OCEANA | Protecting The World's Oceans

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POISON PLANTS:

[CHLORINE FACTORIES ARE A MAJOR GLOBAL SOURCE OF MERCURY]

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FOREWORD

In 2002, a growing number of patients in Dr. Jane Hightower's San Francisco general internal medicine practice were complaining of unusual symptoms such as memory problems, hair loss, fatigue, tremors and stomach aches. These otherwise healthy Californians exercised and paid attention to their diets. They also ate fish. A lot of fish.

On a hunch, Dr. Hightower began to quiz her patients about what kind of fish they liked and how often they ate it. She started running mercury tests and found that her patients' symptoms corresponded with heavy fish consumption – particularly of swordfish and tuna – and extremely high mercury levels, far higher than government authorities consider safe. When patients cut the mercury-contaminated fish from their diets, their symptoms disappeared.[1]

Dr. Hightower's findings evoked a much more serious epidemic that beset communities around Japan's Minamata Bay in the 1950s. Large numbers of fishermen who depended on the bay reported health problems: numbness, tingling in their hands and feet, tremors, blurred vision, and memory problems. An investigation revealed that a local chemical factory had been dumping mercury waste directly into the bay, and the fishermen and their families were ingesting it in fish.[2] Over the years, thousands of people were poisoned and crippled, and hundreds died from mercury poisoning.[3]

Dr. Hightower's patients, however, were not all eating fish poisoned locally. Many were eating fish caught far away, which brought a sobering fact to light: fish throughout the world's oceans are contaminated with mercury. We are all at risk.

A United States Environmental Protection Agency (EPA) scientist now estimates that one out of every six pregnant American women has enough mercury in her blood to cause neurological damage to her developing baby. Each year, hundreds of thousands of babies are born with enough mercury to pose developmental risks.[4]

We have known about the health consequences of mercury in our environment for decades. Neither that long-term knowledge, nor the tremendous amount of attention paid to this issue in recent months has solved the problem. This Oceana report exposes a major mercury source that has been largely ignored despite the fact that it is entirely preventable: chlorine factories that use outdated, 19th century manufacturing processes. Eliminating the use of mercury in these factories would dramatically reduce the mercury contamination otherwise entering our environment, benefiting children, adults, and many marine animals.

EXECUTIVE SUMMARY

MERCURY-CELL CHLORINE PLANTS: A MAJOR, OVERLOOKED, AND COMPLETELY PREVENTABLE SOURCE OF MERCURY POLLUTION.

Mercury is a Global Problem

It is well established that mercury is a global problem. Over the past century, industrial activity has released massive quantities of the toxic chemical into the air and water. Scientists estimate that 50 to 75 percent of the mercury in the atmosphere comes from human sources, and some studies have shown a two - to four - fold increase in mercury concentrations in the planet's air and water since the pre-industrial era.[5]

Mercury in the environment builds up in wildlife through a process called bioaccumulation. Animals high on the food chain carry the most mercury,[6] and many of the fish we eat are close to the top of the marine food chain.

The United Nations Environment Programme (UNEP) reports that fish and fish products – both caught and purchased – are the greatest source of methyl-mercury ingested by humans.[7] Contaminated fish can be found in all the oceans of the world, as mercury climbs up the marine food chain and onto our dinner plates. Forty-five of the fifty U.S. states issued mercury advisories for recreationally caught fish in 2003.[8] Governments in the U.S. and Europe have warned women and children against eating particular fish species including swordfish, shark, tilefish, king mackerel, marlin, pike and tuna.[9] Decades of pollution have caught up with us; now we have become the victims. In fact, a United States Environmental Protection Agency (EPA) scientist estimates that one out of six women now has enough mercury in her blood to pose neurological risks to her developing child.[10]

Mercury-Based Chlorine Plants Rival Coal-Burning Power Plants as Mercury Polluters

As the extent of mercury contamination in our environment, our bodies and our food comes to light, concern over mercury pollution is increasing. Most media and public attention has focused on coal-burning power plants. They are big; they are dirty; they are many. They are, collectively, one of our planet's largest sources of mercury emissions. But they are not the only major mercury polluter. Most people remain unaware that a small subset of the chlorine industry makes a major – and completely preventable – contribution to the global mercury crisis.

Chlorine is a chemical building-block used in everything from swimming pools to plastic tents to paper towels. In 1894, a process was devised to produce chlorine by pumping a saltwater solution (brine) through a vat of mercury, or "mercury-cell," that catalyzes an electrolytic chemical reaction.[11] Newer technologies that do not use mercury have developed, but a number of plants around the world have continued to use the outdated technology – to dangerous effect.

All mercury-cell chlorine plants are required to report their mercury releases to air, water and off-site disposal each year. In the U.S., the industry's self-reported figures are high enough to rank chlorine plants 5th in mercury emissions, among all industries releasing mercury into the air.[12] It is very likely, however, that the quantity of mercury chlorine plants actually emit is much higher. In fact, releases from chlorine plants may be high enough to rival those from power plants, the presumed greatest source of mercury releases to air, in the U.S. and Europe.

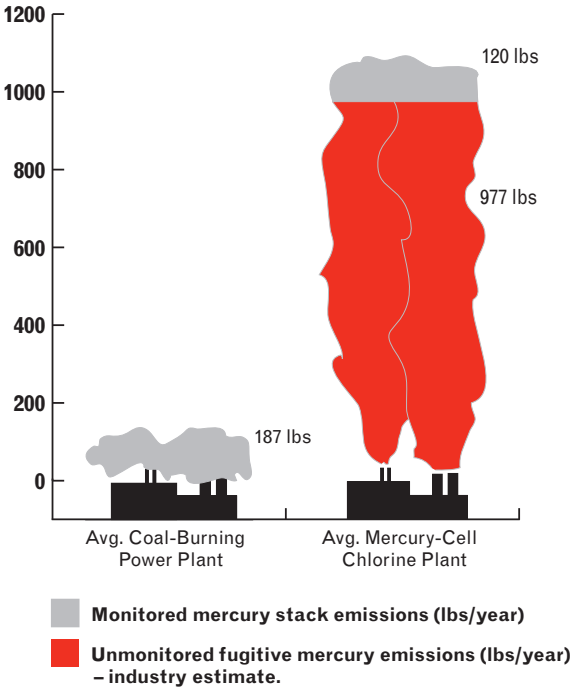
"Lost" Mercury Could Make Chlorine Plants Worst Mercury Polluter of All

The chlorine industry's reported figures for mercury releases to air are based in part on monitored smokestack emissions, but they also include the industry's estimates of the amount of mercury that evaporates during routine operations and escapes through unmonitored ventilation systems and other leaks – so-called "fugitive emissions."[13] According to the company reports, chlorine plants' fugitive emissions are **nine times greater** than monitored mercury releases.[14] Yet this is an estimate only, and there is good reason to suspect that fugitive mercury emissions are even greater than the industry suggests.

In addition to reported releases, mercury-based chlorine plants in the U.S. and Europe "lose" a tremendous amount of mercury each year. Annually,

U.S. MERCURY-CELL CHLORINE PLANTS RELEASE FIVE TIMES MORE MERCURY THAN AVERAGE POWER PLANTS

Not including mercury "lost" by chlorine factories



Source: Oceana based on EPA Toxics Release Inventory Data

Figure 1

the industry uses, or "consumes," far more mercury than it reports having released. But mercury does not get used up in the process of making chlorine. Only small amounts of it end up as impurities in the product. Since mercury is an element, it does not break down into other substances. It has to go somewhere. The lost mercury could be in the air, in the water, in the soil, or in the chlorine facility itself.

The discrepancy between what the industry reports having consumed and what it reports having released is substantial, to say the least:

- In 2000, the nine chlorine plants in the U.S. reported having consumed 79 tons (71 metric tons) of mercury and released 14 tons (~13 metric tons). They had "lost" 65 tons (59 metric tons) far more than the entire combined mercury releases of all 497 power plants in the country (49 tons / 44 metric tons). The EPA declared that "the fate of all the mercury-consumed atmercury-cell chlor-alkali plants remains somewhat of an enigma."[15]
- In 2000, the chlorine plants in the first fifteen member states of the European Union (EU-15) reported having used 105 tons (95 metric tons) of mercury.[16] For the same year, the industry reported that 8.8 tons (8 metric tons) of mercury had been released to the environment.[17] Ninety-six tons (87 metric tons) of mercury were unaccounted for. This is almost **three times** the amount of mercury released to the air by all coal-fired power plants and residential heating in the European Union that year, which totaled about 33 tons (30 metric tons).[18]

The industry contends that the missing mercury seeps into factory infrastructure and equipment.[19] However, what little evidence there is suggests that this explanation is inadequate. A recent plant closure in Maine provides one example. When the pipes and equipment were cleaned out, 33 tons (30 metric tons) of mercury were still missing.[20] It is far more likely that much of the missing mercury escapes as unmonitored fugitive emissions.

Even if only *half* of the lost mercury is released to the environment in this way, the mercury-based chlorine industry would rival coal-fired power plants as the greatest source of mercury pollution in both the United States and Europe.

Mercury-Emitting Chlorine Plants in the United States

There are nine mercury-cell chlorine plants still operating in the United States, located in eight states: Alabama, Delaware, Georgia, Louisiana, Ohio, Tennessee, West Virginia and Wisconsin. According to the industry's own reported estimates, the average mercury-based chlorine plant released 1097 lbs (499 kg) of mercury to air in 2002.[21]

In the same year, on average, power plants in the United States released a total of 186 lbs (85 kg) of mercury to air. Of the 100 power plants with the highest mercury emissions, the average was 586 lbs (266 kg).[22] More simply put, according to industry reported figures (which do not include any of the "lost" mercury), the average mercury-based chlorine plant released five times more mercury than the average mercury-emitting power plant, and twice as much on average as a large power plant in 2002.

Other statistics are equally compelling:

- In seven of the eight states where they operated in 2002, a mercury-based chlorine plant was the largest source of mercury emissions to air in the state. This includes Alabama, Delaware, Louisiana, Ohio, Tennessee, West Virginia and Wisconsin.

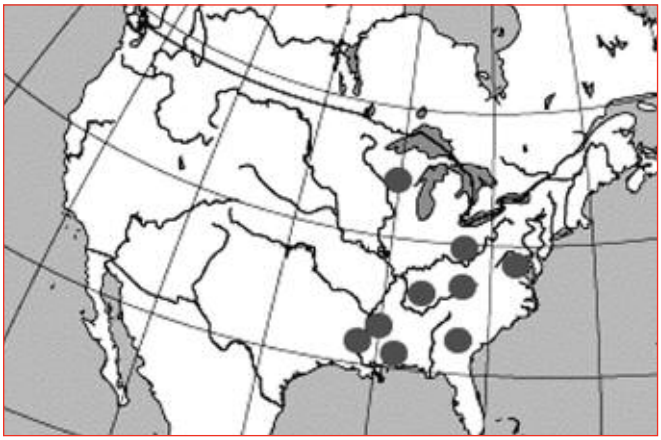
- In both Louisiana and Delaware, mercury-based chlorine plants released more mercury in 2002 than all other sources combined.

