged approximately 1.5 million pounds of chemicals linked to cancer to more than 1,300 waterways during 2010. Nevada's Burns Creek received the largest volume of carcinogenic releases, with a small neighboring creek placing third. The Mississippi River, Ohio River, and Tennessee River also suffered large releases of carcinogens. Pulp and paper mills, gold mines and chemical manufacturers were the industries that released the greatest volume of carcinogenic chemicals in 2010.

Table ES-1. Top 10 Waterways for Total Toxic Discharges

Waterway Name	Toxic Releases (lbs.)
OHIO RIVER (IL, IN, KY, OH, PA, WV)	32,116,310
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	12,746,057
NEW RIVER (NC, VA)	12,070,494
SAVANNAH RIVER (GA, SC)	9,627,865
DELAWARE RIVER (DE, NJ, PA)	6,720,991
MUSKINGUM RIVER (OH)	5,755,618
MISSOURI RIVER (IA, KS, MO, ND, NE)	4,842,275
SHONKA DITCH (NE)	4,614,722
TRICOUNTY CANAL (NE)	3,386,412
ROCK RIVER (IL, WI)	3,370,652

- About 619,000 pounds of chemicals linked to developmental disorders were discharged into more than 1,200 waterways. Burns Creek in Nevada, a small waterway near a gold mine, suffered the greatest amount of developmental toxicant discharges, followed by the Kanawha River in West Virginia and the Mississippi River. Gold mining was the largest source of developmental toxicants, followed by pesticide manufacturing and chemical manufacturing.

- Approximately 342,000 pounds of chemicals linked to reproductive disorders were released to more than 1,100 waterways. West Virginia's Kanawha River received the heaviest dose of reproductive toxicants, followed by the Mississippi, Ohio, and Brazos rivers.

- Discharges of persistent bioaccumulative toxics (including dioxin and mercury), organochlorines, and phthalates are also widespread. Safer industrial practices can reduce or eliminate discharges of these and other dangerous substances to America's waterways.

To protect the public and the environment from toxic releases, the United States should prevent pollution by requiring industries to reduce their use of toxic chemicals and restore and strengthen Clean Water Act protections for all of America's waterways.

The United States should restore Clean Water Act protections to all of America's waterways and improve enforcement of the Clean Water Act.

- The Obama Administration should clarify that the Clean Water Act applies to headwater streams, intermittent waterways, isolated wetlands and other waterways for which Clean Water Act protection has been called into question as a result of recent Supreme Court decisions.

- EPA and the states should strengthen enforcement of the Clean Water Act by, among other things, ratcheting down permitted pollution levels from industrial facilities, ensuring that permits are renewed on time, and requiring mandatory minimum penalties for polluters in violation of the law.

- EPA should eliminate loopholes—such as the allowance of "mixing zones" for persistent bioaccumulative toxic chemicals—that allow greater discharge of toxic chemicals into waterways.

The United States should revise its strategy for regulating toxic chemicals to encourage the development and use of safer alternatives. Specifically, the nation should:

- Require chemical manufacturers to test all chemicals for their safety and submit the results of that testing to the government and the public.

- Regulate chemicals based on their intrinsic capacity to cause harm to the environment or health, rather than basing regulation on resource-intensive and flawed efforts to determine "safe" levels of exposure to those chemicals.

- Require industries to disclose the amount of toxic chemicals they use in their facilities—safeguarding local residents' right to know about potential public health threats in their community and creating incentives for industry to reduce its use of toxic chemicals.

- Require safer alternatives to toxic chemicals, where alternatives exist.

- Phase out the worst toxic chemicals.

Introduction

Water is fundamental to life. Without a supply of safe, clean water, humans and most other plants and animals cannot survive.

For many Americans, water is also fundamental to our quality of life. It shapes the landscapes we live in and enjoy, provides us with opportunities to relax and recreate, and supports healthy ecosystems.

In 1972, America adopted the Clean Water Act with the aim of making all of our nation's waterways safe for fishing and swimming by 1983, and of eliminating toxic discharges into waterways altogether by 1985. Sadly, the goals of that law remain unrealized. Nationwide, 53 percent of our assessed rivers and streams and 69 percent of assessed lakes remain unsafe for fishing, swimming or other uses.[1]

This pollution means that Americans who enjoy fishing have to avoid certain waterways, steer clear of certain fish, and limit the amounts of fresh-caught fish that they eat in order to protect themselves against mercury and other harmful substances that are present in some waterways. Other waterways are unsafe for drinking and swimming, or lose their value as hiking and boating destinations because of pollution.

One contributor to this problem is the direct release of toxic chemicals into waterways by industrial facilities. Forty years after the passage of the Clean Water Act, industrial facilities dumped 226 million pounds of toxic chemicals into waterways in 2010. These pollutants—from carcinogens such as arsenic to developmental toxicants such as mercury and lead to chemicals such as nitrates that destabilize aquatic ecosystems and render water unsafe to drink—contribute substantially to the degradation of America's waterways.

This pollution can be prevented. Common sense measures to reduce the use of toxic chemicals and prevent unchecked toxic dumping into threatened waterways can ensure that the vision of the Clean Water Act is realized, and that of our nation's rivers, lakes, and streams can be enjoyed by all.

Toxic Releases to Waterways Threaten the Environment and Public Health

The direct industrial discharge of toxic substances into waterways has a variety of impacts on our environment. Once in our waterways, toxic chemicals can contaminate sediments, pollute the bodies of aquatic organisms, and infiltrate drinking water supplies, creating a wide variety of problems for humans and the environment.

Toxic Releases and the Environment

Pollution from industrial facilities is a leading cause of water quality problems in our nation's rivers, streams, and lakes. According to the U.S. Environmental Protection Agency (EPA), industrial discharges are thought to be responsible for threatening or fouling water quality in more than 14,000 miles of rivers and more than 220,000 acres of lakes, ponds and estuaries nationwide.[2]

Impacts on Local Waterways

Perhaps the most immediate and severe result of toxic chemical releases on local waterways is the death of wildlife. Toxic chemical releases—whether deliberate or accidental—can trigger fish kills. In Maryland, for example, industrial discharges were responsible for 47 separate fish kill events between 1984 and 2010.[3]

Dramatic fish kills may attract headlines, but routine toxic chemical discharges can have subtle and long-lasting impacts on aquatic life. In the Potomac River, for instance, 80 percent of all male bass—both large and smallmouth—captured by scientists carried female eggs, a sign that their reproductive development had been altered by chemicals in the water.[4] The scientists attributed the developmental abnormalities to a "toxic stew" of chemicals in the river. Exposure to these hormone-disrupting chemicals can cause serious reproductive, developmental, and immune system problems.

Some chemicals that are toxic also pose other, more indirect threats to the health of waterways. Nitrate compounds—which come from agricultural runoff as well as industrial sources—are toxic, but mainly threaten wildlife and ecosystems because they feed the growth of algae, which can deplete oxygen levels in local waterways.

Persistent Bioaccumulative Toxics—Local Pollutants with a Global Impact

Some toxic substances are long-lived and accumulate in animal tissue, becoming more and more concentrated further up the food chain. Decades after scientists first pointed to the dangerous impacts of persistent bioaccumulative toxics (PBTs)—a class of chemicals that includes such notorious chemicals as DDT and PCBs—those substances continue to turn up in the tissues of animals great distances from any known source of pollution, and industries continue to produce, use and discharge PBTs into America's waterways.

Discharges of persistent bioaccumulative toxics to waterways (along with discharges to the land and air) can not only harm wildlife in those waterways, but also impact wildlife thousands of miles away. Some persistent chemicals released to local waterways, for example, eventually evaporate and are carried by rain or snow to locations far away. In the early 1990s, for example, the Great Lakes, which had long received discharges of PCBs from industrial facilities, were a significant net *source* of PCBs to the air—contributing to contamination elsewhere.[5]

PCBs continue to be found in the tissues of polar bears three decades after the United States banned their manufacture.[6] PCB contamination has been linked to immune system and reproductive problems in the bears, which already face threats from another problem caused by pollution: global warming.[7] PCBs have also been linked to a mass die-off of North Sea and Baltic seals during the 1980s, and are among the environmental pollutants linked to health problems in salmon, mink, and other species.[8]

Since the last edition of this report was released in 2009, new federal regulations have been put in place that are likely to significantly reduce one of the largest pathways through which PBTs enter waterways—airborne mercury emissions. In late 2011, EPA issued strong new standards aimed at reducing airborne emissions of mercury and other toxics from power plants and other large sources, which will begin to take effect in the next few years.[9] Although these standards do not affect the toxic releases described in this report, they will significantly reduce the quantity of PBTs present in American waterways, since deposition of airborne mercury through rainfall is a leading source of PBT contamination in American waterways. (Separately, EPA is proceeding with a rulemaking on water discharges from power plants, which could lead to further reductions in emissions described in this report.)[10]

While governments, including the U.S. government, have taken action to reduce or eliminate production of notorious toxic chemicals such as DDT and PCBs, other toxic chemicals continue to be produced in large quantities and show up in the tissues of wildlife around the globe. Brominated flame retardants (BFRs), which have been commonly used in furniture, computer circuit boards and clothing, share some common characteristics with persistent bioaccumulative toxics. BFRs have been shown to cause a variety of health problems in animals during laboratory studies, and are accumulating rapidly in humans and animals. BFRs have been found in sperm whales, Arctic seals, birds, and fish.[11] Direct industrial releases of BFRs, including discharges to waterways, are among the many ways that BFRs can find their way into the environment and into the bodies of animals and humans.[12]

The recent experience with brominated flame retardants shows the dangers of public policy that treats all chemicals as "innocent until proven guilty"—allowing widespread release to consumers and the environment *before* they are demonstrated to be safe. As the story of PCBs shows, the impacts of toxic chemical releases can last for generations and be felt far away from the original source of the pollution.

Toxic Releases and Human Health

Toxic chemicals also have the ability to impact human health, with the potential to trigger cancer, reproductive and developmental problems, and a host of other health effects.

The state of California has developed a list of more than 500 chemicals and substances known to cause cancer, as well as more than 250 chemicals linked to developmental problems and more than 75 chemicals liked to reproductive disorders in men, women, or both.[13] It is likely that others among the 80,000 chemicals registered for commercial use in the United States trigger these or other health effects, as only a small percentage of chemicals have been fully tested for their impact on health.[14]

Once released into waterways, there are many potential pathways for toxic chemicals to impact human health. One pathway is through food. Bioaccumulative toxics build up in animal tissue and find their way into our bodies when we eat animal products. Mercury and dioxin contamination of fish are examples. Mercury enters waterways both directly, through the discharge of mercury-tainted wastewater from power plants and other industrial facilities, and indirectly through emissions from power plant smokestacks that precipitate back into waterways. Once in water, mercury can undergo a series of transformations that enable it to be absorbed and accumulated up the food chain.[15] Similarly, dioxin from sources such as pulp and paper mills that use chlorine can find its way into sediment, where it can be ingested by fish, becoming part of the food chain.

Another route of exposure is through drinking water. A 2009 report by the Environmental Working Group found that 315 pollutants had been found in drinking water between 2004 and 2009; 49 pollutants were found at levels in excess of federal safety standards for the substance in question.[16] For instance, more than 11 million people are served by drinking water systems that exceeded EPA's maximum level for arsenic compounds between 2004 and 2009; 9 million people are served by systems where concentrations of chloroform, a known carcinogen, exceeded EPA's maximum limit during that time period.[17] Other industrial pollutants—including heavy metals such as lead and solvents such as tetrachloroethylene (perc), a carcinogen—have been found in the drinking water consumed by millions of Americans.[18] A 2009 investigative report by the *New York Times* found that roughly one in 10 Americans has been exposed to drinking water that either contained dangerous chemicals or failed to meet federal health standards.[19]

People can even be exposed to toxic chemicals before they are born and as newborns. Brominated flame retardants—which can enter the environment either via direct discharges from industrial plants or emissions from consumer products containing the chemicals—have been found in breast milk, with women in the United States showing the highest concentrations in the world.[20] Many chemicals also can cross the placental barrier, with the potential to disrupt the development of the fetus, creating problems that may be difficult to detect (for example, neurological problems) or may not manifest themselves until years later.

Toxic Releases to U.S. Waterways in 2010*

The discharge of toxic chemicals to U.S. waterways has left a legacy of environmental damage and impacts on human health. While industrial pollution of rivers, streams and lakes has decreased over the last several decades as a result of the Clean Water Act, industrial facilities continue to discharge millions of pounds of toxic chemicals to our waterways each year.

This report uses data from the federal government's Toxics Release Inventory (TRI) to estimate releases of toxic chemicals to American waterways in 2010. It is the second report in a series; our last report on this topic, released in 2009, was based on TRI data from 2007.

Under TRI, industrial facilities are required to release information about their discharges of a limited number of specific toxic chemicals. (See "The Toxic Release Inventory: What it Tells Us About Toxic Pollution … and What it Leaves Out" on page 10.) Industrial facilities that report to TRI reported the release of 231 toxic chemicals or classes of toxic pollutants to American waterways in 2010. Those chemicals vary greatly in their toxicity and the impacts they have on the environment and human health. Some pollutants that are released in large volumes, for example, may have less of an impact on the environment or human health than other highly toxic pollutants released in smaller volumes.

This report also takes advantage of the fact that, for the first time ever, EPA released TRI data from 2010 with information on the watersheds into which chemicals were released, in the form of hydrological unit codes (HUCs) which identify waterways by the watershed region to which they belong. Using these data, we have been able to aggregate releases not only by the individual waterway to which chemicals were released, but also by the broader watershed regions to which those waterways belong. In cases where multiple neighboring waterways receive discharges that then accumulate as streams flow together, aggregating data at the watershed region level can capture the extent of the environmental and public health risks involved in a way that aggregating only at the level of individual waterways may not.

In this report, we examine data on toxic discharges through several lenses, presenting information on the volume of releases to American waterways of:

* Data in this section of the report have been revised as of May 2012.

- All toxic chemicals listed under TRI;
- Toxic chemicals linked to specific health effects—cancer, reproductive disorders, and developmental harm; and
- Certain chemicals that can have a significant impact on the environment and human health in small quantities—including persistent bioaccumulative toxics, organochlorines and phthalates.

226 Million Pounds of Toxic Chemicals Were Released to Waterways in 2010

Approximately 226 million pounds of toxic chemicals were released to America's waterways in 2010. Toxic chemicals were released into more than 1,900 different waterways in all 50 states. Total toxic releases were 6 million pounds less than in 2007, the year covered in the previous edition of this report—a 2.6 percent decrease.

The state of Indiana led the nation in

The Toxics Release Inventory: What it Tells Us About Toxic Pollution … and What it Leaves Out

The Environmental Protection Agency's Toxics Release Inventory (TRI) is the most comprehensive source of information available on the industrial release of toxic substances to America's environment. TRI plays a critical role in informing communities about the potential environmental impacts of nearby industrial facilities and has been used time and again to encourage companies to reduce their toxic discharges and adopt safer practices.

While TRI is an important source of information, it is not perfect. TRI only covers industrial facilities, meaning that many other sources of toxic pollution—from wastewater treatment plants to agricultural facilities—are not reported. Industrial facilities are required to report only the releases of chemicals on the TRI list—meaning that releases of newer chemicals or those of more recent concern might not be reported at all. In addition, industrial facilities must report to TRI only if they meet certain thresholds for the amount of toxic chemicals they manufacture, process or use in a particular year. As a result, some toxic releases to waterways by covered industries are not reported to the public.

In other words, TRI data do not provide a complete picture of the amount of toxic chemicals that flow into the nation's environment. But the TRI is the best and most complete set of data available. In this report, we use TRI data for 2010 to calculate the amount of toxic chemicals discharged by industrial facilities to America's waterways. For important details on how we analyzed the data to derive our conclusions, please see the "Methodology" section at the end of this report.

Table 1: Top Ten States by Toxic Releases in 2010

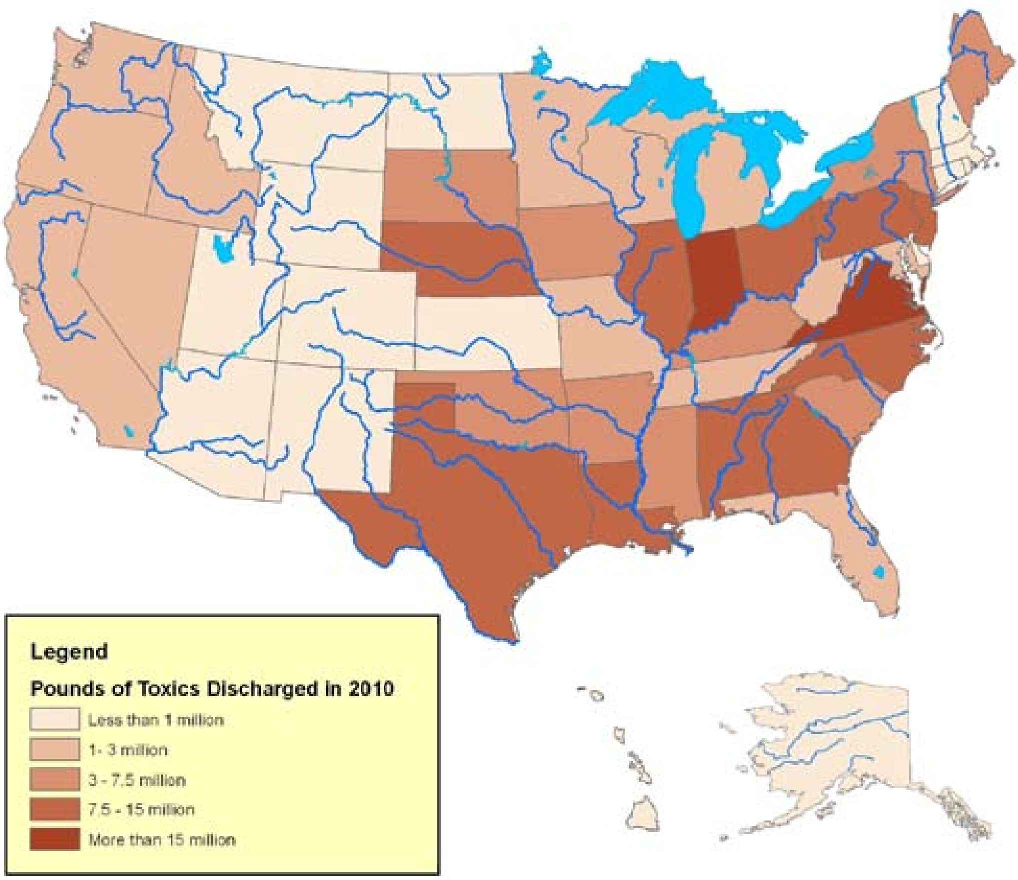
State	Toxic Releases (lbs.)	Rank
Indiana	27,384,933	1
Virginia	18,078,000	2
Nebraska	14,727,942	3
Texas	14,325,126	4
Georgia	12,620,709	5
Louisiana	10,903,183	6
Pennsylvania	10,121,165	7
Alabama	9,857,668	8
Ohio	9,192,337	9
North Carolina	9,168,645	10

total volume of toxic discharges to waterways, with more than 27 million pounds of toxic discharges. Indiana was followed by Virginia, Nebraska, Texas and Georgia for total toxic discharges. (See Table 1.)

Nitrates Accounted for the Largest Share of Toxic Releases in 2010

Releases of nitrate compounds represented just under 90 percent of the total volume of discharges to waterways reported under the TRI. Nitrates are toxic, particularly to infants consuming formula made with nitrate-laden drinking water, who may be susceptible to methemoglobinemia, or "blue baby" syndrome, a disease that

Figure 1. Total Toxic Releases to Waterways Reported to the TRI



reduces the ability of blood to carry oxygen throughout the body.[21] Nitrates have also been linked in some studies to organ damage in adults.[22] Industrial pollution is only one source of nitrate discharges; fertilizer and other agricultural runoff (which are not accounted for in the Toxics Release Inventory) also account for a large volume of nitrate pollution.[23]

Nitrates are also a major environmental threat as one of the leading sources of nutrient pollution to waterways. Nitrates and other nutrients can fuel the growth of algal blooms. As the algae decay, decomposition can cause the depletion of oxygen levels in the waterway, triggering the formation of "dead zones" in which aquatic life cannot be sustained. The dead zone that forms each summer in the Gulf of Mexico has been attributed to the massive flow of nutrients, including nitrates, from the Mississippi River basin. While fertilizer runoff from agricultural activities is the leading source of nitrates in the Mississippi, industrial discharge plays a small but significant role.[24] The Chesapeake Bay is another waterway heavily impacted by nitrate pollution; dead zones form there every summer as a result of industrial, agricultural, and residential runoff. In late 2010, EPA released new rules on the amount of pollution that can be released into the Chesapeake Bay watershed, which will both improve the condition of the bay and provide an example for other major watersheds suffering from heavy pollution discharges.[25]

Table 2. Top 20 Waterways for Total Toxic Discharges, 2010

Waterway Name	Toxic Releases (lbs.)
OHIO RIVER (IL, IN, KY, OH, PA, WV)	32,116,310
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	12,746,057
NEW RIVER (NC, VA)	12,070,494
SAVANNAH RIVER (GA, SC)	9,627,865
DELAWARE RIVER (DE, NJ, PA)	6,720,991
MUSKINGUM RIVER (OH)	5,755,618
MISSOURI RIVER (IA, KS, MO, ND, NE)	4,842,275
SHONKA DITCH (NE)	4,614,722
TRICOUNTY CANAL (NE)	3,386,412
ROCK RIVER (IL, WI)	3,370,652
CAPE FEAR RIVER (NC)	3,364,823
ILLINOIS RIVER (IL)	3,206,211
BIG SIOUX RIVER (SD)	2,949,940
TENNESSEE RIVER (AL, KY, TN)	2,812,843
ROANOKE RIVER (NC, VA)	2,762,330
HOUSTON SHIP CHANNEL (TX)	2,715,239
MONONGAHELA RIVER (PA, WV)	2,627,192
SNAKE RIVER (ID, OR)	2,491,684
MORSES CREEK (NJ)	2,409,387
AROOSTOOK RIVER (ME)	2,271,733

Unsurprisingly, the waterways that rank high for total toxic releases are those with large releases of nitrate compounds. Among the major industrial sources of nitrate compounds are food and beverage manufacturing (slaughterhouses, rendering plants, etc.), primary metals manufacturing, chemical plants, and petroleum refineries. Waterways receiving discharges from these types of facilities, therefore, will tend to rank high on the list for total toxic releases.

The Ohio River topped all waterways for toxic discharges in 2010, with over 32 million pounds of discharges. It was followed by two other large rivers—the Mississippi (of which the Ohio is a tributary) and the New River in North Carolina and Virginia.

Large waterways are not the only ones that receive large amounts of toxic discharges. Several smaller waterways, such as Nebraska's Shonka Ditch and Tricounty Canal, rank among the top waterways for receiving toxic discharges nationwide.

Large Polluters Can Have a Major Impact on Individual Waterways

For 15 of the 50 top waterways by total volume of toxic releases, one company was responsible for all of the toxic discharges. In most cases, the company in question was an agriculture or food company; Tyson Foods, for instance, was the responsible party in three cases, including Nebraska's Tricounty Canal (9th on the list for total discharges). Cargill Inc. was the sole company discharging into the Shonka Ditch (8th on the list); Smithfield Farms was the sole discharger in the case of South Dakota's Big Sioux River (13th); and McCain Foods was the only company discharging into Maine's Aroostook River (20th).

The chemical, petroleum, and manufacturing industries were also represented among the companies solely responsible for polluting a waterway. Morses Creek in New Jersey (19th on the list) was polluted by Conoco Philips' Bayway Refinery. Further down the list, the Little Attapulgus Creek in Georgia received over 1 million pounds of toxics solely from a plant in Attapulgus operated by major chemical manufacturer BASF.

Pollution of large water bodies may have the broadest impact on the public and receive the greatest attention. But as these examples show, small streams receive vast amounts of pollution as well—often from just a single large polluter—creating the potential for significant harm to local ecosystems and for pollution to be carried downstream to larger waterways.

For some larger waterways, the amount of direct discharges may not tell the whole story of the impact of toxic pollution. Many of these rivers flow into one another, aggregating pollution so that by the time the Mississippi reaches the ocean, for instance, it is carrying a portion of the toxics dumped into many other rivers farther upstream (although some of those toxics will have also evaporated, settled into sediment, or otherwise ceased to flow downstream). Examining discharges by watershed region (using the United States Geological Survey's Hydrological Unit Classification system) shows that many of the waterways in which toxic releases take place flow together before reaching the ocean (see Table 3).

The Ohio River, for instance, received 32 million pounds of toxics in 2010. Its tributaries, meanwhile, received an additional 26 million pounds. In total, more than 25 percent of the toxics released into waterways in 2010 were released into the Ohio River or its tributaries.

The Mississippi, meanwhile, which drains much of the North American continent, captures an even larger share of the nation's toxic releases in its watershed. Over 125 million pounds of toxics were released into waterways tributary to the Mississippi in 2010—more than half the total released in the entire United States.