- ASHTA Chemicals, a mercury based chlorine factory in Ashtabula, Ohio, was the fifth ranking mercury emitter in the United States based on 2002 data.

- Nationwide, eight mercury-cell chlorine plants ranked among the top 25 mercury polluters (from all industries),in 2002.[23]

- The mercury-cell chlorine industry is the nation's fifth largest mercury polluting industry. [24] Its true rank could be substantially higher, depending on the fate of the "lost" mercury.

Locations of Mercury-Based Chlorine Factories in the U.S.



Mercury-Emitting Chlorine Plants in Europe

Mercury pollution from chlorine plants is not limited to the United States. The chlorine industry is also a major source of mercury emissions in Europe.

There are 53 mercury-cell chlorine plants currently operating in the European Union (EU) – 44 in Western Europe, seven in new (as of 2004) EU member states and two in countries joining in 2007.[25]

Statistics from 2001 show that:[26]

- In the United Kingdom, a mercury-cell chlorine plant operated by Ineos Chlor is the greatest single source of mercury emissions in the country. Three chlorine plants emit one-third of all the UK's mercury releases.

U.S. Chlorine Factories Release Tons of Mercury (2002)

RANK BY TOTAL MERCURY RELEASES	FACILITY	CITY	STATE	EMISSIONS TO AIR (lbs)			TOTAL EMISSIONS (lbs) (TO AIR, WATER, AND OFF-SITE)
				fugitive	stack	total air	
1	Olin	Charleston	TN	1045	85	1130	2512
2	Occidental Chemicals	New Castle	DE	1046	28	1074	2238
3	PPG	New Martinsville	WV	1045	188	1233	2167
4	Occidental Chemicals	Muscle Shoals	AL	1067	20	1087	1771
5	ASHTA	Ashtabula	OH	1046	349	1395	1568
6	Vulcan	Port Edwards	WI	1054	28	1082	1462
7	PPG	Lake Charles	LA	1045	177	1222	1460
8	Pioneer	St. Gabriel	LA	862	48	910	1184
9	Olin	Augusta	GA	585	154	739	1028

Source: Oceana based on EPA Toxics Release Inventory Data

Table 1

- In Belgium, the top two mercury emitters are mercury-cell chlorine plants.

- In Finland, the only mercury-cell chlorine plant still active ranks second in the nation (of all industries) for total mercury emissions.

- In France, five of the seven active mercury-cell chlorine plants ranks in the nation's top ten (from all industries) for total mercury emissions.

Mercury contaminates our environment, our communities, and our food

Mercury releases from mercury-cell chlorine plants have both local and distant effects, beginning in the factories themselves. After mercury evaporates from the mercury cells, and before it escapes through cell room vents, much of it must pass through the air in which factory employees work, and which they breathe.

In the early 1990s, Olin Corporation (a U.S. company) settled a lawsuit with contracted workers who had been directed to sever a pipe which, when cut, spilled mercury onto the floor and onto the clothes and skin of the employees. They subsequently became ill, reporting symptoms that included nausea, dizziness, headaches, cramps, joint pain and memory loss.[27] In Riegelwood, North Carolina, at least 71 former HoltraChem employees who worked at the company's old plant (now a Superfund site) have also filed civil lawsuits, claiming health damages from mercury exposure.[28]

Eventually, mercury released into the air or water travels greater distances, carried by wind and water currents and biological processes. Scientists believe that mercury released to the atmosphere may take anywhere from six days to two years to fall to land or surface water. Some mercury found in rain may be coming from sources as far as 2,500 km (about 1,550 miles) away.[30] Much of it will ultimately make its way to the sea and contribute to the global poisoning of marine wildlife. Every kind of marine creature suffers from mercury contamination, but the most affected are those at the top of the food chain – large fish, marine mammals, and, of course, humans.

Mercury released in wastewater enters local ecosystems even more directly. The pollution can

Top 25 Chlorine Factories that Release Mercury to Air in Europe (2001)

RANK	FACILITY	COUNTRY	TOTAL EMISSIONS (kg)
1	Ineos Chlor LTD	UK	1151
2	Degussa AG Werk	Germany	312
3	Vestolit	Germany	273
4	EniChem S.p.A (Syndial S.p.A. – Priolo)	Italy	265
5	Solvay Electrolyse	France	213.6
6	Atofina	France	195
7	Solvay Quimica (Torrelavega)	Spain	190
8	Vintron	Germany	186
9	Solvay-Solvic SA	Belgium	177.7
10	Tessenderlo Chemie	Belgium	174.6
11	Albion Chemicals	UK	173.2
12	BASF AG	Germany	165
13	Aragonesas Industrias y Energia SA	Spain	162.4
14	Atofina	France	161
15	Solvay Chimica Italia S.p.A	Italy	155
16	Bayer AG	Germany	146
17	Atofina	France	144.4
18	LII Europe	Germany	142
19	Bayer AG	Germany	133.4
20	Albemarle PPC	France	125
21	Solvay NV	Belgium	113
22	Vinnolit	Germany	107
23	Borsodchem Rt	Hungary	97
24	Aragonesas Industrias y Energia SA Puerto	Spain	90.8
25	Ercros Industrial	Spain	82.8

Source Oceana with data from the EPER database which has data for the EU-15 countries and Norway and Hungary. Data unavailable for one plant in France, one plant in Italy, two plants in Spain.

Table 2

A charter boat unloads a catch of yellowfin tuna and dolphinfish at Pirates' Cove Marina, North Carolina. NOAA

build up in the food chain, and can be very harmful to animals and people living in the vicinity. Seven of the nine operating chlorine plants using mercury-cell technology are Resource Conservation and Recovery Act (RCRA) Corrective Action Sites and 14 of the 32 inactive chlorine plants that once used mercury-cell technology are Superfund sites.[29] Both classifications refer to areas identified by the government as dangerously contaminated with hazardous waste.

The Use of Mercury in Chlorine Manufacturing is Completely Unnecessary

This 19th century mercury-cell technology is antiquated, unnecessary and dangerous. Two alternative production methods exist: membrane cell and diaphragm cell. Most of the U.S. chlorine industry uses the newer technologies – in fact, 90% of U.S. chlorine is produced using mercury-free processes.[31] In Europe, though sixty percent of the industry still uses mercury-cell technology, the European Commission agreed in 1996 to take action to prevent releases of pollutants like mercury to water, air or land from industrial activities.[32] Through the Integrated Pollution Prevention and Control Directive (IPPC), the Commission required facilities to follow what are called Best Available Techniques (BAT), a concept and term similar to one used in the United States. Because cleaner, more efficient methods of chlorine production are available, the mercury-based process is not considered to be a BAT, and European chlorine facilities are required to phase out the use of mercury by October of 2007.[33]

No new mercury-cell plants have been built since 1970, and new construction is effectively limited by restrictions on mercury emissions from new plants in the United States.[34] In Europe, the industry trade group, Euro Chlor, has agreed not to build any new plants with this outdated technology.[35]

Eliminating mercury technology does not mean that plants must be closed. Many plants around the world have successfully converted from mercury-based to cleaner, newer technologies – a conversion that can lower plants' energy and labor costs while increasing capacity.[36] According to Euro Chlor, companies typically save 15% on their electric bills and 10% on total energy bills when they convert.[37] Conversion of one Alabama facility also reduced hazardous waste generation by 92%.[38]

Oceana Solutions

Oceana is seeking solutions to the global mercury problem. Our goal is to defend the European Union's mercury phase-out and to win a complete transition to mercury-free technology there and in the United States.

Recommendations

Maintain European phase-out

- The European Union should require full compliance with the IPPC directive and the 2007 conversion deadline.
- The requirement should stand for all current members of the EU and be a condition of becoming a member.

Phase out mercury-emitting chlorine production in the United States by 2008

- EPA should require all nine operating facilities to convert to mercury-free technology, which is the maximum achievable control technology for producing chlorine.
- EPA should require any temporarily closed (idled) plants to shift to mercury-free technology before reopening.

- Facilities still using mercury-emitting technology should be required to monitor fugitive emissions, and conduct tests to identify the status of the lost mercury.

Ensure the safe disposal of mercury when plants convert or shut down

- Because mercury is a highly toxic substance, chemical companies and governments should be responsible for the cleanup of the site once a plant has been converted or closed. Surplus mercury and old equipment should be disposed of properly in a hazardous waste facility and not exported to other countries that are not currently subject to a phase-out.
- Companies should properly treat and clean-up mercury-contaminated groundwater, surface water, soils and sediments on the site of the plant.

Conclusion

The chlorine industry is a major mercury source that has been almost completely ignored, yet this industry can completely eliminate its mercury pollution. Europe is moving toward an industry-wide transition to mercury-free technology; the U.S. should do the same. By bringing their production processes into the 21st century, chlorine manufacturers can greatly reduce the amount of mercury that is released and carried into our environment, our communities and our food.

I. THE PROBLEM: MERCURY IS DANGEROUS

Mercury Poses Serious Health Risks to Children and Adults

There is a very good reason one handles thermometers with care. Mercury is a poison. When ingested by humans in sufficient quantities it can cause severe neurological damage. Symptoms can include impaired coordination, memory loss, tingling in the extremities, tremors, blurred vision, headaches, joint pain, fatigue and depression.[42] Research suggests that mercury exposure may increase the victim's risk of heart disease and kidney damage; mercury exposure is also associated with infertility in both men and women.[43] Finally, methylmercury (the most dangerous form) is considered a possible human carcinogen.[44]

As dangerous as mercury is for adults, it is even more detrimental to children and developing fetuses.

A UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) SCIENTIST NOW ESTIMATES THAT ONE OUT OF EVERY SIX AMERICAN WOMEN HAS ENOUGH MERCURY IN HER BLOOD TO CAUSE NEUROLOGICAL DAMAGE TO A DEVELOPING BABY.[39]

According to the Environmental Protection Agency (EPA), the "safe level" of mercury in a woman's blood is 5.8 micrograms of mercury per liter of blood (ug/L) – which means that anything above that is cause for concern. Because mercury becomes more concentrated as it passes from a mother to her fetus, it only takes 3.5 ug/L in a pregnant woman's blood to pose a risk to her developing baby.[45] Such concentrations of mercury will have a far greater effect on the fetus than on the mother.[46] Without her ever feeling a tingling finger or forgetting an acquaintance's name, a pregnant woman who eats moderate quantities of contaminated fish may have enough mercury in her blood to handicap her child.