The Grand Calumet River: Showcasing the Impacts of Toxic Pollution

In 1985, biologist Thomas Simon spotted a finless, bloody carp swimming in Indiana's Grand Calumet River. "It looked like someone had beaten it up," he told the *New York Times*. Even such an unhealthy carp's presence was good news, however; it was the first living fish seen in the river in years.[26] The Grand Calumet highlights the damage that industrial pollution can do to a waterway, and the ongoing damage being done by industrial pollution.

The Grand Calumet and its neighboring waterways, including the Little Calumet, Burns Ditch (which drains the river to Lake Michigan), and various shipping and industrial canals form one of the most polluted networks of rivers in the country. At one point in the 1960s, before the passage of the Clean Water Act, the river was so polluted that even sludge worms (extremely hardy animals that survive in sewage and heavily polluted waters where other animal life cannot) were unable to live there.[27]

Much of the pollution there accumulated decades ago, through industrial discharges that left the river bottom covered in sediments containing highly toxic PCBs and other severely dangerous chemicals, and through leaks from five different Superfund toxic waste sites that border the river. Cleanup efforts are ongoing, at significant cost; in 2011 alone, the government spent $50 million to remove highly toxic sediments from the Grand Calumet.[28]

Even as millions of dollars are dedicated to restoring the Grand Calumet and its neighboring waters to health, new discharges to those waters placed the watershed high in the ranks of polluted waters. The Little Calumet-Galien watershed region, containing the Grand Calumet, closely linked rivers, and a portion of the shore of Lake Michigan, ranked 20th in the nation for overall toxic discharges, 14th for discharges of developmental toxicants, and 9th for discharges of reproductive toxicants in 2010—a heavy concentration of pollution even if the waterways in question had been pristine to begin with.

Three metals plants discharged toxics into the Grand Calumet and its connected waterways in 2010—U.S. Steel's Gary Works and Midwest plant (a sheet and tin finishing facility) and ArcelorMittal USA's Indiana Harbor plant. Those facilities released a range of metal wastes and other toxics into the waterways, including chromium and benzene – both of which act as carcinogens and developmental and reproductive toxicants – and arsenic compounds, which are carcinogenic and act as developmental toxins.

As those chemicals flow into Lake Michigan, they join benzene, ethylbenzene and other refinery byproducts released by a BP Products of North America oil refinery in Whiting, Indiana, and nitrates released by a Cargill corn mill directly into the lake.

The Grand Calumet and its neighboring waterways are exactly the type of waters the Clean Water Act was intended to restore to a usable state. The ongoing pollution problem in those rivers—produced by a combination of accumulated pollution from previous decades and new toxics deposited into the rivers every year—shows how that vision has yet to be met.

Table 3: Toxic Releases by Watershed Region

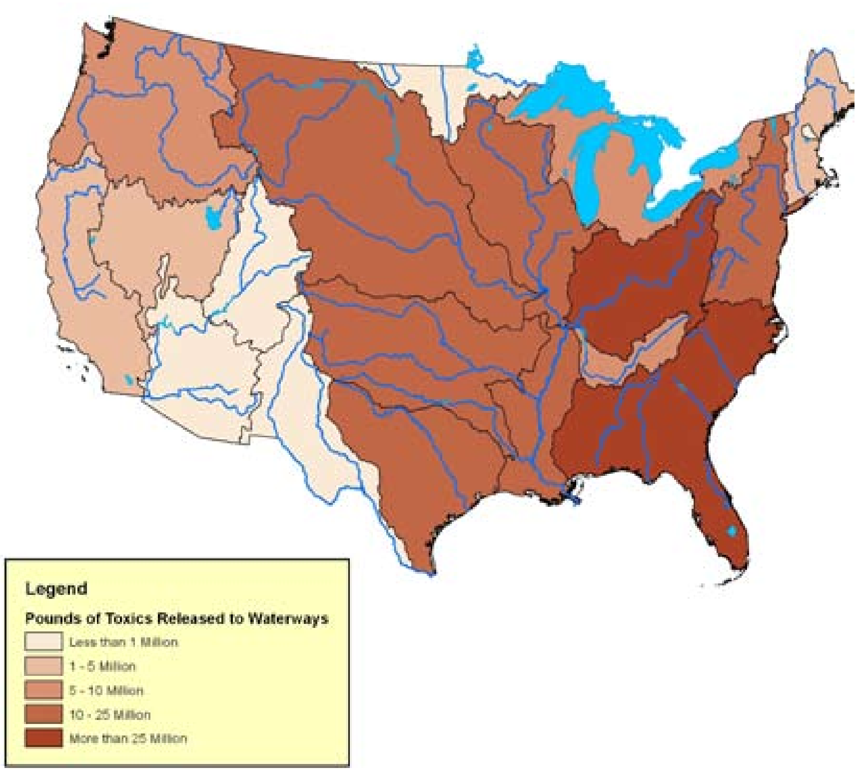
Watershed Region	Toxic Releases (lbs.)
Ohio	58,538,931
South Atlantic-Gulf	40,370,911
Mid Atlantic	24,378,351
Missouri	19,509,654
Upper Mississippi	18,637,428
Lower Mississippi	12,456,995
Texas-Gulf	12,368,918
Arkansas-White-Red	10,927,949
Great Lakes	9,692,222
Pacific Northwest	5,579,141

Several of these watershed areas (the South Atlantic-Gulf, Texas-Gulf, and Pacific Northwest) contain multiple outlets to the ocean. Toxics released in these regions do not all follow the same path to the sea.

Releases of Toxic Chemicals Linked to Human Health Problems Are Widespread

The high volume of toxic discharges to America's waterways is a tremendous concern for the ongoing health of our rivers, streams and lakes. But toxic chemicals vary in the impacts they have on human health, as well as in their toxicity. To gain a fuller understanding of the impact of toxic discharges, it is helpful to examine the releases of chemicals that, while released in smaller volumes, are linked to severe and chronic health problems.

Figure 2: Toxic Discharges by Watershed Region, Contiguous United States, 2010



Cancer

In 2010, manufacturing facilities discharged approximately 1.5 million pounds of cancer-causing chemicals into waterways.[29] Nevada's Burns Creek received the largest volume of carcinogens in 2010, while neighboring Mill Creek placed third. The Mississippi River received the second largest volume of releases, while the Ohio and Tennessee rivers rounded out the top five.

Cancer-causing chemicals were discharged into more than 1,300 waterways nationwide in 2010. Several industries discharge large amounts of cancer-causing chemicals to waterways. The pulp and paper industry was the largest emitter of cancer-causing chemicals to waterways, discharging more than 539,000 pounds of those substances to waterways, more than one-third of the total amount released nationwide. The metal ore mining industry released the second-largest amount of carcinogens; 328,000 pounds, or 22 percent of the national total, largely due to the release of 315,000 pounds of arsenic compounds and other carcinogenic compounds from the Jerritt Canyon Mine in Nevada.

Regionally, releases of carcinogenic chemicals are concentrated in the Mississippi watershed and in the Southeast. Waterways draining to the Mississippi received 558,000 pounds of carcinogens in 2010, more than a third of the total volume of such chemicals released nationally; the lower Mississippi, home to a number of

Table 4. Top 20 Waterways for Discharges of Cancer-Causing Chemicals, 2010

Waterway Name	Releases of Cancer-Causing Chemicals (lbs.)	Rank
BURNS CREEK (NV)	198,152	1
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	181,697	2
MILL CREEK (NV)	85,150	3
OHIO RIVER (IL, IN, KY, OH, PA, WV)	69,398	4
TENNESSEE RIVER (AL, KY, TN)	62,393	5
COOPER RIVER (SC)	45,327	6
RED RIVER (AR, LA, OK)	38,552	7
SAMPIT RIVER (SC)	34,407	8
AMELIA RIVER (FL)	33,824	9
ALABAMA RIVER (AL)	31,906	10
WINTERS CREEK (NV)	31,826	11
COLUMBIA RIVER (OR, WA)	27,557	12
PEARL RIVER (LA, MS)	24,097	13
OUACHITA RIVER (AR, LA)	21,782	14
BRAZOS RIVER (TX)	21,069	15
ARKANSAS RIVER (AR, CO, KS, OK)	19,687	16
HOLSTON RIVER (TN)	19,450	17
LAKE CHAMPLAIN (NY)	15,963	18
CHATTAHOOCHEE RIVER (AL, GA)	15,550	19
WHEELER RESERVOIR (AL)	14,841	20

Toxic Releases From the Jerritt Canyon Mine: The Outsized Impact of Large Polluters

Jerritt Canyon Mine in Nevada has made headlines for its contributions to environmental contamination in the past. The facility, which includes a roaster that processes ore in addition to a mine, was the subject of an investigation in which environmental regulators found that the roasters had been emitting large amounts of mercury, and that the mine's operators had failed to take required steps to reduce emissions.[30]

The mine was allowed to reopen briefly in early 2009, but failed to meet deadlines for improving its emissions control equipment, and was shut down again that summer, reopening in October of that year.[31]

Prior to 2010, the Jerritt Canyon Mine had emitted large amounts of toxics into the atmosphere and onto dry land. It had not, however, reported releasing toxics into waterways.[32] In 2010, however, the facility reported a massive discharge – more than 1.2 million pounds—of arsenic, nickel, zinc, and copper compounds into three small streams near the mine. (This release was accompanied by a significant increase in the volume of air emissions from the facility.)

The creeks affected by the discharge from the Jerritt Canyon facility are small, but received several of the largest pollutant loads of any waterway in the United States. The Jerritt Canyon mine is located in an arid region, within the Great Basin (the major region of the United States in which water does not flow to either ocean, instead leaving through evaporation). As such, pollution that damages the limited water resources of the region can have an outsized ecological impact.

oil refineries and petrochemical plants, saw particularly large volumes of releases. Waterways in the Southeast received 363,000 pounds of carcinogens. The third-greatest region by volume of carcinogenic discharges was the Great Basin—again, because of the heavy release of arsenic and other compounds to streams around the Jerritt Canyon Mine.

Developmental and Reproductive Toxicants

Among the toxic chemicals discharged to America's waterways are those shown to impede the proper physical and mental development of fetuses and children. Among the potential health effects of these chemicals are fetal death, structural defects such as cleft lip/cleft palate and heart abnormalities, as well as neurological, hormonal, and immune system problems.

In 2010, industrial facilities released approximately 619,000 pounds of developmental toxicants to more than 1,200 of America's waterways. The largest dose of these chemicals went into Burns Creek in Nevada, in the form of a 123,000 pound discharge of arsenic compounds from Yukon Nevada Gold's Jerritt Canyon Mine. (The streams that received the fourth and sixth largest discharges, Mill Creek and Winter Creek, were also the recipients of arsenic compound discharges from the Jerritt Canyon facility.)Those three creeks received more developmental toxicants than the Mississippi and Ohio rivers combined. West Virginia's Kanawha River received the second-largest volume of discharges, from a pesticide manufacturing plant operated by the Bayer Group. The Mississippi River received the third largest volume of discharges.

Regionally, releases of developmental toxicants were concentrated in the Mississippi watershed and in the Great Basin (again, because of the Jerritt Canyon Mine release). A total of 291,000 pounds of developmental toxicants were released in the Mississippi watershed. The Ohio River basin and Lower Mississippi were the sites of the largest releases within the Mississippi watershed. Gold mining, pesticide and fertilizer manufacturing, and basic chemical manufacturing were the leading industries for developmental toxicant releases.

Releases of reproductive toxicants into waterways totaled 342,000 pounds in 2010, with discharges occurring to more than 1,100 waterways nationwide. Because some high-volume developmental toxicants also have the potential to interfere with reproductive health, many of the same waterways that have received large amounts of developmental toxicants also rank high for reproductive toxicant releases. The Kanawha River received the largest dose

Table 5. Top 20 Waterways for Releases of Developmental Toxicants, 2010

Waterway Name	Releases of Developmental Toxics (lbs.)	Rank
BURNS CREEK (NV)	123,081	1
KANAWHA RIVER (WV)	86,296	2
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	74,549	3
MILL CREEK (NV)	49,964	4
OHIO RIVER (IL, IN, KY, OH, PA, WV)	46,816	5
WINTERS CREEK (NV)	31,826	6
KANSAS RIVER (KS)	10,485	7
BRAZOS RIVER (TX)	10,404	8
JAMES RIVER (VA)	9,432	9
TENNESSEE RIVER (AL, KY, TN)	7,430	10
CAPE FEAR RIVER (NC)	7,124	11
GALVESTON BAY (TX)	4,415	12
HERRINGTON LAKE (KY)	4,122	13
COOSA RIVER (AL, GA)	4,013	14
LAKE ERIE (MI, NY, OH, PA)	3,983	15
COLUMBIA RIVER (OR, WA)	3,714	16
CROOKED CREEK (MO)	3,455	17
BEE FORK CREEK (MO)	3,346	18
ALABAMA RIVER (AL)	3,332	19
BLOCKHOUSE HOLLOW RUN (OH)	3,310	20

of reproductive toxicants, followed by the Mississippi, Ohio, and Brazos rivers.