Children exposed to mercury in the womb, a time that they are developing rapidly, may later have problems with attention span, language, visual-spatial skills, memory and coordination.[47] Neurological damage may delay development so that children may walk and talk later than normal, have slower reflexes and lower IQ scores.[48] At its most extreme, mercury can cause severe brain damage, mental retardation, blindness, seizures, and the inability to speak.[49]

Mercury is a Dangerous Contaminant in Fish

Most toxic substances sold at the grocery store are labeled with appropriate warnings. A person's weekly dose of mercury, on the other hand, may come in an unmarked fillet of fish or a can of tuna. The United Nations Environment Programme (UNEP) reports that fish and fish products – both caught and purchased – are the greatest source of methylmercury ingested by humans.[50]

How have some fish become so contaminated? While some mercury occurs naturally in the environment, human industrial activities have significantly increased mercury mobilized and released to the environment.[51] Mercury released into the air as vapor travels and eventually falls to the earth as rain or snow, making its way into lakes, rivers, estuaries, and ultimately to the sea. Some mercury is also released directly into waterways, and more still leaks into the environment through improper or ineffective disposal practices on land. Bacteria that live in these bodies of water transform some of the mercury into its most dangerous form, methylmercury, which unlike the inorganic form accumulates in fish and animal tissue.[52]

This attribute of mercury – the capacity of its organic form to bioaccumulate – is what makes it so dangerous.[53] Most of the land-dwelling creatures

EACH YEAR, HUNDREDS OF THOUSANDS OF BABIES ARE BORN WITH ENOUGH MERCURY TO POSE RISKS OF NEUROLOGICAL EFFECTS BECAUSE OF HIGH MERCURY LEVELS IN THEIR MOTHERS' DIETS.[40]

we eat, such as cattle and poultry, are low on the food chain (mostly herbivores), while large fish like tuna and swordfish are predators at the end of a long sequence of predators and prey. They eat smaller fish that eat even smaller fish that eat crustaceans…and so on. Much of the mercury consumed is stored in the tissues of animals that ingest it. When smaller animals get eaten, they pass the mercury in their bodies on to their predators. Thus, the concentration of mercury in animals increases as it travels up the food chain.

As it builds up in marine food chains mercury is finding its way onto our dinner plates, and today contaminated seafood is a global problem. Federal governments are issuing increasing numbers of warnings against eating various species of fish. Several European Union member states have advised mothers and children against eating swordfish, marlin, pike and tuna.[54] In the United States, the Food and Drug Administration (FDA) and EPA have warned women of childbearing age and children not to eat swordfish, king mackerel, tilefish, or shark and to limit their consumption of albacore tuna.[55] Recreational anglers in 45 of the 50 U.S. states have been warned against eating some of the fish they catch.[56] Moreover, fishermen and their families in coastal areas along the Mediterranean and the Atlantic island of Madeira have very high mercury levels in their bodies based on measurements made of their hair.[57]

IN FRANCE, NEARLY HALF (44%) OF CHILDREN BETWEEN THE AGES OF THREE AND SIX MAY BE EXCEEDING SAFE LEVELS OF MERCURY LARGELY AS A RESULT OF FISH CONSUMPTION. COMPARED TO OTHER EUROPEANS, HOWEVER, THE FRENCH CONSUME RELATIVELY LITTLE FISH.[41]

Besides presenting human health concerns, mercury also affects the health of fish and other marine life that consume fish, including seals, dolphins, whales and sea lions. As in humans, effects are most pronounced in young fish but levels in adult fish also can be high enough to cause problems.[58]

Where Does the Mercury Come From?

Global mercury contamination of seafood is largely the result of human industrial activities. It is estimated that 50 to 75 percent of the mercury now in the environment comes from human sources; the remainder is the product of natural emissions, such as volcanoes.[59] Studies have suggested a two-to four-fold increase in mercury concentrations in air and marine surface waters since the pre-industrial era.[60] The greatest and most publicized source of mercury emissions is combustion: the burning of fossil fuels and waste incineration. In 2002, UNEP estimated that 70 percent of global mercury emissions come from these sources.[61] Other mercury-emitting activities include medical waste incineration, gold mining, and some aspects of offshore oil drilling.

Because of the number of coal-burning plants and their cumulative effect, the attention of the press, the public, and consumer interest groups has focused on this industry as the primary mercury source. One industry, however, has been virtually ignored despite the scale of its mercury problem and despite that fact that its use of mercury is entirely unnecessary: **the chlorine industry.**

Swordfish caught in the Mediterranean.

II. MERCURY BASED CHLORINE FACTORIES: AN UNNECESSARY SOURCE OF POISON

Chlorine is everywhere. It is a critical ingredient used to disinfect swimming pools and drinking water; it is an ingredient in drain cleaner, bleach, plastics, tents, playground balls and a host of other everyday items. In 1894, a process was devised to commercially manufacture chlorine by pumping salty water (brine) through a vat of pure mercury, known as a mercury cell. The mercury cell stimulates a chemical process that converts the brine into chlorine, hydrogen, and caustic soda (used to make detergents and other products).[64] More recently, mercury-free production methods have been developed and adopted by much of the chlorine industry around the world. Antiquated mercury-based facilities remain, however, and continue to release mercury into the air and water.

Nine chlorine plants currently operate in the United States using the outdated mercury cell process. Together, the active chlorine plants pumped 8.5 tons (7.7 metric tons) of mercury into the environment in 2002.[65]

IN 2000, ELEVEN CHLORINE PLANTS "LOST" MORE MERCURY THAN WAS RELEASED BY ALL 497 MERCURY-EMITTING POWER PLANTS IN THE UNITED STATES.[62]

Individually, each plant is a polluter worthy of national ranking. Eight of the nine active chlorine factories placed among the top 25 releasers of mercury to air in the country in 2002.[66] One facility, operated by ASHTA Chemicals, in Ashtabula, Ohio, is the fifth-largest single source of mercury air pollution in the country.[67] On average, one of these plants releases about 1097 lbs (499 kg) of mercury into the air and about 13 lbs (~6 kg) directly into water in any given year of operation.[68]

In Europe, there are 53 mercury-based chlorine plants: 44 in Western Europe, seven in the countries that joined the European Union in 2004, and two in the two countries that will join the EU in 2007.[69] Fully one-third of the mercury releases in the United Kingdom comes from mercury-emitting chlorine factories.[70] Europe, however, is in the process of phasing out the use of mercury to make chlorine. There, facilities are required to phase out the use of mercury by October, 2007.[71]

Top 25 Sources of U.S.Mercury Air Emissions (2002)

FACILITY	STATE	TOTAL AIR EMISSIONS (lbs)
Jerritt Canyon Joint Venture	NV	4741
Lehigh Southwest Cement Co.	CA	2345
Limestone Electric Generating Station	TX	1800
Alcoa World Alumina LLC Point Comfort	TX	1453
ASHTA Chemicals Inc.	**OH**	**1395**
Cortez Gold Mines Mill 2	NV	1356
Barrick Goldstrike Mines Inc.	NV	1356
TXU Monticello Steam Electric Station & Lignite Mine	TX	1324
American Electric Power Conesville Plant	OH	1300
Essroc Cement Corp.	IN	1262
Reliant Energy Keystone Power Plant	PA	1235
PPG Industries Inc.	**WV**	**1233**
PPG Industries Inc.	**LA**	**1222**
Jeffrey Energy Center	KS	1216
Olin Corp.	**TN**	**1130**
W.A. Parish Electric Generating Station	TX	1100
Occidental Chemical Corp.	**AL**	**1087**
Vulcan Materials Co. Port Edwards Plant	**WI**	**1082**
Alabama Power Co. Miller Steam Plant	AL	1077
Occidental Chemical Corp.	**DE**	**1074**
Oxy Vinyls L.P. – Deer Park	**TX**	**1046**
Martin Lake Steam Electric Station & Lignite Mine	TX	1027
American Electric Power H.W. Pirkey Power Plant	TX	1000
Georgia Power Scherer Steam Electric Generating...	GA	943
Pioneer Americas LLC	**LA**	**910**

Source: Oceana based on EPA Toxics Release Inventory Data **Table 3**

Most Mercury Releases are "Fugitive"

Mercury-cell chlorine plants vary in size, and production capacity. On average a plant in Europe is smaller than one in the United States.[72] For example, the U.S. plant operated by Olin in Augusta,

Georgia, contains 60 mercury cells, each of which measures 48 feet in length and five in depth (~15 by 1.5 meters). These mercury cells are essentially large vats of mercury which can hold approximately 186 tons (~169 metric tons) total.[73] Such enormous quantities of mercury make for enormous quantities of mercury gas released.

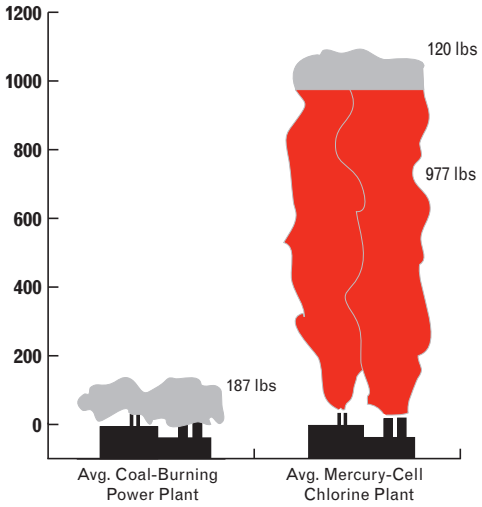
Mercury leaves chlorine plants in several ways. Some mercury separates as vapor during the electrolysis process and is routed through factory smokestacks, which are equipped with monitoring devices to track mercury emissions. The industry reports these as mercury "stack emissions" – which average about 120 lbs per year (~55 kg) per plant.[74]

Mercury is also discharged directly into surface water. In 2002, such waste totaled 107 lbs (~49 kg), a per-plant average of 12 lbs (5.4 kg).[75] Still more mercury is disposed of off-site or in hazardous waste disposal facilities.Because the industry is required to report to the EPA all of its releases to air, water, and land, including off-site disposal, these figures come directly from the companies.

Most of the mercury released from chlorine plants, however, does not exit through monitored smoke-stacks, discharge pipes or off-site disposal operations, but rather escapes as what are called

U.S. MERCURY-CELL CHLORINE PLANTS RELEASE FIVE TIMES MORE MERCURY THAN AVERAGE POWER PLANTS

Not including mercury "lost" by chlorine factories



Monitored mercury stack emissions (lbs/year)

Unmonitored fugitive mercury emissions (lbs/year) – industry estimate.

Source: Oceana based on EPA Toxics Release Inventory Data

Figure 2

IN 2000, IN THE EU-15, 96 TONS (87 METRIC TONS) OF MERCURY WERE UNACCOUNTED FOR – NEARLY THREE TIMES THE AMOUNT RELEASED TO THE AIR BY ALL POWER PLANTS AND RESIDENTIAL HEATING FACILITIES IN THOSE COUNTRIES.[63]

"fugitive" emissions. Because mercury is a volatile element, and because the cell room operates at high temperatures, mercury can evaporate both during normal operations and when the vats are opened for maintenance.[76]

Mercury that evaporates from vats is released through the factories' ventilation systems. Plant management rarely monitors these fugitive emissions – the companies are simply allowed, under United States regulations, to estimate their amount at 1.3 kg/plant/day (about 2.9 lbs/plant/day).[77] In 2002, fugitive emissions averaged about 977 lbs of mercury (444 kg) per plant per year – or approximately 4.4 tons total per year (~4 metric tons) in the United States.

Overall, the industry reports unmonitored fugitive emissions (most of which must pass through areas where people work) to be about nine times higher than the total monitored mercury stack emissions reported to the EPA by these facilities. It should be kept in mind that this is an estimate, since fugitive emissions are not monitored.

But when it is all added up, the amount of mercury these plants bring in does not equal what they report sent out, which may explain why many of these plants have left legacies of toxic contamination in their communities.

Tons More Poison Lost Every Year

In addition to their reported mercury releases, mercury-cell chlorine plants "lose" mercury. Quite simply, the plants consume more mercury than they report releasing. So far, neither the mercury-using

chlorine factories nor the government agencies that regulate them have been able to account for the difference or adequately explain the problem. Mercury does not get used up in the process of making chlorine. Only small amounts of it end up as impurities in the product. Since mercury is an element, it does not break down into other substances. It has to go somewhere. The lost mercury must be in the air, in the water, on the land, or in the facility itself.

In 2000, in the United States alone, the industry lost 65 tons (59 metric tons) of mercury, far more than the entire combined mercury releases of all 497 mercury-emitting power plants in the country (about 49 tons / 44 metric tons).[78] If even half of those 65 tons made their way into the environment, then the small group of mercury-based chlorine plants would rival coal burning power plants as the number one source of mercury contamination in the U.S.

In 2000, the chlorine plants in the first fifteen member states of the European Union (EU-15) reported that they used 104.5 tons (95 metric tons) of mercury.[79] For the same year, releases totaled 4.5 tons (4 metric tons) of mercury to the air, and the industry reported that 8.8 tons (8 metric tons) of mercury were released to the environment.[80] Ninety-six tons (87 metric tons) of mercury were unaccounted for. This is almost three times the amount of mercury released to the air by all coal-fired power plants and residential heating in the EU-15 that year which totaled approximately 33 tons (30 metric tons).[81]

The amount of mercury lost varies from year to year because it is counted in the year that replacement mercury is bought by the factory. It is also dependent on the number of facilities operating in a given year. While no data are available for 2001, the industry reported losing 28 tons (25 metric tons) in 2002 and 30 tons (27 metric tons) in 2003. (See Table 4)

Companies Can Eliminate Mercury Releases

The good news is that this mercury pollution is entirely preventable. Mercury-cell technology is antiquated, unnecessary and dangerous. Two alternative production methods exist: membrane-cell and diaphragm-cell. Today, 90 percent of chlorine made in the United States is produced using these mercury-free technologies.[84] No new mercury-cell plants have been built since 1970, and new construction is effectively limited by restrictions on mercury emissions by new plants.[85] In Europe, though 60 percent of the industry uses mercury-cell technology, the industry has been directed to phase out the use of mercury by 2007.[86] In addition, the industry trade group in Europe, Euro Chlor has agreed not to build any new plants that use a mercury-based process.[87]

U.S. Plants Lose Tons of Mercury Annually

Year	Lost (tons)	Source
2000	65	EPA
2001	–	Data unavailable
2002	28	Chlorine Institute
2003	30	Chlorine Institute [83]

Table 4

Europe Sees the Light Before the United States

Mercury-emitting chlorine plants are considered obsolete in Europe. European governments have recognized that mercury is harmful to public health, and should be reduced, and that the use of mercury in chlorine production should be phased out.

The European Commission agreed in 1996 to take action to prevent releases of pollutants like mercury to water, air or land from industrial activities. The Commission required facilities to follow what are called Best Available Techniques (BAT), a concept and term similar to one used in the United States. In Europe, due to the availability of cleaner, more efficient technology, the mercury-emitting chlorine production process is not considered to be BAT. Therefore, facilities are required to phase out the use of mercury by October, 2007.[88] Euro Chlor, however, is promoting an alternative timeframe that would result in 13 additional years of mercury releases to the environment. Some countries also have committed to phase-out mercury use, although according to a slower schedule than required by the Directive.[89]

In the United States, the Clean Air Act has a similar requirement for BAT, called Maximum Achievable Control Technology (MACT). The EPA has side-stepped that requirement by claiming that mercury-

emitting chlorine facilities are a different category than their mercury-free counterparts. So instead of designating mercury-free technology as MACT, as was done in Europe, the U.S. plants will only have to meet the maximum achievable **mercury-emitting** control technology.[90] This will allow the facilities to continue to operate as they are now, releasing and losing tons of mercury each year. All of the releases to the environment could be eliminated simply by acknowledging that the MACT is mercury-free, and shifting to that technology as is required in Europe.[91]

PLANTS HAVE CONVERTED SUCESSFULLY TO ELIMINATE MERCURY RELEASES

Occidental Chemical Corporation: Mobile, Alabama: United States: 1991: Occidental Chemical's Mobile plant converted from mercury based chlor-alkali production to environmentally superior membrane technology in 1991, reducing hazardous wastes generated by 92% from 38 tons per year to three tons per year.[99]

Borregaard: Sarpsborg: Norway: 1997: In Norway, the last mercury-cell plant ceased its mercury-based operations in September 1997. Borregaard converted from mercury-cell to membrane technology.[100]

India: Three companies have completely phased out their mercury cells, switching to membrane cells: Punjab Alkalies & Chemicals Ltd, Century Rayon Ltd, and NRC Ltd.[101]

Germany: Two plants converted to membrane technology: Elektro Chemie, Bitterfield and Bayer, Dormagen.[102]

Donau Chemi, Brückl: Austria: 1999: During the conversion of this facility, the plant continued to run at 80% capacity, avoiding major losses in production.[103]

BF Goodrich Corp. (Westlake Vinyls): Calvert City, KY: United States: 2003: Membrane technology went online in January, 2003. The plant's mercury cells were decommissioned by June, 2003 and are now inactive.[104]

Box 1

Conversion is Both Possible and Practical

Conversion from mercury-based to mercury-free technology is both possible and practical, as demonstrated by the European commitment and examples of chlorine plants that have already made the switch. In fact, evidence suggests that by converting from mercury-cell to membrane technology, chlorine plants can lower energy and labor costs while increasing capacity.[92] This results in reduced operating expenses.

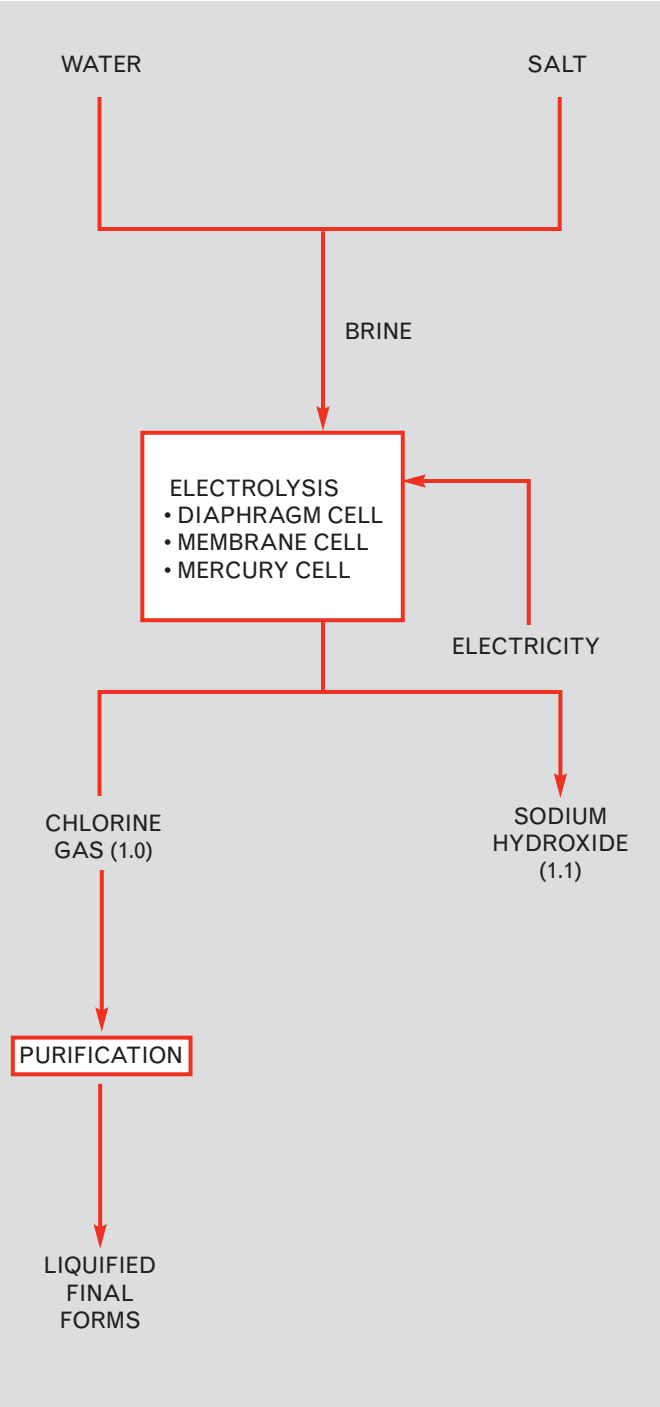
According to Euro Chlor, companies typically save 15% of their electrical energy costs and 10% of their total energy costs as a result of conversion.[93]

Many examples of conversions already exist. Occidental Chemical's Mobile, Alabama plant converted from mercury-based chlorine production to mercury-free membrane technology in 1991. Besides eliminating mercury emissions, the project reduced the amount of hazardous wastes generated by 92%, from 38 tons per year to three tons per year.[94] The conversion project also saved the company approximately $51,000 annually and reduced its consumption of natural gas.[95] By converting to mercury-free technology, the Borregaard plant in Norway reported an electrical energy savings of 30% per metric ton of caustic produced and saved 25% in labor costs.[96] Additional examples are provided in Box 1.

The cost of conversion for an individual plant may vary according to factors that include the plant's current infrastructure, size and location of the facility. For this reason, cost estimates vary widely. In 1995, the EPA estimated costs between $100,000 and $200,000 per ton of chlorine produced per day. For a facility that produces about 65,000 tons per year, the cost would range from $20 to $40 million.[97] Similarly, in 2001, Euro Chlor predicted conversion will cost roughly 530 Euros per metric ton of annual chlorine capacity, though many plants already have converted for less.[98]

Mercury-based chlorine production is a dangerous relic of the past. Newer, cleaner technology exists. Both chemical companies and the public ultimately benefit from the conversion of mercury-based plants to membrane technology.