Pesticide and fertilizer manufacturing and basic chemical manufacturing were the leading industrial sources of reproductive toxicants; each accounted for approximately one quarter of the nation's total volume of releases. Fossil fuel power generation was the third largest source of such discharges, producing just over 10 percent of the nation's total releases. Seven out of every ten pounds released nationwide went into waterways in the broader Mississippi basin; the Ohio River basin and Lower Mississippi area saw the largest releases.

Releases of Small-Volume Toxic Chemicals Also Pose Concern

As noted earlier, toxic chemicals vary greatly in their toxicity and effects on the environment and health. Some toxic chemicals trigger severe health effects at low levels of exposure.

Some particular groups of relatively small-volume chemicals worthy of concern are the following:

Table 6. Top 20 Waterways for Releases of Reproductive Toxicants, 2010

Waterway Name	Releases of Reproductive Toxics (lbs.)	Rank
KANAWHA RIVER (WV)	85,653	1
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	70,934	2
OHIO RIVER (IL, IN, KY, OH, PA, WV)	36,505	3
BRAZOS RIVER (TX)	12,870	4
KANSAS RIVER (KS)	10,485	5
TENNESSEE RIVER (AL, KY, TN)	5,342	6
GALVESTON BAY (TX)	4,415	7
BEE FORK CREEK (MO)	3,346	8
CROOKED CREEK (MO)	3,309	9
ALABAMA RIVER (AL)	3,282	10
ARKANSAS RIVER (AR, CO, KS, OK)	3,110	11
EVERETT HARBOR (WA)	2,700	12
DELAWARE RIVER (DE, NJ, PA)	2,510	13
CHATTAHOOCHEE RIVER (AL, GA)	2,240	14
LAKE MICHIGAN (IL, IN, MI, WI)	2,041	15
HOLSTON RIVER (TN)	2,006	16
PACIFIC OCEAN (CA, HI, OR, WA)	1,991	17
CUYAHOGA RIVER (OH)	1,896	18
LAKE ERIE (MI, NY, OH, PA)	1,847	19
MUSKINGUM RIVER (OH)	1,814	20

Persistent Bioaccumulative Toxics

Persistent bioaccumulative toxicants (PBTs) are those that persist in the environment (that is, are difficult or impossible to destroy) and accumulate up the food chain. As humans are generally at the top of the food chain, PBTs pose particular problems for us. Consuming fish contaminated with mercury, for example, can impair the neurological development of fetuses and small children.[33]

Direct surface water discharges of PBTs are common across the United States. Over 90,000 pounds of PBTs were released to more than 1,000 waterways in 2010.

Lead and lead compounds were, by both volume and range of distribution, the primary PBTs released to waterways in the United States in 2010. More than 900 waterways across the country received direct discharges of lead compounds in 2010; over 82,000 pounds of lead and lead compounds were released. Polycyclic aromatic compounds, a family of cancer-causing chemicals released primarily by chemical plants and oil refineries, were discharged into more than 140 waterways. And dioxins, which are mainly released by the chemical industry, were discharged into more than 90 waterways nationwide.

The leading industries discharging PBTs were pulp and paper mills, electric power plants, metal ore mining facilities, and oil refineries. The Ohio River, Mississippi River, and Alabama River received the heaviest discharges. Two small Missouri waterways, Bee Fork Creek and Crooked Creek, ranked fourth and fifth because of heavy discharges of lead from mines and smelters operated by the Renco Group and Doe Run Resources Corp.

Discharges of even small amounts of PBTs can have serious consequences. For example, industrial facilities reported releasing approximately 35 pounds of dioxin and dioxin-like compounds into waterways nationwide in 2010—a small fraction of the 226 million pounds of toxics released. However, given that the World Health Organization guidelines for dioxin recommend exposure of less than *one-billionth of a gram* per day, even this relatively small amount of dioxin discharges can have serious implications for public health.[34]

Organochlorines and Phthalates

Organochlorine pesticides and phthalates are both classes of chemicals with serious implications for health—and for which safer alternatives are available. Organochlorines, the family of pesticides that includes DDT, have been linked to a wide variety of impacts on the environment and human health, including cancer, interference with the endocrine system, immune system problems, and developmental and reproductive disorders.[35] While DDT and some other organochlorines have been banned, others remain in use today.

Phthalates are added to plastic products such as food wrapping and children's toys to make them flexible. Some phthalates have been linked to reproductive and developmental problems.[36]

Organochlorines and phthalates are not as widely released as many of the other toxic substances discussed in this report, but still impact waterways nationwide. Releases of organochlorines were reported to 10 waterways nationwide, with the Des Plaines River in Illinois receiving the greatest amount of total discharges. A large portion of the total discharges were in the form of hexachlorobenzene, a now-banned pesticide that is produced as a by-product of certain chemical processes.[37] Phthalates were released to 11 waterways nationwide, with two waterways in Tennessee—a tributary of Little Nixon Creek and the Holston River—leading the way for total releases.

Direct discharges of organochlorines and phthalates by industrial facilities are not necessarily the most important routes of exposure to these chemicals—people are more likely to be exposed to phthalates, for example, in consumer products. The continued discharge of these chemicals to waterways, however, underscores the many ways in which these substances, once produced, find their way into our environment, and reinforces the need for pollution prevention to be the primary approach to reducing toxic health threats.

Protecting America's Waterways from Toxic Releases: Chemical Policy and the Clean Water Act

The millions of pounds of toxic discharges to America's waterways—coupled with the continued discharge of smaller amounts of hazardous substances such as lead, mercury and dioxin—suggest that there are deep flaws in the policy tools the United States uses to keep toxic chemicals out of our waterways.

Environmental policy in the United States has several weaknesses. It too often takes an "innocent until proven guilty" approach to potential health hazards. It focuses more on stopping pollution at the end of the pipe rather than encouraging inherently safer products and industrial practices. And it fails even in the task of stopping pollution at the end of the pipe because of gaping loopholes in environmental laws and inadequate enforcement. The result is the continued release of toxic chemicals into America's rivers, streams, and lakes.

The Clean Water Act: Ensuring Strong Protection for All of America's Waterways

The federal Clean Water Act is the nation's primary bulwark against pollution of our waterways. Yet, for too long, implementation of the Clean Water Act has failed to live up to the vision of pollution-free waterways embraced by its authors. Moreover, the Clean Water Act is facing perhaps the most important test in its history as a result of judicial decisions that have limited the law's scope.

To protect the environment and human health from releases of toxic chemicals into our waterways, federal and state governments should take several steps to strengthen implementation of the Clean Water Act.

Protections for Small Waterways

A series of court decisions, culminating in the U.S. Supreme Court's 2006 decision in the case of *Rapanos v. United States*, have threatened the protection that intermittent and headwater streams and isolated wetlands have traditionally enjoyed under the Clean Water Act. These waterways play important roles in local ecology, while protection of headwaters and intermittent streams is critical for maintaining water quality downstream.

The *Rapanos* decision left unclear exactly which waterways do enjoy protection under the Clean Water Act. Navigable waterways and those that cross state boundaries, along with their tributaries, retain their traditional protections. But the Supreme Court's unusual 4-1-4 ruling in the *Rapanos* case has left the courts and EPA torn between two different standards for Clean Water Act jurisdiction—the strict standard, embraced by four of the court's members, that eliminates protection for intermittent streams and those without a surface connection to covered waterways, and the less stringent legal standard, outlined in a concurring opinion by Justice Anthony Kennedy, that requires a "significant nexus" to exist with a navigable waterway for a waterbody to enjoy protection under the Clean Water Act.[38]

The *Rapanos* decision and other previous decisions threaten the protection enjoyed by thousands of waterways nationwide—with real consequences for the environment. In much of the American West, for example, perennial streams are uncommon. Only 3 percent of all streams in Arizona, for example, are perennial, along with 8 percent in New Mexico and 9 percent in Nevada.[39] Furthermore, across the country 58 percent of all streams are at risk of increased pollution due to these court decisions.[40] Nationwide, EPA estimates that 117 million people are served by drinking water systems that draw their water from headwaters streams or intermittent waterways.[41] These important waterways could completely lose protection under the federal Clean Water Act, leaving discharges to those waterways unregulated by EPA. **The administration should ensure that the Clean Water Act applies to headwater streams, intermittent waterways, isolated wetlands and other waterways by finalizing proposed guidelines and conducting a rulemaking this year.**

Improve Enforcement of the Clean Water Act

The Clean Water Act is America's main source of protection against water pollution, but it has not always been adequately enforced. States (who are primarily responsible for enforcing the law in most of the country) have often been unwilling to tighten pollution limits on industrial dischargers and have often let illegal polluters get away with exceeding their permitted pollution levels without penalty or with only a slap on the wrist.

EPA and states should tighten implementation of the Clean Water Act by:

- Ensuring that pollution permits are renewed on schedule and ratcheting down permitted pollution levels with each successive five-year permit period with the goal of achieving zero pollution discharge wherever possible. As of December 2009, nearly one out of every five discharge permits for major industrial facilities had expired.[42] Timely renewal of permits, coupled with reductions in the amount of pollution allowed at each permit renewal, can move the nation closer to achieving the original zero-discharge goal of the Clean Water Act.

- Eliminating "mixing zones" for persistent bioaccumulative toxics. Mixing zones are areas of waterways near discharge points where the level of pollution can legally exceed water quality criteria without triggering action to reduce pollution levels. The idea behind mixing zones is that water from a discharge pipe might not meet water quality criteria, but that with dilution, the level of pollution would not harm the overall quality of the waterway. Mixing zones are a dubious concept at best from the perspective of protecting waterways from pollution and are wholly inappropriate for certain types of pollutants. Persistent bioaccumulative toxics—which have the capacity to contaminate sediment and/or accumulate in aquatic organisms—are among those for which mixing zones are particularly problematic. States should eliminate the use of mixing zones for PBTs and consider elimination for other toxic chemical discharges as well.

- Establishing mandatory minimum penalties for Clean Water Act violations. Often, violators of the Clean Water Act escape serious penalty. State and EPA officials are often resistant to penalizing polluters, even after multiple violations of the law. Establishing mandatory minimum penalties for violations of the Clean Water Act would ensure that illegal pollution does not go unpunished and act as a deterrent to illegal polluters. Congress should also ensure that EPA receives adequate funding for enforcement staff to ensure that the nation keeps a sufficient number of environmental "cops on the beat."

A New Chemical Policy in the U.S.: Protecting the Environment and Public Health

The best way to protect the public and the environment from toxic chemical discharges is to reduce the use and production of toxic chemicals in the first place. Reducing the use of toxic chemicals will not only reduce discharges to waterways, but can also reduce other forms of exposure to toxic chemicals, including releases to the air and land and exposure through consumer products.

Switching to Safer Alternatives

Safer alternatives exist for many toxic chemicals. Replacing these chemicals with safer alternatives can reduce threats at all stages of a product's lifespan—from manufacturing to use to disposal.

Many examples exist of safer alternatives to toxic chemicals released into America's waterways:

- Tetrachloroethylene (also known as perchloroethylene or perc) is a toxic solvent used in dry cleaning and textile processing and is a cancer-causing chemical.[43] Industrial facilities reported releasing more than 299 pounds of perc directly to U.S. waterways in 2010, but that figure does not include discharges by the thousands of smaller facilities nationwide that use the chemical but do not report to the TRI. Hundreds of dry cleaners across the country have switched to safer processes that do not rely on perc, including "wet" cleaning using water and the use of liquid carbon dioxide. With safer alternatives on the market, California has taken steps to phase out the use of perc at dry cleaners, with the chemical to be eliminated from use by 2023.[44]

- Formaldehyde is used in a wide variety of consumer products and has been linked to health effects ranging from allergies to cancer.[45] In 2010, industrial facilities reported releasing more than 191,000 pounds of formaldehyde to waterways. Safer alternatives for many uses of formaldehyde already exist, including adhesives based on non-toxic, natural ingredients.

- Phthalates are a class of chemicals used in hard plastics to make them flexible, as ingredients in personal care products, and in other applications. California has listed five phthalates as developmental and/or reproductive toxicants.[46] A wealth of safer alternatives exist, including plastics other than PVC (which typically includes phthalates) and alternative plasticizers for PVC.[47]

- Changes in industrial processes can reduce releases of toxic byproducts, such as dioxins. Oxygen-based processes, for example, can eliminate the need for chlorine bleaching in paper production, thereby eliminating the creation of dioxins.[48]

The importance of pursuing inherently safer alternatives, rather than relying solely on pollution controls at the end of the pipe, is demonstrated by coal-fired power plants. For decades, emissions from power plant smokestacks have been a major public health concern. In an effort to clean up the nation's air, power plants have increasingly been fitted with scrubbers that remove pollutants such as arsenic and heavy metals. However, these pollutants, once captured, can find their way into waterways, either via permitted liquid discharges from the plants themselves or the leaching of contaminants from coal ash into waterways.[49] The use of inherently safer alternatives—such as renewable energy—can reduce these threats.

Reforming Chemical Policy

Manufacturers, however, will face little incentive to develop and use safer alternatives to toxic chemicals without clear guidance from government. Chemical policy must be based both on appropriate science and on the imperative to protect the public from harmful exposures before they occur.

Among the cornerstones of this new chemical policy should be the following:

Regulation of chemicals based on their intrinsic hazards. America's system for testing and regulating toxic chemicals is based on time-consuming, resource-intensive and anachronistic forms of risk assessment. Much time and energy is wasted determining "safe" levels of exposure to toxic chemicals based on laboratory experimentation. These assessments often fail to investigate the impacts that chemical exposures can have on vulnerable populations or at vulnerable stages of development, nor do they assess the impact of cumulative exposures to a chemical over time, the synergistic effects of exposure to multiple chemicals, or the subtler potential impacts resulting from low-dose exposures. The result is that many chemicals with the potential to harm human health or the environment remain in use—and the process for evaluating all chemicals for safety is more difficult and time-consuming than it needs to be.

Instead, the United States should regulate chemicals based on their intrinsic hazards. That is, if evidence exists that a chemical causes cancer, for example, the presumption of public policy should be that public exposure to that chemical should be minimized, if not eliminated altogether.

Evaluation of all chemicals on the market. Chemical manufacturers should be required to test all of their chemicals for safety before they are put on the market. Manufacturers of existing chemicals should be required to disclose all relevant health and safety information to the public and to fill in the gaps in their health and safety assessments within a reasonable period of time.

Planned phase-out of hazardous chemicals. Once a chemical has been deemed hazardous, the goal of public policy should be to reduce, and then eliminate, exposures to that chemical. Chemicals for which safer alternatives already exist should be scheduled for phase out. Evaluations of safer alternatives should include not only the potential for chemical-for-chemical substitutions but also changes in manufacturing processes and product design that can reduce or eliminate the need for toxic chemicals. For chemicals for which safer alternatives do not yet exist, there should be strict limits on use and exposure to protect the public, as well as a targeted timeline for ultimate phase-out.

Required disclosure of industrial toxic chemical use. Facilities that use significant amounts of toxic chemicals should be required to disclose which chemicals they are using and in what amounts, so that nearby communities can be aware of potential threats and to create incentives for industrial facilities to reduce their use of toxic chemicals. In addition, facilities should be required to develop plans to reduce toxic chemical use and adopt safer alternatives. States such as Massachusetts and New Jersey that have aggressively adopted this pollution prevention approach have experienced declines in toxic chemical use, the creation of toxic byproducts, and toxic discharges to the environment.[50]

Setting clear standards designed to protect the public from toxic chemical exposures—and insisting upon the managed phase-out of dangerous chemicals—can unleash innovation in the design of safer products and industrial processes, while reducing threats to the public.

Methodology

The data and analysis in this report are based on 2010 data from the federal Toxics Release Inventory, as downloaded from the Environmental Protection Agency's Envirofacts database on 16 January 2012. The Toxics Release Inventory is frequently revised after the posting of the national public data release, which is the basis for this report. The most recently updated data can be found at EPA's TRI Explorer Web site at www.epa.gov/triexplorer/.

Totaling Toxic Releases by Waterway

Facilities reporting to TRI self-report the names of the waterways to which they release toxic substances. These waterway names are sometimes misspelled or inconsistent. Some facilities report releases to unidentified tributaries of other waterways. Moreover, many waterways cross state boundaries, such that total emissions to a waterway must be calculated for facilities in different states. The following procedures were used to "clean" the waterway names in the TRI database, assign discharges to the proper waterways, and to identify waterways that cross state boundaries.

1) Obvious spelling errors or differences in the formatting of waterways receiving discharges were repaired manually on a case-by-case basis. Waterways with the same name, in the same watershed (as determined using the USGS's Hydrological Unit Classification (HUC) system) were assumed to be the same waterway. Where two waterways with the same name were listed in different watersheds within a state (as determined using the USGS's Hydrological Unit Code (HUC) classification system), they were examined manually to determine if they were, in fact, the same waterway or two separate waterways of the same name.

2) Where TRI records indicated that a chemical was released to an unnamed tributary of another waterway, the releases were classified with those of the named waterway. In addition, where records indicated that releases reached a larger waterway via a smaller waterway, the releases were classified with the larger waterway.

3) Releases to waterways identified as "forks" or "branches" of a larger waterway were classified with the larger waterway (e.g. "West Fork of the Susquehanna River"). Releases to waterways identified as

"Little" or "Big" rivers (e.g. "Little Beaver River," "Beaver River") were classified separately.

4) Waterway names that were common across the boundaries of two adjacent states were identified and reviewed manually using the USGS's Hydrological Unit Classification system. In cases where it was clear that the waterways listed were either within the same hydrological unit in both states, or located in adjacent hydrological units in the two states, the waterway was assumed to cross state lines and discharges to that waterway from facilities in both states were summed. In cases in which it was unclear whether the discharges were to the same waterway, the discharges to the waterway(s) were listed separately by state.

Linking Toxic Chemicals with Health Effects

Chemicals were determined to cause cancer or developmental or reproductive disorders based on their presence on the state of California's Proposition 65 list of *Chemicals Known to the State to Cause Cancer or Reproductive Toxicity*, last updated on 3 February 2012. Chemicals on the Proposition 65 list were matched to those in the TRI database using their Chemical Abstracts Service (CAS) identification numbers. Several classes of chemicals (e.g. dioxins, various metal compounds) are not identified by CAS number—these chemical classes in the TRI database were linked to the Proposition 65 list by manual comparison. In some cases, a particular chemical compound was listed in the Proposition 65 database, but there was no corresponding listing of that particular compound in the TRI database. In these cases, it was assumed that every individual member of a TRI chemical class exhibited the health effects of the corresponding chemical from the Proposition 65 list. In some cases, we assumed that all compounds of a given substance (such as lead) exhibited the same health effects as the substance itself. Finally, some substances on the Proposition 65 list only cause health effects in particular chemical configurations. In cases where we could not determine the chemical configuration from the TRI database, we assumed that all releases exhibited the health effects of the corresponding chemical on the Proposition 65 list.

Chemicals in other classifications of substances analyzed in this report were identified as follows:

- Persistent bioaccumulative toxics were identified based on their presence on the EPA's list of PBTs requiring reporting at lower thresholds under TRI, obtained from U.S. EPA, *TRI PBT Chemical List*, downloaded from www.epa.gov/tri/trichemicals/pbt%20chemicals/pbt_chem_list.htm, 7 February 2012.

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Appendix: Detailed Data on Toxic Discharges to Waterways*

Table A-1: Toxic Discharges to Waterways by State, 2010

State	All toxic releases		Cancer-causing chemicals		Developmental toxics		Reproductive toxics	
	Releases (lb.)	Rank	Releases (lb.)	Rank	Releases (lb.)	Rank	Releases (lb.)	Rank
Indiana	27,384,933	1	24,774	16	17,257	8	11,332	7
Virginia	18,078,000	2	21,396	19	16,821	9	7,388	11
Nebraska	14,727,942	3	352	41	362	36	328	36
Texas	14,325,126	4	61,810	5	25,486	5	24,722	3
Georgia	12,620,709	5	61,479	6	5,164	18	4,415	15
Louisiana	10,903,183	6	194,477	2	74,439	3	70,865	2
Pennsylvania	10,121,165	7	26,064	14	7,007	17	5,697	13
Alabama	9,857,668	8	131,738	3	19,207	7	10,180	9
Ohio	9,192,337	9	43,739	12	27,744	4	19,325	4
North Carolina	9,168,645	10	48,547	10	10,508	13	3,117	17
Illinois	8,835,506	11	13,520	23	7,364	16	6,910	12
New Jersey	8,492,919	12	14,476	22	2,169	26	2,349	22
Kentucky	6,605,678	13	54,735	9	21,175	6	12,777	5
Mississippi	6,302,787	14	21,673	18	1,683	28	1,601	27
Iowa	6,212,757	15	15,029	21	2,366	23	2,362	20
New York	5,777,340	16	22,126	17	4,099	19	2,886	19
South Carolina	4,263,813	17	102,778	4	2,482	22	2,204	23
Arkansas	3,932,819	18	60,266	7	2,173	25	2,144	24
Oklahoma	3,779,744	19	7,030	28	3,001	20	2,998	18
Maine	3,182,302	20	12,604	24	1,958	27	1,956	25
South Dakota	3,002,973	21	651	37	664	34	651	32
Tennessee	2,797,594	22	44,866	11	12,232	10	9,890	10
Wisconsin	2,759,986	23	6,607	29	1,552	29	1,543	28
California	2,617,138	24	2,999	32	965	32	961	31
Idaho	2,502,016	25	11,611	26	313	39	312	38
West Virginia	2,237,603	26	17,095	20	96,171	2	92,867	1
Michigan	2,166,048	27	8,727	27	7,604	14	3,317	16
Missouri	2,043,474	28	12,063	25	12,023	11	10,664	8
Florida	1,639,420	29	56,197	8	2,743	21	1,836	26
Oregon	1,557,035	30	25,125	15	2,351	24	2,351	21
Washington	1,521,432	31	38,923	13	7,603	15	5,638	14
Minnesota	1,455,401	32	1,200	36	336	38	336	35

* Data in this section revised May 2012.

Table A-1: Toxic Discharges to Waterways by State, 2010 (cont'd)

State	All toxic releases		Cancer-causing chemicals		Developmental toxics		Reproductive toxics	
	Releases (lb.)	Rank	Releases (lb.)	Rank	Releases (lb.)	Rank	Releases (lb.)	Rank
Maryland	1,362,561	33	1,359	34	713	33	646	33
Nevada	1,293,701	34	315,147	1	204,885	1	0	49
Colorado	720,881	35	25	48	25	48	22	46
Delaware	600,283	36	1,760	33	1,482	30	1,427	29
Hawaii	452,359	37	403	40	63	44	58	42
Connecticut	297,505	38	1,290	35	290	40	289	39
Kansas	246,968	39	352	42	11,557	12	11,556	6
Montana	237,165	40	58	45	13	50	11	48
Alaska	190,257	41	204	43	142	42	129	41
Vermont	122,487	42	0	50	214	41	0	49
Utah	102,145	43	3,211	31	1,418	31	1,073	30
North Dakota	91,044	44	597	38	496	35	466	34
New Mexico	50,801	45	181	44	140	43	140	40
Wyoming	13,792	46	21	49	20	49	20	47
Massachusetts	6,957	47	4,561	30	345	37	325	37
New Hampshire	1,798	48	57	46	35	46	35	44
Arizona	1,619	49	533	39	52	45	46	43
District of Columbia	1,068	50	0	50	0	51	0	49
Rhode Island	779	51	26	47	34	47	22	45

Table A-2. Top 50 Waterways for Total Toxic Releases, 2010

Waterway	Toxic Releases (lbs.)	Rank
Ohio River (IL, IN, KY, OH, PA, WV)	32,116,310	1
Mississippi River (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	12,746,057	2
New River (NC, VA)	12,070,494	3
Savannah River (GA, SC)	9,627,865	4
Delaware River (DE, NJ, PA)	6,720,991	5
Muskingum River (OH)	5,755,618	6
Missouri River (IA, KS, MO, ND, NE)	4,842,275	7
Shonka Ditch (NE)	4,614,722	8
Tricounty Canal (NE)	3,386,412	9
Rock River (IL, WI)	3,370,652	10
Cape Fear River (NC)	3,364,823	11
Illinois River (IL)	3,206,211	12
Big Sioux River (SD)	2,949,940	13
Tennessee River (AL, KY, TN)	2,812,843	14
Roanoke River (NC, VA)	2,762,330	15
Houston Ship Channel (TX)	2,715,239	16
Monongahela River (PA, WV)	2,627,192	17
Snake River (ID, OR)	2,491,684	18
Morses Creek (NJ)	2,409,387	19
Aroostook River (ME)	2,271,733	20
Grand Calumet River (IN)	2,012,998	21
Big Blue River (NE)	2,001,553	22
Parker Creek (VA)	1,964,000	23
Hudson River (NJ, NY)	1,667,999	24
Kalamazoo River (MI)	1,647,360	25
Brazos River (TX)	1,558,414	26
Cottonwood Branch (TX)	1,533,000	27
Corpus Christi Inner Harbor (TX)	1,497,542	28
Arkansas River (AR, CO, KS, OK)	1,474,020	29
Tankersley Creek (TX)	1,452,257	30
Tehuscana Creek (TX)	1,438,000	31
Genesee River (NY)	1,393,996	32
Seneca River (NY)	1,383,423	33
Sipsey Creek (MS)	1,339,293	34
Grand Neosho River (OK)	1,310,621	35
Wisconsin River (WI)	1,277,510	36
Graves Creek (AL)	1,276,298	37
Hyde Run Ditch (OH)	1,246,449	38
Little Attapulgus Creek (GA)	1,234,500	39
Willamette River (OR)	1,208,155	40
Wateree River (SC)	1,206,878	41

Table A-2. Top 50 Waterways for Total Toxic Releases, 2010 (cont'd.)