The Chlorine Production Process



Source: Research Triangle Institute, 2000. Diagram from report to EPA Office of Air Quality Planning and Standards[107]

Figure 3

How is Chlorine Made?

The chemical transaction that converts salt and water into chlorine, hydrogen and caustic soda is known as electrolysis – a process in which an electrical charge is used to pull ions out of their initial bonds and allow them to recombine in new ways. To produce chlorine, sodium chloride (table salt) is dissolved in water. The salty solution, or brine, is pumped into an electrolytic cell, where the ions that make up the salt and water molecules become charged, are pulled apart, and then cluster to form new molecules.

There are three methods of inducing this chemical reaction, each relying on a different type of cell: the mercury cell, the membrane cell, and the diaphragm cell. Apart from the fact that the two more modern technologies are mercury-free, the three processes are nearly identical.[106]

The Mercury Cell

In mercury-cell technology, mercury is the agent that pulls the charged ions in the salt and water molecules out of their original bonds. Saltwater (brine) is pumped into a massive vat of liquid mercury. The mercury serves as the negative electrode (cathode) and lures positively-charged sodium (Na) ions out of their chloride bonds. The sodium ions latch on to mercury ions to form NaHg, abandoning the chloride ions to their new independence, to eventually become chlorine gas.

Later in the process, the sodium (Na) and mercury (Hg) ions split once again, the sodium now joining with hydroxide (OH) ions liberated from water molecules. The final products of the process are sodium hydroxide (caustic soda), hydrogen and chlorine gas. The elemental mercury is theoretically recycled to the electrolysis cell.[108] Unfortunately, a good deal of mercury evaporates over the course of this process, and is released from the chlorine plant in monitored or fugitive emissions.[109]

III. MERCURY FROM CHLORINE PLANTS: UNITED STATES

Mercury-Emitting Chlorine Plants Release Tons of Mercury Each Year

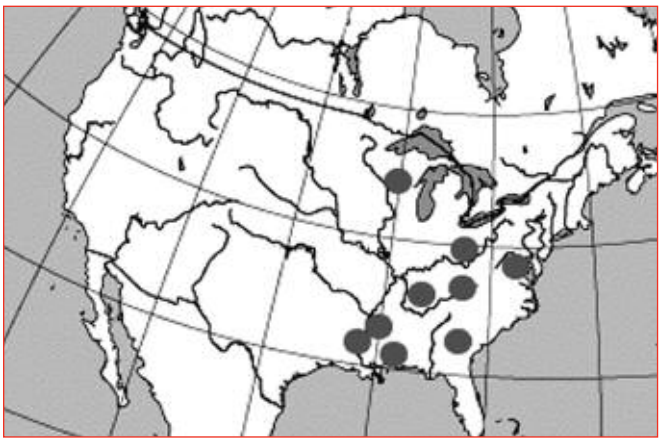
THE MERCURY "ENIGMA"

In 2000, the EPA acknowledged that the eleven operating mercury-based chlorine plants had "lost" 65 tons (56 metric tons) of mercury – an amount far greater than the 49 tons (44 metric tons) emitted by the nation's entire coal-burning industry. Collectively, the chlorine plants used 79 tons (71 metric tons) of mercury and reported 14 tons (13 metric tons) released as waste. But what happened to the remaining 65 tons (56 metric tons)? The most plausible explanation was that the remaining mercury had evaporated and escaped through vents in the cell room as fugitive emissions. The industry responded that the missing material had seeped into plant equipment, such as pipes and tanks. Neither claim could be proven, and the EPA declared that "the fate of all the mercury consumed at mercury cell chlor-alkali plants remains somewhat of an enigma."[110]

Box 2

Nine mercury-cell chlorine plants still operate in the United States. They are located in eight states: Alabama, Delaware, Georgia, Louisiana, Ohio, Tennessee, West Virginia and Wisconsin. Each of these facilities is a major mercury emitter. Of the nine plants, in 2002, the Olin Corporation's plant in Charleston, Tennessee ranked first in total reported mercury releases to the environment (2512 lbs / 1141 kg), followed closely by the Occidental Chemical Company (OxyChem) facility in Delaware, which itself reported releasing more than a ton (2238 lbs / 1017 kg). The PPG plant in New Martinsville, West Virginia, ranked third with emissions totaling 2167 lbs (985 kg).[111]

Locations of Mercury-Based Chlorine Factories in the U.S.



On average, one of these plants releases about 1097 lbs (499 kg) of mercury into the air in any given year of operation. The average large U.S. power plant, in contrast, released 586 lbs (266 kg) of mercury to the air in 2002 (average taken from top 100 mercury-emitting power plants). Put more simply, on average a mercury-cell chlorine plant in the U.S. releases approximately twice as much mercury as a large mercury-emitting U.S. power plant.[112]

U.S. Chlorine Factories Release Tons of Mercury (2002)

RANK BY TOTAL MERCURY RELEASES	FACILITY	CITY	STATE	EMISSIONS TO AIR (lbs)			TOTAL EMISSIONS (lbs) (TO AIR, WATER, AND OFF-SITE)
				fugitive	stack	total air	
1	Olin	Charleston	TN	1045	85	1130	2512
2	Occidental Chemicals	New Castle	DE	1046	28	1074	2238
3	PPG	New Martinsville	WV	1045	188	1233	2167
4	Occidental Chemicals	Muscle Shoals	AL	1067	20	1087	1771
5	ASHTA	Ashtabula	OH	1046	349	1395	1568
6	Vulcan	Port Edwards	WI	1054	28	1082	1462
7	PPG	Lake Charles	LA	1045	177	1222	1460
8	Pioneer	St. Gabriel	LA	862	48	910	1184
9	Olin	Augusta	GA	585	154	739	1028

Table 5 Source: Oceana based on EPA Toxics Release Inventory Data

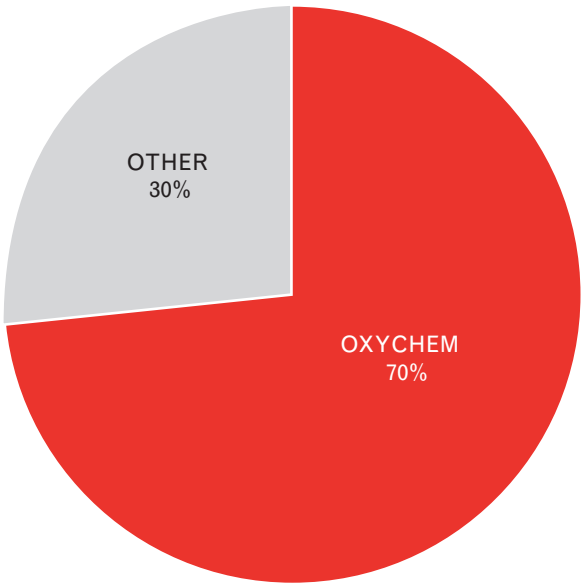
As previously stated, these emissions are company-reported figures compiled by the EPA. Given the tens of thousands of pounds of mercury that chlorine plants have lost or for which they have failed to account, the self-reported figures are unlikely to be accurate. With both reported releases and "lost" mercury taken into consideration, the nine mercury-based chlorine plants in the U.S. may rival the entire power industry as the nation's largest industrial mercury polluter. (See Box 2)

Mercury-Emitting Chlorine Plants Rank First in Mercury Releases in Seven States

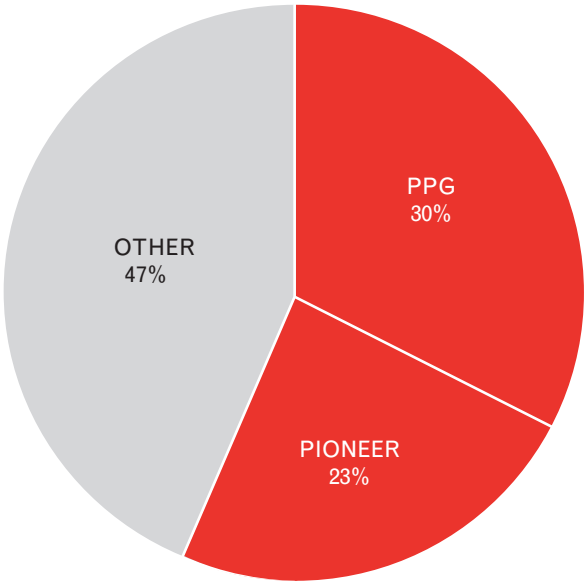
In 2002, in seven of the eight states where they were operating, mercury-emitting chlorine plants released more mercury to the air than any other source in that state. In Georgia, the eighth state, the mercury-based chlorine plant ranked second. There are two other states with mercury-cell chlorine plants that have recently shut down or converted – one in Texas, which was idle in 2002 and cannot be considered, and a Westlake Vinyls plant that was the largest single source of mercury air emissions in Kentucky in 2001, prior to its conversion.[113]

In two states, Louisiana and Delaware, the chlorine plants not only ranked first, but released more

PERCENTAGE OF MERCURY AIR EMISSIONS (DELAWARE, 2002)



PERCENTAGE OF MERCURY AIR EMISSIONS (LOUISIANA, 2002)



mercury than all other sources combined.[114] In Delaware, a chlorine facility operated by OxyChem accounted for more than 70 percent of mercury releases to the air, and 75 percent of the total mercury released (to air, water and off-site disposal).[115] In Louisiana, two chlorine plants combined accounted for more than 50 percent of all air emissions.[116] In Kentucky, before it closed, Westlake Vinyls emitted more than 20 percent of mercury released to air and about 68 percent of total mercury released in that state.

Appendix I provides an analysis of each of these facilities and mercury pollution problems in each state.

Regulations Should be Strengthened

The regulations governing mercury emissions from chlorine plants urgently need to be strengthened. Because the plants release mercury into the air, they are subject to the Federal Clean Air Act and comparable state and local laws.[117] In December 2003, the EPA weakened the rules that apply to mercury-cell chlorine plants.

First, the agency essentially exempted mercury-cell chlorine plants from Clean Air Act standards that apply to mercury-free chlorine plants. Under the Clean Air Act, the agency requires facilities that emit hazardous pollutants such as mercury to use Maximum

HOLTRACHEM LEAVES MESSY LEGACY IN MAINE

From 1967 to 2000, HoltraChem Manufacturing Company operated a mercury-cell chlorine plant in Orrington, Maine, during which time the site was the subject of numerous violations for mercury pollution and other offenses.[125] Violations since 1989 include discharges of mercury-containing brine to leach fields, a 1995 discharge of 65,000 gallons (~246,000 L) of wastewater high in mercury, and a 1997 leak that spilled 30,000 to 270,000 gallons(~113,550 to over 1 million L) of mercury-contaminated brine.[126]

In 1986, the EPA had ordered the plant to clean up the property and the river under RCRA. Dissatisfied with the owner's progress, the United States filed a lawsuit in 1991 in federal court, which was settled in 1993 with the owner's promise to clean up the property and river.[127] The site has been the subject of numerous investigations and enforcement actions by the Maine Department of Environmental Protection (Maine DEP).