Waterway	Toxic Releases (lbs.)	Rank
Alabama River (AL)	1,158,007	42
Sandy Bottom Branch (VA)	1,154,357	43
Tombigbee River (AL)	1,150,458	44
James River (VA)	1,144,239	45
Little River (OK)	1,143,858	46
Des Moines River (IA)	1,141,003	47
San Pablo Bay (CA)	1,090,256	48
Schuylkill River (PA)	1,043,922	49
Susquehanna River (NY, PA)	1,036,108	50

Table A-3 Top 50 Waterways for Releases of Cancer-Causing Chemicals, 2010

Waterway	Releases of Cancer-causing Chemicals (lbs.)	Rank
BURNS CREEK (NV)	198,152	1
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	181,697	2
MILL CREEK (NV)	85,150	3
OHIO RIVER (IL, IN, KY, OH, PA, WV)	69,398	4
TENNESSEE RIVER (AL, KY, TN)	62,393	5
COOPER RIVER (SC)	45,327	6
RED RIVER (AR, LA, OK)	38,552	7
SAMPIT RIVER (SC)	34,407	8
AMELIA RIVER (FL)	33,824	9
ALABAMA RIVER (AL)	31,906	10
WINTERS CREEK (NV)	31,826	11
COLUMBIA RIVER (OR, WA)	27,557	12
PEARL RIVER (LA, MS)	24,097	13
OUACHITA RIVER (AR, LA)	21,782	14
BRAZOS RIVER (TX)	21,069	15
ARKANSAS RIVER (AR, CO, KS, OK)	19,687	16
HOLSTON RIVER (TN)	19,450	17
LAKE CHAMPLAIN (NY)	15,963	18
CHATTAHOOCHEE RIVER (AL, GA)	15,550	19
WHEELER RESERVOIR (AL)	14,841	20
DELAWARE RIVER (DE, NJ, PA)	14,805	21
TURTLE RIVER (GA)	14,300	22
SAVANNAH RIVER (GA, SC)	13,982	23
DAN RIVER (NC)	13,253	24
TOMBIGBEE RIVER (AL)	12,319	25
SNAKE RIVER (ID, OR)	11,335	26
WILLAMETTE RIVER (OR)	10,691	27
CAPE FEAR RIVER (NC)	9,920	28
ROANOKE RIVER (NC, VA)	9,811	29
NECHES RIVER (TX)	8,944	30
ALTAMAHA RIVER (GA)	8,801	31
CONECUH/ESCAMBIA RIVER (AL)	8,574	32
FENHOLLOWAY RIVER (FL)	8,426	33
PORT TOWNSEND BAY (WA)	7,451	34
CATAWBA RIVER (NC, SC)	7,274	35
ST. CROIX RIVER (ME)	7,000	36
PUGET SOUND (WA)	6,958	37
BEAVER CHANNEL (IA)	6,917	38
GREAT PEE DEE RIVER (SC)	6,757	39
COOSA RIVER (AL, GA)	6,634	40
YORK RIVER (VA)	6,524	41
LAKE ERIE (MI, NY, OH, PA)	6,407	42
PAINT CREEK (OH)	6,364	43
PIGEON RIVER (NC, TN)	5,423	44
MUSKINGUM RIVER (OH)	5,136	45
HOUSTON SHIP CHANNEL (TX)	5,011	46
CLARION RIVER (PA)	4,997	47
ELEVEN MILE CREEK (FL)	4,946	48
HERRINGTON LAKE (KY)	4,706	49
PACIFIC OCEAN (CA, HI, OR, WA)	4,468	50

Table A-4. Top 50 Waterways for Releases of Developmental Toxics, 2010

Waterway	Releases of Developmental Toxics (lbs.)	Rank
BURNS CREEK (NV)	123,081	1
KANAWHA RIVER (WV)	86,296	2
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	74,549	3
MILL CREEK (NV)	49,964	4
OHIO RIVER (IL, IN, KY, OH, PA, WV)	46,816	5
WINTERS CREEK (NV)	31,826	6
KANSAS RIVER (KS)	10,485	7
BRAZOS RIVER (TX)	10,404	8
JAMES RIVER (VA)	9,432	9
TENNESSEE RIVER (AL, KY, TN)	7,430	10
CAPE FEAR RIVER (NC)	7,124	11
GALVESTON BAY (TX)	4,415	12
HERRINGTON LAKE (KY)	4,122	13
COOSA RIVER (AL, GA)	4,013	14
LAKE ERIE (MI, NY, OH, PA)	3,983	15
COLUMBIA RIVER (OR, WA)	3,714	16
CROOKED CREEK (MO)	3,455	17
BEE FORK CREEK (MO)	3,346	18
ALABAMA RIVER (AL)	3,332	19
BLOCKHOUSE HOLLOW RUN (OH)	3,310	20
ARKANSAS RIVER (AR, CO, KS, OK)	3,132	21
MUSKINGUM RIVER (OH)	3,122	22
HOLSTON RIVER (TN)	3,103	23
EVERETT HARBOR (WA)	2,703	24
TOMBIGBEE RIVER (AL)	2,666	25
DELAWARE RIVER (DE, NJ, PA)	2,587	26
CHATTAHOOCHEE RIVER (AL, GA)	2,561	27
CORPUS CHRISTI BAY (TX)	2,222	28
LAKE MICHIGAN (IL, IN, MI, WI)	2,065	29
GENESEE RIVER (NY)	2,037	30
WABASH RIVER (IN, IL)	2,024	31
PACIFIC OCEAN (CA, HI, OR, WA)	1,996	32
ROUGE RIVER (MI)	1,987	33
CUYAHOGA RIVER (OH)	1,897	34
CLINCH RIVER (TN, VA)	1,835	35
MISSOURI RIVER (IA, KS, MO, ND, NE)	1,803	36
WARRIOR RIVER (AL)	1,776	37
MONONGAHELA RIVER (PA, WV)	1,619	38
CUMBERLAND RIVER (KY, TN)	1,594	39
KASKASKIA RIVER (IL)	1,527	40
LITTLE CALUMET RIVER (IL, IN)	1,517	41
MOBILE RIVER (AL)	1,448	42
GREAT SALT LAKE (UT)	1,375	43
CONNER RUN (WV)	1,353	44
GRAVELLY RUN (VA)	1,340	45
YORK RIVER (VA)	1,320	46
OUACHITA RIVER (AR, LA)	1,229	47
BILLS CREEK (MO)	1,210	48
INDIANA HARBOR SHIP CANAL (IN)	1,131	49
RED RIVER (AR, LA, OK)	1,127	50

Table A-5. Top 50 Waterways for Releases of Reproductive Toxics, 2010

Waterway	Releases of Reproductive Toxics (lbs.)	Rank
KANAWHA RIVER (WV)	85,653	1
MISSISSIPPI RIVER (AR, IA, IL, KY, LA, MN, MO, MS, TN, WI)	70,934	2
OHIO RIVER (IL, IN, KY, OH, PA, WV)	36,505	3
BRAZOS RIVER (TX)	12,870	4
KANSAS RIVER (KS)	10,485	5
TENNESSEE RIVER (AL, KY, TN)	5,342	6
GALVESTON BAY (TX)	4,415	7
BEE FORK CREEK (MO)	3,346	8
CROOKED CREEK (MO)	3,309	9
ALABAMA RIVER (AL)	3,282	10
ARKANSAS RIVER (AR, CO, KS, OK)	3,110	11
EVERETT HARBOR (WA)	2,700	12
DELAWARE RIVER (DE, NJ, PA)	2,510	13
CHATTAHOOCHEE RIVER (AL, GA)	2,240	14
LAKE MICHIGAN (IL, IN, MI, WI)	2,041	15
HOLSTON RIVER (TN)	2,006	16
PACIFIC OCEAN (CA, HI, OR, WA)	1,991	17
CUYAHOGA RIVER (OH)	1,896	18
LAKE ERIE (MI, NY, OH, PA)	1,847	19
MUSKINGUM RIVER (OH)	1,814	20
COLUMBIA RIVER (OR, WA)	1,805	21
LITTLE CALUMET RIVER (IL, IN)	1,517	22
MONONGAHELA RIVER (PA, WV)	1,502	23
KASKASKIA RIVER (IL)	1,457	24
CUMBERLAND RIVER (KY, TN)	1,366	25
GRAVELLY RUN (VA)	1,340	26
CLINCH RIVER (TN, VA)	1,300	27
OUACHITA RIVER (AR, LA)	1,228	28
BILLS CREEK (MO)	1,210	29
TOMBIGBEE RIVER (AL)	1,142	30
INDIANA HARBOR SHIP CANAL (IN)	1,131	31
RED RIVER (AR, LA, OK)	1,124	32
YORK RIVER (VA)	1,104	33
WARRIOR RIVER (AL)	1,049	34
GREAT SALT LAKE (UT)	1,029	35
STROTHER CREEK (MO)	1,001	36
SAVANNAH RIVER (GA, SC)	995	37
MORSES CREEK (NJ)	991	38
ILLINOIS RIVER (IL)	989	39
CALCASIEU RIVER (LA)	969	40
LAKE SINCLAIR (GA)	900	41
WALNUT RIVER (KS)	872	42
GENESEE RIVER (NY)	838	43
CAPE FEAR RIVER (NC)	832	44
WOOD RIVER (IL)	804	45
WISCONSIN RIVER (WI)	785	46
LITTLE NIXON CREEK (TN)	760	47
CEDAR RIVER (IA)	731	48
NECHES RIVER (TX)	717	49
GRAND CALUMET RIVER (IN)	684	50

Table A-6: Top Watersheds by Releases of All Toxic Chemicals in 2010

Watershed	Toxic Releases (lbs.)	Rank
Lower Ohio-Little Pigeon. Indiana.	24,450,588	1
Upper New. North Carolina, Virginia.	12,006,609	2
Middle Savannah. Georgia, South Carolina.	6,172,314	3
Muskingum. Ohio.	5,787,144	4
Cohansey-Maurice. New Jersey.	5,354,987	5
Blackbird-Soldier. Iowa, Nebraska.	4,727,380	6
Lower Platte-Shell. Nebraska.	4,623,017	7
Lower Savannah. Georgia, South Carolina.	3,465,170	8
Middle Platte-Buffalo. Nebraska.	3,386,537	9
Middle Ohio-Laughery. Indiana, Kentucky, Ohio.	3,336,162	10
Lower Rock. Illinois, Wisconsin.	3,290,686	11
Bayou Sara-Thompson. Louisiana, Mississippi.	3,147,945	12
Eastern Lower Delmarva. Virginia.	3,118,357	13
Lower Big Sioux. Iowa, Minnesota, South Dakota.	2,949,940	14
Lower Illinois. Illinois.	2,812,570	15
Lower Roanoke. North Carolina.	2,762,301	16
Lumber. North Carolina, South Carolina.	2,743,689	17
Lower Monongahela. Pennsylvania, West Virginia.	2,617,727	18
Buffalo-San Jacinto. Texas.	2,519,168	19
Little Calumet-Galien. Illinois, Indiana, Michigan.	2,464,189	20
Sandy Hook-Staten Island. New Jersey, New York.	2,417,862	21
Lake Walcott. Idaho.	2,299,380	22
Meduxnekeag. Maine.	2,271,733	23
Upper Pearl. Mississippi.	2,186,994	24
Lower Mississippi-Baton Rouge. Louisiana.	2,094,253	25
Middle Big Blue. Nebraska.	2,001,438	26
Schuylkill. Pennsylvania.	1,850,514	27
Flint-Henderson. Illinois, Iowa.	1,794,858	28
Upper Susquehanna-Tunkhannock. Pennsylvania.	1,711,983	29
East Central Louisiana Coastal. Louisiana.	1,706,474	30
Lower Iowa. Iowa.	1,691,343	31
Kalamazoo. Michigan.	1,656,576	32
Upper Ohio-Shade. Ohio, West Virginia.	1,573,128	33
Hudson-Hoosic. New York, Massachusetts, Vermont.	1,567,730	34
Lower Brazos-Little Brazos. Texas.	1,533,151	35
South Corpus Christi Bay. Texas.	1,532,770	36
Upper Ohio. Ohio, Pennsylvania, West Virginia.	1,490,086	37
Lake O the Pines. Texas.	1,485,297	38
Middle Brazos-Lake Whitney. Texas.	1,438,024	39
Seneca. New York.	1,395,344	40
Lower Genesee. New York.	1,394,006	41
Wheeler Lake. Alabama,Tennessee.	1,384,624	42
Lower Neosho. Arkansas, Oklahoma.	1,310,621	43
Upper Leaf. Mississippi.	1,301,219	44
Middle Green. Kentucky.	1,294,447	45
Upper Humboldt. Nevada.	1,293,527	46
Locust. Alabama.	1,287,866	47
Cedar-Portage. Ohio.	1,282,822	48
Lower Ochlockonee. Florida, Georgia.	1,234,500	49
Wateree. South Carolina.	1,207,525	50

Table A-7: Top 50 Watersheds for Releases of Cancer-Causing Chemicals, 2010

Watershed	Releases of Cancer-causing Chemicals (lbs.)	Rank
Upper Humboldt. Nevada.	315,128	1
Lower Mississippi-Baton Rouge. Louisiana.	109,508	2
Cooper. South Carolina.	46,671	3
Wheeler Lake. Alabama,Tennessee.	43,945	4
Carolina Coastal-Sampit. North Carolina, South Carolina	34,565	5
St Marys. Florida, Georgia.	33,824	6
Lower Brazos. Texas.	20,496	7
East Central Louisiana Coastal. Louisiana.	20,107	8
Lower Columbia-Clatskanie. Oregon, Washington.	20,052	9
Lower Little Arkansas, Oklahoma.	19,514	10
South Fork Holston. Tennessee, Virginia.	19,477	11
Lake George. New York, Vermont.	15,963	12
Lower Alabama. Alabama.	15,098	13
Pickwick Lake. Alabama, Mississippi, Tennessee.	14,922	14
Lower Arkansas-Maumelle. Arkansas.	14,623	15
Cumberland-St. Simons. Georgia.	14,300	16
Middle Pearl-Silver. Mississippi.	13,918	17
Silver-Little Kentucky. Indiana, Kentucky.	13,736	18
Lower Ohio-Little Pigeon. Indiana.	13,554	19
Middle Ohio-Laughery. Indiana, Kentucky, Ohio.	13,271	20
Upper Dan. North Carolina, Virginia.	13,254	21
Upper Ohio-Shade. Ohio, West Virginia.	13,223	22
Bayou Pierre. Louisiana.	13,068	23
Bayou Macon. Arkansas, Louisiana.	12,822	24
Bayou De Chien-Mayfield. Kentucky, Tennessee.	12,596	25
Copperas-Duck. Illinois, Iowa.	12,517	26
Lower Savannah. Georgia, South Carolina.	11,457	27
Clearwater. Idaho, Washington.	11,317	28
Upper Alabama. Alabama.	11,303	29
Puget Sound. Washington.	11,302	30
Lower Ouachita-Bayou De Loutre. Arkansas, Louisiana.	10,834	31
Lower Ouachita. Louisiana.	10,731	32
Upper Black. Arkansas, Missouri.	10,564	33
Upper Willamette. Oregon.	10,535	34
Cohansey-Maurice. New Jersey.	10,420	35
Lower Pearl. Louisiana, Mississippi.	10,159	36
Bayou Sara-Thompson. Louisiana, Mississippi.	10,011	37
Lower Roanoke. North Carolina.	9,808	38
Lower Chattahoochee. Alabama, Florida, Georgia.	9,467	39
Upper Ohio. Ohio, Pennsylvania, West Virginia.	9,378	40
Lower Tennessee-Beech. Mississippi, Tennessee.	9,366	41
Lower Cape Fear. North Carolina.	9,217	42
Lower Neches. Texas.	9,039	43
Altamaha. Georgia.	8,801	44
Lower Conecuh. Alabama, Florida.	8,594	45
Econfina-Steinhatchee. Florida.	8,426	46
Middle Tombigbee-Chickasaw. Alabama, Mississippi.	7,662	47
Muskingum. Ohio.	7,403	48
Lower St. Johns. Florida.	7,275	49
St. Croix. Maine.	7,000	50

Table A-8: Top 50 Watersheds for Releases of Developmental Toxics, 2010

Watershed	Releases of Developmental Toxics (lbs.)	Rank
Upper Humboldt. Nevada.	204,876	1
Lower Kanawha. West Virginia.	87,264	2
Lower Mississippi-Baton Rouge. Louisiana.	63,535	3
Upper Ohio-Shade. Ohio, West Virginia.	10,747	4
Lower James. Virginia.	10,744	5
Middle Kansas. Kansas.	10,498	6
Upper Black. Arkansas, Missouri.	10,096	7
Lower Brazos. Texas.	9,976	8
Middle Ohio-Laughery. Indiana, Kentucky, Ohio.	9,847	9
Lower Ohio-Little Pigeon. Indiana.	8,947	10
Upper Ohio. Ohio, Pennsylvania, West Virginia.	7,669	11
Silver-Little Kentucky. Indiana, Kentucky.	6,320	12
Northeast Cape Fear. North Carolina.	5,668	13
Little Calumet-Galien. Illinois, Indiana, Michigan.	5,446	14
Upper Ohio-Wheeling. Ohio, Pennsylvania, West Virginia.	4,769	15
West Galveston Bay. Texas.	4,434	16
Lower Kentucky. Kentucky.	4,303	17
Ottawa-Stony. Michigan, Ohio.	3,493	18
Lower Columbia-Clatskanie. Oregon, Washington.	3,487	19
Puget Sound. Washington.	3,375	20
Muskingum. Ohio.	3,224	21
Lower Coosa. Alabama.	3,133	22
South Fork Holston. Tennessee, Virginia.	3,130	23
Polecat-Snake. Oklahoma.	2,665	24
Upper Alabama. Alabama.	2,545	25
Ohio Brush-Whiteoak. Kentucky, Ohio.	2,516	26
South Corpus Christi Bay. Texas.	2,459	27
Lower Tombigbee. Alabama.	2,448	28
Mattaponi. Virginia.	2,438	29
Guntersville Lake. Alabama, Georgia, Tennessee.	2,426	30
Detroit. Michigan.	2,239	31
Kentucky Lake. Kentucky, Tennessee.	2,150	32
Cuyahoga. Ohio.	2,067	33
Lower Grand. Louisiana.	2,062	34
Lower Genesee. New York.	2,046	35
Cahokia-Joachim. Illinois, Missouri.	1,948	36
Siletz-Yaquina. Oregon.	1,928	37
East Central Louisiana Coastal. Louisiana.	1,907	38
Peruque-Piasa. Illinois, Missouri.	1,824	39
Buffalo-San Jacinto. Texas.	1,821	40
Powell. Tennessee.	1,768	41
Lower Mississippi-New Orleans. Louisiana.	1,745	42
Upper Tallapoosa. Alabama, Georgia.	1,725	43
Middle Wabash-Busseron. Illinois, Indiana.	1,638	44
Lower Kaskaskia. Illinois.	1,530	45
Lower Tennessee-Beech. Mississippi, Tennessee.	1,521	46
Lower Monongahela. Pennsylvania, West Virginia.	1,509	47
Lower Cape Fear. North Carolina.	1,469	48
Mobile-Tensaw. Alabama.	1,456	49
Jordan. Utah.	1,397	50

Table A-9: Top 50 Watersheds for Releasess of Reproductive Toxics, 2010

Watershed	Releases of Reproductive Toxics (lbs.)	Rank
Lower Kanawha. West Virginia.	85,721	1
Lower Mississippi-Baton Rouge. Louisiana.	61,727	2
Lower Brazos. Texas.	12,767	3
Middle Kansas. Kansas.	10,498	4
Upper Ohio-Shade. Ohio, West Virginia.	10,415	5
Upper Black. Arkansas, Missouri.	9,950	6
Lower Ohio-Little Pigeon. Indiana.	7,481	7
Upper Ohio. Ohio, Pennsylvania, West Virginia.	7,417	8
Little Calumet-Galien. Illinois, Indiana, Michigan.	5,337	9
Silver-Little Kentucky. Indiana, Kentucky.	5,217	10
Middle Ohio-Laughery. Indiana, Kentucky, Ohio.	4,670	11
West Galveston Bay. Texas.	4,433	12
Puget Sound. Washington.	3,371	13
Polecat-Snake. Oklahoma.	2,664	14
Upper Alabama. Alabama.	2,496	15
Mattaponi. Virginia.	2,438	16
South Fork Holston. Tennessee, Virginia.	2,031	17
Cuyahoga. Ohio.	1,946	18
Cahokia-Joachim. Illinois, Missouri.	1,942	19
Siletz-Yaquina. Oregon.	1,928	20
Kentucky Lake. Kentucky, Tennessee.	1,920	21
Muskingum. Ohio.	1,907	22
Lower Mississippi-New Orleans. Louisiana.	1,744	23
Lower James. Virginia.	1,733	24
East Central Louisiana Coastal. Louisiana.	1,595	25
Lower Columbia-Clatskanie. Oregon, Washington.	1,566	26
Peruque-Piasa. Illinois, Missouri.	1,565	27
Buffalo-San Jacinto. Texas.	1,546	28
Lower Tennessee-Beech. Mississippi, Tennessee.	1,520	29
Lower Kaskaskia. Illinois.	1,460	30
Lower Monongahela. Pennsylvania, West Virginia.	1,453	31
Upper Tallapoosa. Alabama, Georgia.	1,415	32
Ottawa-Stony. Michigan, Ohio.	1,359	33
Powell. Tennessee.	1,306	34
Brandywine-Christina. Delaware, Maryland, Pennsylvania.	1,214	35
York. Virginia.	1,104	36
Lower Calcasieu. Louisiana.	1,062	37
Jordan. Utah.	1,052	38
Bayou Sara-Thompson. Louisiana, Mississippi.	1,047	39
Lower Ouachita. Louisiana.	1,026	40
Sandy Hook-Staten Island. New Jersey, New York.	1,025	41
Mulberry. Alabama.	990	42
Middle Cedar. Iowa.	948	43
Wheeler Lake. Alabama,Tennessee.	932	44
Lower Tombigbee. Alabama.	924	45
Cohansey-Maurice. New Jersey.	924	46
Upper Oconee. Georgia.	906	47
Upper Walnut River. Kansas.	872	48
Lower Grand. Louisiana.	847	49
Lower Genesee. New York.	847	50