The plant permanently shut down in 2000, leaving behind extensive pollution and an expensive cleanup. An investigation determined that the property and parts of the Penobscot River are contaminated with mercury and other pollutants, and the area is now a RCRA corrective action site.[128] There is mercury contamination in the soils and sediments, groundwater, surface water and biological samples, and elevated mercury levels have been found as far away as 20 miles (13 km) down-river.[129] There are five landfills on-site that contain hazardous waste.[130]

The Maine People's Alliance and the Natural Resources Defense Council filed and won a lawsuit against HoltraChem and Mallinckrodt (the former owner) forcing a more detailed study of the impact of the site on the Penobscot River*. The EPA and the Maine DEP are also proceeding with a cleanup of the site and the mercury cell is being dismantled.[131] A *Washington Post* article noted that after this plant's 2000 closure, state officials concluded that mercury had permeated the plant, seeped into the river, groundwater and soil and will take years and millions of dollars to clean up. In addition, despite the draining of the plant's pipes and several years of cleanup, 33 tons (30 metric tons) of mercury are still missing.[132]

*See Maine People's Alliance, et al. v. Holtrachem Mfg. Co., et al., 211 F.Supp.2d 237 (D. Me. 2002); Maine People's Alliance, et al. v. Holtrachem Mfg. Co., et al., 295 F.Supp.2d 97 (D. Me. 2003).

Box 3

Acheivable Control Technology to limit air pollution emissions – in this case, mercury-free technology. But rather than requiring the antiquated plants to meet the emissions standards of the majority of the industry by phasing out the mercury-based technology, the EPA established a loophole by creating a separate sub-category – and a separate set of emissions regulations – just for these nine mercury-emitting plants. As a result, the regulations would effectively sanction the continued use of the hundred-year-old, mercury-polluting process, rather than requiring these plants to move into the 21st century.

Second, as previously mentioned, U.S. regulations allow the estimation of fugitive emissions. When revising the rules for mercury-cell chlorine plants, the EPA had the chance to require monitoring of these emissions, which has been shown feasible.[118] Instead, the new regulations require only a set of maintenance activities or "work practices" designed to minimize these emissions, without requirements for monitoring to see if they are actually minimizing pollution.[119]

The Natural Resources Defense Council and the Sierra Club have challenged the rule in court.[120] Their lawsuit has been stayed pending EPA's reconsideration of the new regulation.

Mercury-Cell Plants are Hazardous Waste Sites

While mercury-cell plants contribute to the global mercury problem, they also have local consequences. In addition to their allowable mercury emissions (and unknown "losses"), some of the companies still operating mercury-cell chlorine plants in the United States have violated the Clean Air and Clean Water

Acts – both for the illegal disposal of mercury and for other illegal pollution. Nearly all of the companies still operating mercury-cell plants have incurred substantial fines and clean-up costs for past pollution. The vast majority of sites of past and current plants are now listed as Superfund or Resource Conservation and Recovery Act (RCRA) Corrective Action Sites.[121]

Seven of the nine operating chlorine plants using mercury-cell technology are RCRA Corrective Action Sites; an additional one is a proposed Corrective Action Site.[122] RCRA regulates the generation, transportation, handling, storage, and disposal of hazardous wastes from "cradle to grave" in the United States. When hazardous wastes have been released into the environment, the EPA or a state government can require an owner or operator of a site to investigate and clean up the wastes.[123]

Fourteen of the 32 inactive chlorine plants that once used mercury-cell technology are Superfund sites. [124] The Superfund program, enacted in the Comprehensive Environmental Responsibility, Compensation, and Liability Act of 1980, authorizes the EPA to require owners, operators and other responsible parties to pay for the clean up of abandoned hazardous waste sites. The most serious hazardous waste sites are placed on the National Priorities List (NPL) for possible long-term cleanup.

Mercury Contaminates Our Environment, Our Communities and Our Food

Mercury contamination from chlorine plants has cascading effects, beginning in the factories themselves. After mercury evaporates from the mercury cells, and before it escapes through cell room vents, much of it passes through the air in which factory employees work, and which they breathe.

In the 1990's, Olin Corporation settled a lawsuit with contracted workers who had been directed to sever a pipe which, when cut, spilled mercury onto the floor and onto the clothes and skin of the employees. They subsequently became ill, reporting symptoms including nausea, dizziness, headaches, cramps, joint pain and memory loss.[133] In Riegelwood, North Carolina, at least 71 former HoltraChem employees who worked at the company's old plant (now a Superfund site) have also filed civil lawsuits, claiming health damages from mercury exposure.[134]

GOVERNMENTS IN THE U.S. AND EUROPE HAVE WARNED WOMEN AND CHILDREN AGAINST EATING PARTICULAR FISH SPECIES INCLUDING SWORDFISH, SHARK, TILEFISH, KING MACKEREL, MARLIN, PIKE AND TUNA.

The risks of mercury exposure extend to local communities. Mercury released in wastewater enters local ecosystems even more directly. The pollution can build up in the food chain, and can be very harmful to animals and people living in the vicinity. In 2003, 45 states issued fish consumption advisories (2,300 in total) as a result of local mercury contamination.[135] Twenty-one states warned citizens against eating fish from any lakes and/or rivers in their states.[136] In December 2004, West Virginia issued a statewide advisory, becoming the 22nd state to do so.[137]

Equally disturbing is the advisory issued by the Food and Drug Administration (FDA), which is responsible for advising the public about contaminants in commercial seafood. The FDA, in conjunction with the EPA, has warned women and children not to consume four commercially available types of fish: swordfish, tilefish, shark and king mackerel, and to limit consumption of albacore tuna to six ounces each week.[138]

These fish are contaminated with mercury from a variety of sources, not just chlorine factories. As this report shows, however, the nine mercury-based chlorine facilities in the United States are major contributors to national mercury emissions, and the unnecessary pollution they produce ultimately adds to the contamination of fish around the world.

IV. MERCURY-EMITTING CHLORINE PLANTS: EUROPE

Mercury-Emitting Chlorine Production Still a Problem in Europe

There are 53 mercury-emitting chlorine plants in Europe (44 in Western Europe, seven in the EU 2004 accession countries, and two in the EU 2007 accession countries).[141] They are located in Belgium, the Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Slovenia, the Slovak Republic, Spain, Sweden, Switzerland, and the United Kingdom.[142]

In the last 15 years at least 34 sites in the Netherlands, Germany, United Kingdom, Finland, France, Sweden, Norway, Italy, Portugal, Belgium, Spain, Austria and Denmark have shut down either all or part of their mercury-based production processes, with some of these plants converting to membrane technology.[143]

Emissions from Mercury-Cell Chlorine Plants (Europe 2001)

RANK	FACILITY	COUNTRY	TOTAL EMISSIONS (kg)
1	Ineos Chlor LTD	UK	1151
2	Degussa AG Werk	Germany	312
3	Vestolit	Germany	273
4	EniChem S.p.A (Syndial S.p.A. – Priolo)	Italy	265
5	Solvay Electrolyse	France	213.6
6	Atofina	France	195
7	Solvay Quimica (Torrelavega)	Spain	190
8	Vintron	Germany	186
9	Solvay-Solvic SA	Belgium	177.7
10	Tessenderlo Chemie	Belgium	174.6
11	Albion Chemicals	UK	173.2
12	BASF AG	Germany	165
13	Aragonesas Industrias y Energia SA	Spain	162.4
14	Atofina	France	161
15	Solvay Chimica Italia S.p.A	Italy	155
16	Bayer AG	Germany	146
17	Atofina	France	144.4
18	LII Europe	Germany	142
19	Bayer AG	Germany	133.4
20	Albemarle PPC	France	125
21	Solvay NV	Belgium	113
22	Vinnolit	Germany	107
23	Borsodchem Rt	Hungary	97
24	Aragonesas Industrias y Energia SA Puerto	Spain	90.8
25	Ercros Industrial SA	Spain	82.8
26	Solvay Solexis S.p.A – Stabilimento di Bussi	Italy	66.5
27	ECI Elektro-Chemie	Germany	63.6
28	ICI ChlorChem (Ineos)	Germany	61.1
29	Akzo Nobel Chemicals BV	Netherlands	58.6
30	Quimica Del Cinca SA	Spain	45
31	Eka Chemicals Oy	Finland	41.9
32	Eka Chemicals AB	Sweden	33.6
33	Tessenderlo Italia SRL	Italy	33.1
34	Saline di Volterra (PI) (Stabilimento sito)	Italy	29.8
35	Electroquímica de Hernani SA	Spain	28.4
36	Hellenic Petroleum SA Inorganics Unit	Greece	24.3
37	Aragonesas Industrias Y Energía SA	Spain	22
38	Hydro Polymers	Sweden	16.6
39	Akzo Nobel Base Chemicals AB	Sweden	16.5
40	Rhodia Eco Services LTD	UK	14.7
41	PC Loos (Tessenderlo Chemie)	France	11
42	Caffaro S.p.A – Stabilimento di Brescia	Italy	6.3
43	Enichem (Syndial Spa Stabilimento di Assemini)	Italy	2.3

Source Oceana with data from the EPER database which has data for the EU-15 countries and Norway and Hungary. Data unavailable for one plant in France, one plant in Italy, two plants in Spain.

Table 6

MERCURY IN THE RIVER

Mercury "has been seeping out into the River Elbe for decades – in Stalinist times as much as 2000 kg (4400 lbs) each year. The river winds northwards into the sea at Hamburg in Germany, where the sludge in the harbor became so toxic that it had to be dredged."[139] Much of the mercury comes from factories, including the SPOLchemie chlorine plant in Ústí nad Labem, Czech Republic. This plant produces chlorine and many other chemicals. It is now undergoing renovations to comply with European Union production standards.[140]

Box 4

Lost Mercury in Europe…and Steps to Solve It

As in the United States, not all mercury is recycled within the chlorine production process. Some of the mercury is lost to air, water, wastes and products, while some accumulates in equipment.