Table A-10: Top Facilities by Releases of All Toxic Chemicals in 2010

Facility Name	State	Owner	Toxic Releases (lb.)	Waterways Affected	Rank
AK STEEL CORP (ROCKPORT WORKS)	IN	AK STEEL CORP	24,305,396	Ohio River	1
US ARMY RADFORD ARMY AMMUNITION PLANT	VA	US DEPARTMENT OF DEFENSE	12,006,602	New River	2
AK STEEL CORP COSHOCTON WORKS	OH	AK STEEL CORP	5,500,750	Muskingum River	3
DUPONT CHAMBERS WORKS	NJ	E I DU PONT DE NEMOURS & CO INC	5,354,113	Delaware River	4
TYSON FRESH MEATS INC WWTP	NE	TYSON FOODS INC	4,623,500	Missouri River	5
CARGILL MEAT SOLUTIONS CORP	NE	CARGILL INC	4,614,722	Shonka Ditch	6
DSM CHEMICALS NORTH AMERICA INC	GA	DSM HOLDING CO INC	4,527,472	Savannah River	7
TYSON FRESH MEATS INC	NE	TYSON FOODS INC	3,386,412	Tricounty Canal	8
TYSON FRESH MEATS INC - JOSLIN IL	IL	TYSON FOODS INC	3,290,330	Rock River	9
NORTH AMERICAN STAINLESS	KY	ACERINOX SA	3,206,744	Ohio River	10
JOHN MORRELL & CO	SD	THE SMITHFIELD FOODS INC	2,949,940	Big Sioux River	11
EXXONMOBIL REFINING & SUPPLY BATON ROUGE REFINERY	LA	EXXON MOBIL CORP	2,833,713	Mississippi River	12
CARGILL MEAT SOLUTIONS CORP	IL	CARGILL INC	2,811,787	Illinois River	13
SMITHFIELD PACKING CO INC TAR HEEL DIV	NC	THE SMITHFIELD FOODS INC	2,743,689	Cape Fear River	14
LEWISTON PROCESSING PLANT	NC	PERDUE FARMS INC	2,530,906	Roanoke River	15
USS - CLAIRTON WORKS	PA	US STEEL CORP	2,415,233	Monongahela River, Peters Creek	16
BASF CORP - SAVANNAH OPERATIONS	GA	BASF CORP	2,415,000	Savannah River	17
CONOCOPHILLIPS CO - BAYWAY REFINERY	NJ	CONOCOPHILLIPS	2,403,408	Morses Creek	18
MCCAIN FOODS USA	ID	MCCAIN FOODS USA INC	2,299,380	Snake River	19
MCCAIN FOODS USA INC	ME	MCCAIN FOODS USA INC	2,271,733	Aroostook River	20
USS GARY WORKS	IN	US STEEL CORP	2,021,582	Grand Calumet River, Lake Michigan	21
ACCOMAC PROCESSING PLANT	VA	PERDUE FARMS INC	1,964,000	Parker Creek	22
FARMLAND FOODS INC	NE	FARMLAND FOODS INC	1,739,613	Big Blue River	23

Table A-10: Top Facilities by Releases of All Toxic Chemicals in 2010

Facility Name	State	Owner	Toxic Releases (lb.)	Waterways Affected	Rank
ROQUETTE AMERICA INC	IA	ROQUETTE FRERES	1,704,810	Mississippi River	24
TYSON FRESH MEATS INC	IA	TYSON FOODS INC	1,691,335	Cedar River, Iowa River	25
JBS PLAINWELL	MI	JBS USA	1,646,574	Chart Creek, Kalamazoo River	26
SANDERSON FARMS INC	TX	SANDERSON FARMS INC	1,533,000	Cottonwood Branch	27
FINCH PAPER LLC	NY	FINCH PAPER HOLDINGS	1,480,125	Hudson River	28
PILGRIM'S PRIDE CORP MT PLEASANT COMPLEX	TX	PILGRIMS PRIDE CORP	1,452,257	Tankersley Creek	29
SANDERSON FARMS INC	TX	SANDERSON FARMS INC	1,438,000	Tehuscana Creek	30
CF INDUSTRIES INC	LA	CF INDUSTRIES HOLDINGS INC	1,415,463	Mississippi River	31
EASTMAN KODAK CO EASTMAN BUSINESS PARK	NY	EASTMAN KODAK CO	1,393,986	Genesee River, Paddy Hill Creek	32
ANHEUSER-BUSCH INC	NY	ANHEUSER-BUSCH INBEV	1,383,423	Seneca River	33
PECO FOODS INC	MS	PECO FOODS INC	1,339,293	Sipsey Creek	34
PRYOR SOLAE	OK	E I DU PONT DE NEMOURS & CO INC	1,310,452	Grand Neosho River	35
JERRITT CANYON MINE	NV	YUKON NEVADA GOLD	1,293,522	Burns Creek, Mill Creek, Winters Creek	36
TYSON FOODS INC BLOUNTSVILLE PROCESSING PLANT	AL	TYSON FOODS INC	1,276,298	Graves Creek	37
MATERION BRUSH INC	OH	MATERION INC	1,246,454	Hyde Run Ditch, Portage River	38
BASF CORP ATTAPULGUS OPS	GA	BASF CORP	1,234,500	Little Attapulgus Creek	39

Table A-10: Top Facilities by Releases of All Toxic Chemicals in 2010

Facility Name	State	Owner	Toxic Releases (lb.)	Waterways Affected	Rank
ASCEND PERFORMANCE MATERIALS LLC - DECATUR PLANT	AL	SK CAPITAL PARTNERS	1,175,356	Tennessee River	40
TYSON FOODS INC - TEMPERANCEVILLE	VA	TYSON FOODS INC	1,154,357	Sandy Bottom Branch	41
TYSON FOODS INC BROKEN BOW PROCESSING PLANT	OK	TYSON FOODS INC	1,143,842	Little River	42
JEWEL ACQUISITION LLC - MIDLAND PLANT	PA	ALLEGHENY TECHNOLOGIES INC	1,111,055	Ohio River	43
CARGILL MEAT SOLUTIONS CORP	IA	CARGILL INC	1,084,503	Des Moines River	44
CARPENTER TECHNOLOGY CORP	PA	(none listed)	1,034,654	Schuylkill River	45
INVISTA SARL CAMDEN MAY PLANT	SC	KOCH INDUSTRIES INC	1,032,712	Wateree River	46
BABCOCK & WILCOX NUCLEAR OPERATIONS GROUP	VA	BABCOCK & WILCOX CO INC	1,025,859	James River	47
CONOCOPHILLIPS SAN FRANCISCO REFINERY	CA	CONOCOPHILLIPS	1,006,498	San Pablo Bay	48
PCS NITROGEN FERTILIZER LP	LA	PCS NITROGEN FERTILIZER LP	962,909	Mississippi River	49
PILGRIM'S PRIDE CORP SANFORD FACILITY	NC	PILGRIMS PRIDE CORP	938,647	Deep Creek	50

Table A-11: Top Discharging Facility by State, All Toxic Chemicals, 2010

State	Facility	Owner	Toxic Releases (lbs.)	Waterways Affected
Alabama	TYSON FOODS INC BLOUNTSVILLE PROCESSING PLANT	TYSON FOODS INC	1,276,298	Graves Creek
Alaska	POGO MINE	SUMITOMO METAL MINING AMERICA INC	180,240	Goodpaster River
Arizona	FREEPORT-MCMORAN MIAMI INC	FREEPORT MCMORAN COPPER & GOLD	1,277	Lower Pinal Creek
Arkansas	TYSON FOODS HOPE PROCESSING PLANT	TYSON FOODS INC	689,475	Caney Creek
California	CONOCOPHILLIPS SAN FRANCISCO REFINERY	CONOCOPHILLIPS	1,006,498	San Pablo Bay
Colorado	CARGILL MEAT SOLUTIONS CORP	CARGILL INC	235,217	South Platte River
Connecticut	CYTEC INDUSTRIES INC	CYTEC INDUSTRIES INC	140,424	Quinnipiac River
Delaware	DELAWARE CITY REFINERY	PBF ENERGY	380,082	Delaware River
District of Columbia	US ARMY CORPS OF ENGINEERS MCMILLAN WTP WASHINGTON AQUEDUCT	US DEPARTMENT OF DEFENSE	1,067	Potomac River
Florida	PILGRIM'S PRIDE PROCESSING PLANT	PILGRIMS PRIDE CORP	623,050	Suwannee River
Georgia	DSM CHEMICALS NORTH AMERICA INC	DSM HOLDING CO INC	4,527,472	Savannah River
Hawaii	JOINT BASE PEARL HARBOR-HICKAM HAWAII	US DEPARTMENT OF DEFENSE	380,000	Pacific Ocean
Idaho	MCCAIN FOODS USA	MCCAIN FOODS USA INC	2,299,380	Snake River
Illinois	TYSON FRESH MEATS INC - JOSLIN IL	TYSON FOODS INC	3,290,330	Rock River
Indiana	AK STEEL CORP (ROCKPORT WORKS)	AK STEEL CORP	24,305,396	Ohio River
Iowa	ROQUETTE AMERICA INC	ROQUETTE FRERES	1,704,810	Mississippi River
Kansas	CARGILL MEAT SOLUTIONS CORP	CARGILL INC	147,489	Arkansas River
Kentucky	NORTH AMERICAN STAINLESS	ACERINOX SA	3,206,744	Ohio River
Louisiana	EXXONMOBIL REFINING & SUPPLY BATON ROUGE REFINERY	EXXON MOBIL CORP	2,833,713	Mississippi River
Maine	MCCAIN FOODS USA INC	MCCAIN FOODS USA INC	2,271,733	Aroostook River
Maryland	ERACHEM COMILOG INC - BALTIMORE PLANT	COMILOG US INC	922,688	Curtis Creek

Table A-11: Top Discharging Facility by State, All Toxic Chemicals, 2010 (cont'd.)

State	Facility	Owner	Toxic Releases (lbs.)	Waterways Affected
Massachusetts	ONYX SPECIALTY PAPERS INC - WILLOW MILL	(none listed)	3,696	Housatonic River
Michigan	JBS PLAINWELL	JBS USA	1,646,574	Chart Creek, Kalamazoo River
Minnesota	SOUTHERN MINNESOTA BEET SUGAR COOPERATIVE	SOUTHERN MINNESOTA BEET SUGAR COOPERATIVE	562,026	County Ditch 45
Mississippi	PECO FOODS INC	PECO FOODS INC	1,339,293	Sipsey Creek
Missouri	TYSON FOODS INC - PROCESSING PLANT	TYSON FOODS INC	410,724	Little Muddy Creek
Montana	CHS INC LAUREL REFINERY	CHS INC	111,566	Yellowstone River
Nebraska	TYSON FRESH MEATS INC WWTP	TYSON FOODS INC	4,623,500	Missouri River
Nevada	JERRITT CANYON MINE	YUKON NEVADA GOLD	1,293,522	Burns Creek, Mill Creek, Winters Creek
New Hampshire	MERRIMACK STATION	PUBLIC SERVICE CO OF NEW HAMPSHIRE	1,542	Merrimack River
New Jersey	DUPONT CHAMBERS WORKS	E I DU PONT DE NEMOURS & CO INC	5,354,113	Delaware River
New Mexico	US DOD USAF HOLLOMAN AFB	US DEPARTMENT OF DEFENSE	46,267	Lagoon G
New York	FINCH PAPER LLC	FINCH PAPER HOLDINGS	1,480,125	Hudson River
North Carolina	SMITHFIELD PACKING CO INC TAR HEEL DIV	THE SMITHFIELD FOODS INC	2,743,689	Cape Fear River
North Dakota	GREAT RIVER ENERGY STANTON STATION	GREAT RIVER ENERGY	52,955	Missouri River
Ohio	AK STEEL CORP COSHOCTON WORKS	AK STEEL CORP	5,500,750	Muskinigum River
Oklahoma	PRYOR SOLAE	E I DU PONT DE NEMOURS & CO INC	1,310,452	Grand Neosho River
Oregon	TDY INDUSTRIES INC (DBA WAH CHANG)	ALLEGHENY TECHNOLOGIES INC	548,479	Willamette River
Pennsylvania	USS - CLAIRTON WORKS	US STEEL CORP	2,415,233	Monongahela River, Peters Creek
Rhode Island	BB & S TREATED LUMBER OF NE	(none listed)	404	Black Swamp
South Carolina	INVISTA SARL CAMDEN MAY PLANT	KOCH INDUSTRIES INC	1,032,712	Wateree River

Table A-11: Top Discharging Facility by State, All Toxic Chemicals, 2010 (cont'd.)

State	Facility	Owner	Toxic Releases (lbs.)	Waterways Affected
South Dakota	JOHN MORRELL & CO	THE SMITHFIELD FOODS INC	2,949,940	Big Sioux River
Tennessee	EASTMAN CHEMICAL CO TENNESSEE OPERATIONS	EASTMAN CHEMICAL CO	788,135	Holston River
Texas	SANDERSON FARMS INC	SANDERSON FARMS INC	1,533,000	Cottonwood Branch
Utah	CHEVRON PRODUCTS CO - SALT LAKE REFINERY	CHEVRON CORP	90,594	Northwest Oil Drain Canal
Vermont	IBM CORP	IBM CORP	121,518	Winooski River
Virginia	US ARMY RADFORD ARMY AMMUNITION PLANT	US DEPARTMENT OF DEFENSE	12,006,602	New River
Washington	SIMPSON TACOMA KRAFT CO LLC	SIMPSON INVESTMENT CO	261,473	Puget Sound
West Virginia	DUPONT WASHINGTON WORKS	E I DU PONT DE NEMOURS & CO INC	551,164	Ohio River
Wisconsin	MCCAIN FOODS USA INC	MCCAIN FOODS USA INC	807,600	Wisconsin River
Wyoming	PACIFICORP DAVE JOHNSTON PLANT	BERKSHIRE HATHAWAY	7,398	North Platte River