In 2000, the chlorine plants in the first fifteen member states of the EU-15 reported that they used 104.5 tons (95 metric tons) of mercury.[144] That same year, the industry reported that 8.8 tons (8 metric tons) of mercury were released to the environment.[145] Ninety-six tons (87 metric tons) of mercury were unaccounted for. This is almost **three times** the amount of mercury released to the air by all coal-fired power plants and residential heating in the EU that year, which totaled about 33 tons (30 metric tons).[146]

Regulation (Mercury Phase-Out Required in Europe)

The European Commission agreed in 1996 to take action to prevent releases of pollutants like mercury to water, air or land from industrial activities. As discussed previously, through the Integrated Pollution Prevention and Control Directive (IPPC), the Commission requires facilities to follow BAT, a concept and term similar to one used in the United States. In Europe, due to the availability of cleaner, more efficient technology, the mercury-emitting chlorine production process is not considered to be BAT. Therefore, facilities are required to phase out the use of mercury by October, 2007.[147]

Euro Chlor, however, is promoting an alternative timeframe that would result in 13 additional years of mercury releases to the environment. Some countries also have committed to phase-out mercury use, but according to a slower schedule than what is required by the Directive.[148] In addition, members of the Paris Convention for the Prevention of Marine Pollution From Land-Based Sources (PARCOM) have also agreed that mercury-cell chlorine plants should be phased out completely but have set a target date of 2010.[149]

Sweden, Belgium, Poland, the Netherlands and Finland all have timetables set to meet the 2010 deadline, while other countries have already met the deadline. In Portugal, the only mercury-based plant already had converted to membrane cells in 2002.[150]

It is anticipated that mercury being removed from European facilities that are subject to phase-outs may flow to countries with weaker, or no phase-out requirements. The European chlorine industry has agreed to return used mercury to the mining company Minas de Almaden. This mercury will then be resold, and will replace raw mercury that would otherwise be mined.[151]

Chlorine Production Second only to Power as Main Mercury Source

Overall, in 1995, the mercury cell chlorine process was the number two source of European mercury emissions (18%), behind the combustion of coal in power plants and residential heat furnaces which together generated 31% of the emissions from the EU-15.[152]

In 2000, power plants over 50 megawatts in the EU-15 released nearly 20 tons (18 metric tons) of mercury to air, compared to the 4.5 tons (4.1 metric tons) released by chlorine factories to the air in those same countries.[153] Since the mercury-based chlorine plants lost almost three times the total releases by all coal-fired power plants and residential heating in the EU that year, it is difficult to determine whether coal combustion or chlorine production is the number one source of mercury releases.

In addition to conversion, PARCOM included requirements to reduce the amount of pollution that a plant is allowed to release to the environment.[154] Because of this and closures and conversions, the European mercury releases have been reduced considerably from 1977 levels.[155]

Despite this reduction, chlorine plants are still producing thousands of kilograms of poisonous mercury overall. This pollution is completely avoidable, yet the legacy of pollution continues.

- In Belgium, three of the top ten sources of mercury pollution were chlorine factories, accounting for 20% of total mercury releases at 1023 lbs (465 kg).

- In the United Kingdom, two of the three mercury-cell chlorine factories ranked number one and number three for mercury emissions. The three mercury-based plants alone accounted for over one-third of the mercury pollution in the entire country at 2714 lbs (1234 kg).[156]

- In France, chlorine plants account for 23% of the mercury air emissions, 38% of the mercury emissions to water and almost 25% of mercury emissions overall.[157]

Appendix II provides an analysis of many of these facilities and mercury pollution problems in eleven European countries.

Effects: Local and Distant Contamination

Mercury releases from mercury-cell chlorine plants have both local and distant effects. Mercury released in wastewater enters local ecosystems even more directly. The pollution can build up in the food chain, and can be very harmful to animals and people living in the vicinity – as well as long distances from the plant.

Studies in Europe show that mercury from chlorine plants can contribute over 60% of the industrial mercury in a given area. In some countries such as Ukraine, Belgium, and the United Kingdom, the (average) contribution from the chlorine industry in some areas exceeds ten percent of the total mercury deposited for the whole country.[158]

Mercury released into the air or water can also travel great distances, carried by wind and water currents and biological processes. Scientists believe that mercury released to the atmosphere may take anywhere from six days to two years to fall to land. Some mercury found in rain may be coming from sources as far as 2,500 km (about 1,550 miles) away.[159] It is estimated that 80% of the mercury deposited in southern Sweden originates from other countries.[160] Even countries like Denmark, Norway and Estonia that have no mercury-cell chlorine plants receive mercury pollution from chlorine plants in other countries.[161]

As in the United States, some mercury-cell chlorine factories in the EU are responsible for mercury contamination of land and waterways on site. In many places, this contamination is a major environmental problem.[162] In Sweden, two sites had high contamination, both on land, and in sediment in the sea or lakes nearby. In both cases, clean-up of the site was needed.[163] In Germany, two chlorine factory sites were cleaned up in Bitterfeld, and Sow-Leuna. Mercury-contaminated soil, building material and steel were removed at both sites, 65,000 metric tons (71,500 tons) and 230,000 metric tons (253,000 tons) respectively.[164]

V. OCEANA SOLUTIONS

Oceana is seeking solutions to the global mercury problem. Our goal is to defend the European Union's mercury phase-out and to win a complete transition to mercury-free technology there and in the United States.

Recommendations

Maintain European phase-out

- The European Union should require full compliance with the IPPC directive and the 2007 conversion deadline.
- The requirement should stand for all current members of the EU and be a condition of becoming a member.

Phase out mercury-emitting chlorine production in the United States by 2008

- EPA should require all nine operating facilities to convert to mercury-free technology, which is the maximum achievable control technology for producing chlorine.
- EPA should require any temporarily closed (idled) plants to shift to mercury-free technology before reopening.
- Facilities still using mercury-emitting technology should be required to monitor fugitive emissions, and conduct tests to identify the status of the lost mercury.

Ensure the safe disposal of mercury when plants convert or shut down

- Because mercury is a highly toxic substance, chemical companies and governments should be responsible for the cleanup of the site once a plant has been converted or closed. Surplus mercury and old equipment should be disposed of properly in a hazardous waste facility and not exported to other countries that are not currently subject to a phase-out.
- Companies should properly treat and clean up mercury-contaminated groundwater, surface water, soils and sediments on the site of the plant.

Conclusion

The chlorine industry is a major mercury source that has been almost completely ignored, yet this industry can completely eliminate its mercury pollution. Europe is moving toward an industry-wide transition to mercury-free technology; the U.S. should do the same. By bringing their production processes into the 21st century, chlorine manufacturers can greatly reduce the amount of mercury that is released and carried into our environment, our communities and our food.

APPENDIX I

[UNITED STATES]

STATE-BY-STATE ANALYSIS OF LOCAL MERCURY CONTAMINATION FROM MERCURY-CELL CHLORINE PLANTS

Today there are mercury-cell chlorine plants operating in eight states: Alabama, Delaware, Georgia, Louisiana, Ohio, Tennessee, West Virginia and Wisconsin. In seven of the eight states where mercury-cell chlorine plants are currently operating, they are the #1 source of mercury pollution in the states based on 2002 data.[165]

In 2003, 45 states issued fish consumption advisories as a result of local mercury contamination.[166] This resulted in 2,300 advisories across the country that year due to mercury contamination in recreationally caught fish. Twenty-one states warned citizens against eating fish from any lakes and/or rivers in the state.[167] In 2004, West Virginia issued a statewide advisory as well.[168]

ALABAMA

The only mercury-cell chlorine plant still operating in Alabama, Occidental Chemical Corporation's (OxyChem) facility in Muscle Shoals, is the largest single source of mercury pollution in the state.[169]

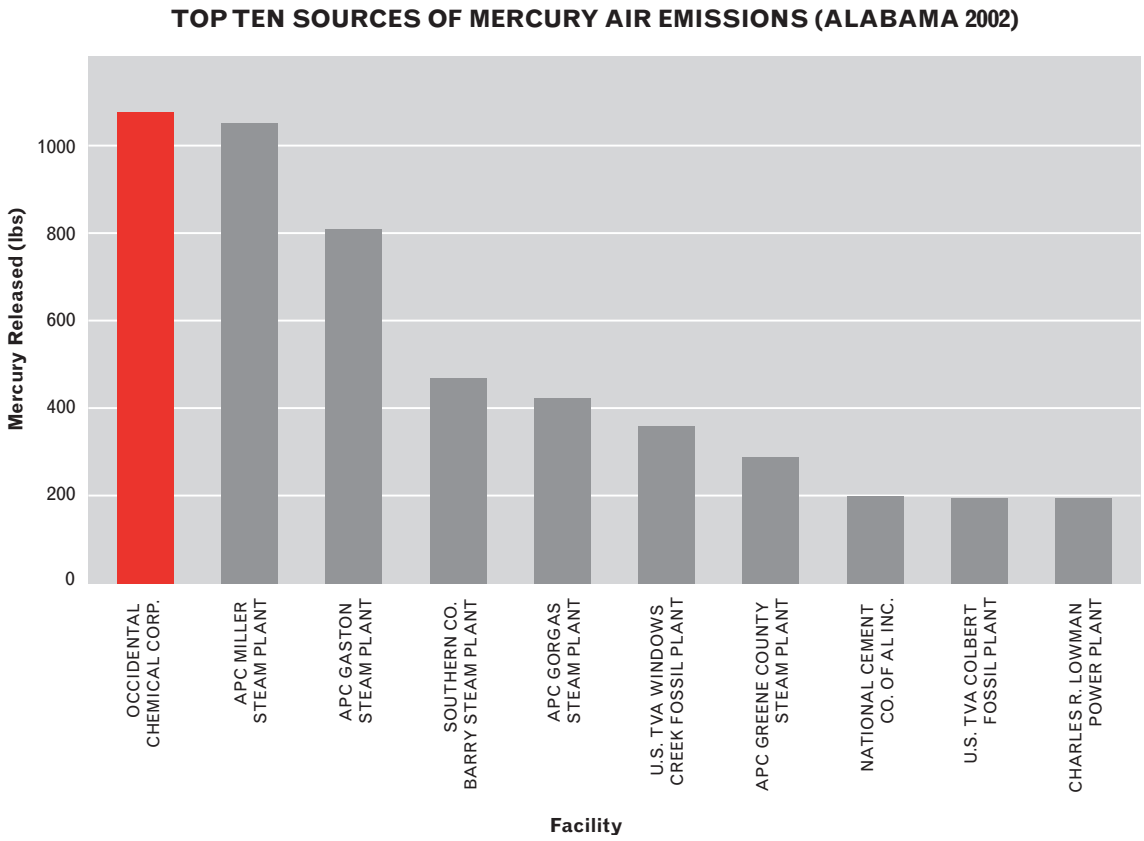
Alabama has been plagued with mercury problems. Some of the state's residents have been shown to have much higher levels of mercury in their blood than normal.[170] While some of Alabama's mercury has a distant origin, much of it may have come from chlorine factories in the state.

Alabama was once the site of at least five mercury-cell chlorine plants.[171] Today only one remains in operation. The OxyChem plant is located in Muscle Shoals, in Northwest Alabama, near Pond Creek and the Tennessee River.[172]

Key statistics for OxyChem's Muscle Shoals plant (in 2002)[173]

- #1 source of mercury released to the air in Alabama
- #4 source of total mercury pollution in Alabama
- Responsible for 18 % of mercury released to the air in Alabama
- #17 source of mercury released to the air in the United States
- #38 source of total mercury pollution in the United States
- RCRA Corrective Action Site[174]

In 2002, this plant released 1087 lbs (494 kg) of mercury to the air and 9.6 lbs (4.4 kg) into water and disposed of 664 lbs (302 kg) off site (primarily in landfills). Of the air emissions, 1067 lbs (485 kg) of the mercury came from fugitive emissions while only 20 lbs (9 kg) were measured and released as stack emissions.[175]



Source: Oceana based on EPA Toxics Release Inventory Data

Former Plants, A Legacy of Pollution

Most of the chlorine plants that once operated within Alabama's borders are gone, but the mercury is not. The Mobile area was once a chlorine industry hub, home to plants owned by the Olin Corporation, Stauffer Chemicals, and OxyChem, among others.[176] The sites of these former plants are now Superfund and/or RCRA sites – areas identified by the government as contaminated with hazardous wastes that pose a threat to human health and the environment.[177]

One of the mercury-contaminated Superfund sites is at the location of Stauffer Chemical's former plant at Cold Creek Swamp, in the Mobile-Tensaw Delta region, a few miles above the town of Axis.[178]

Another is the site of the former Olin plant, which operated using mercury-cell technology from 1952 to 1982, in the Olin basin, on the edge of the delta near the Mobile County – Washington County line.[179] Olin continues to operate a chlorine plant at this site using diaphragm cell technology.[180] Tests show that past releases of mercury and organic chemicals have contaminated the shallow groundwater beneath the former plant site, and that nearby wetlands along the Tombigbee River are contaminated from past wastewater discharges as well. [181] As part of a 2003 fish monitoring survey, the Alabama Department of Environmental Management (ADEM) tested fish in the Olin Basin, even though this private waterbody is not accessible to the public. Mercury concentrations were above the FDA guidance level in bass, blue catfish, and black crappie.[182]

The last of Alabama's former mercury-cell facilities in Mobile is OxyChem, and it is a RCRA Corrective Action Site.[183] This plant was converted to membrane technology in 1991, reducing hazardous wastes generated from 38 tons per year to three tons per year.[184]

Mercury-Related Fish Advisories

In Alabama, there are two types of advisories issued by the Department of Public Health:[185]

> A **limited consumption advisory** states that women of reproductive age and children less than 15 years of age should avoid eating certain types of fish from specific waterbodies. Other people should limit consumption to one meal per month.
> A **no consumption advisory** recommends that everyone should avoid eating certain species of fish in the defined area.

There were 26 advisories for mercury,[186] including no-consumption advisories for certain species (in most cases, largemouth bass) in 19 bodies of water. One additional reservoir had a limited-consumption advisory.

A no-consumption advisory for all species was issued for Cold Creek Swamp, located very close to the site of a former mercury-cell chlorine plant.

The Department of Public Health also issued a statewide advisory for king mackerel caught anywhere on the Gulf Coast: citizens were warned not to eat king mackerel longer than 39 inches, and to consume limited amounts of smaller fish.[187]

DELAWARE

The only mercury-cell chlorine plant still operating in Delaware is the largest single source of mercury pollution in the state.

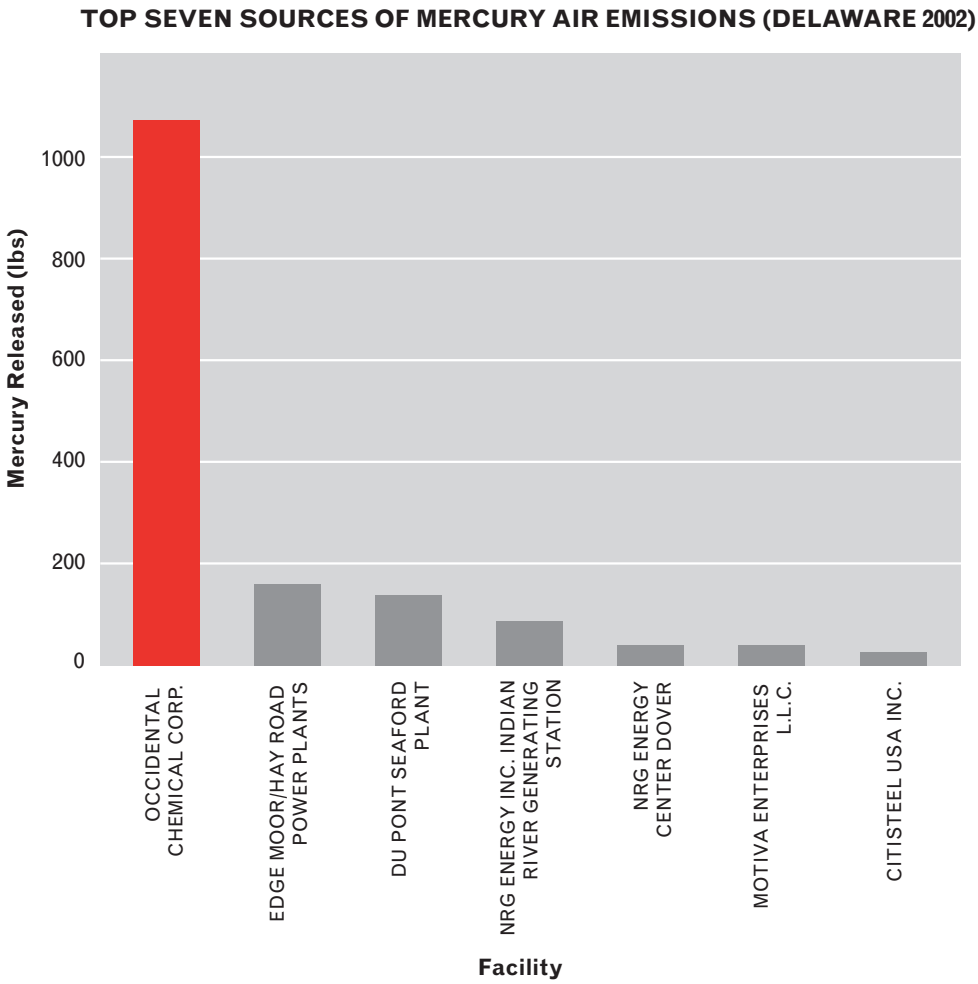
The Occidental Chemical Corporation (OxyChem) plant is located in Delaware City, near Red Lion Creek and the Delaware River.[188]

Key statistics for OxyChem's Delaware City plant (in 2002)[189]

- #1 source of mercury released to the air in Delaware
- #1 source of total mercury pollution in Delaware
- Responsible for 71% of mercury air emissions in Delaware
- Responsible for 75% of total mercury releases in Delaware
- #20 source of mercury released to the air in the United States
- #28 source of total mercury pollution in the United States
- RCRA hazardous waste Corrective Action Site[190]

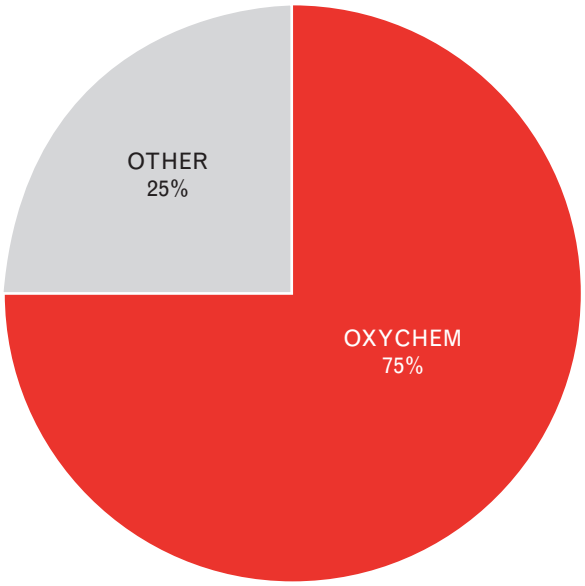
In 2002, this plant released 1074 lbs (488 kg) of mercury to the air and 20.8 lbs (9.5 kg) into the water and disposed of 1144 lbs (520 kg) off-site (primarily in landfills). Of the air emissions, 1046 lbs (475 kg) of the mercury came from fugitive emissions while 28 lbs (13 kg) were measured and released as stack emissions.[191]

This plant was partially idled in 2003 which will result in a decrease in emissions in that year.[192]

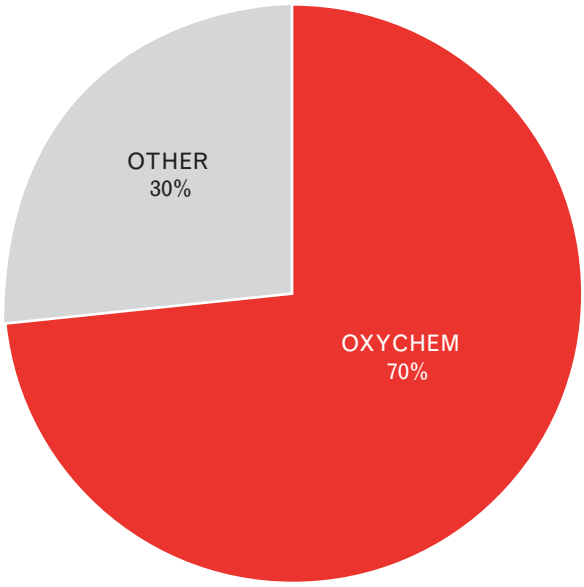


Source: Oceana based on EPA Toxics Release Inventory Data

PERCENTAGE OF TOTAL MERCURY RELEASES (DELAWARE, 2002)



PERCENTAGE OF MERCURY AIR EMISSIONS (DELAWARE, 2002)



Mercury Contamination

This OxyChem plant has released enough mercury into its surrounding environment to qualify as a RCRA Corrective Action Site.[193] In 1991, the EPA directed the plant to investigate and treat contaminated soils, sediments, surface water or groundwater that may have been affected by hazardous waste releases. OxyChem removed and treated mercury-contaminated soil and was required to construct a barrier, to prevent mercury from leaching into groundwater, and to begin a waste monitoring system in 2004.[194]

2004 Mercury-Related Fish Advisories[195]

The state has issued four fish advisories for mercury: one for two lakes, one for the length of the Delaware River and one for the Delaware Bay. In fact the Delaware River and Bay are so contaminated that in March of 2004, Delaware and New Jersey jointly issued a fish consumption advisory for both waterways. Citizens were warned not to eat fish caught in the Delaware Estuary north of the Chesapeake, or in the Delaware Canal up to the Pennsylvania border; and not to eat large bluefish caught south of the canal. Children and women of child-bearing age were warned not to eat any striped bass, bluefish, white perch, American eel, channel catfish or white catfish caught in the estuary below the Pennsylvania border.

Two other advisories issued by the state of Delaware warned against eating finfish from Becks Pond more than once a year, and finfish from Silver Lake in Dover more than twice a year.

GEORGIA

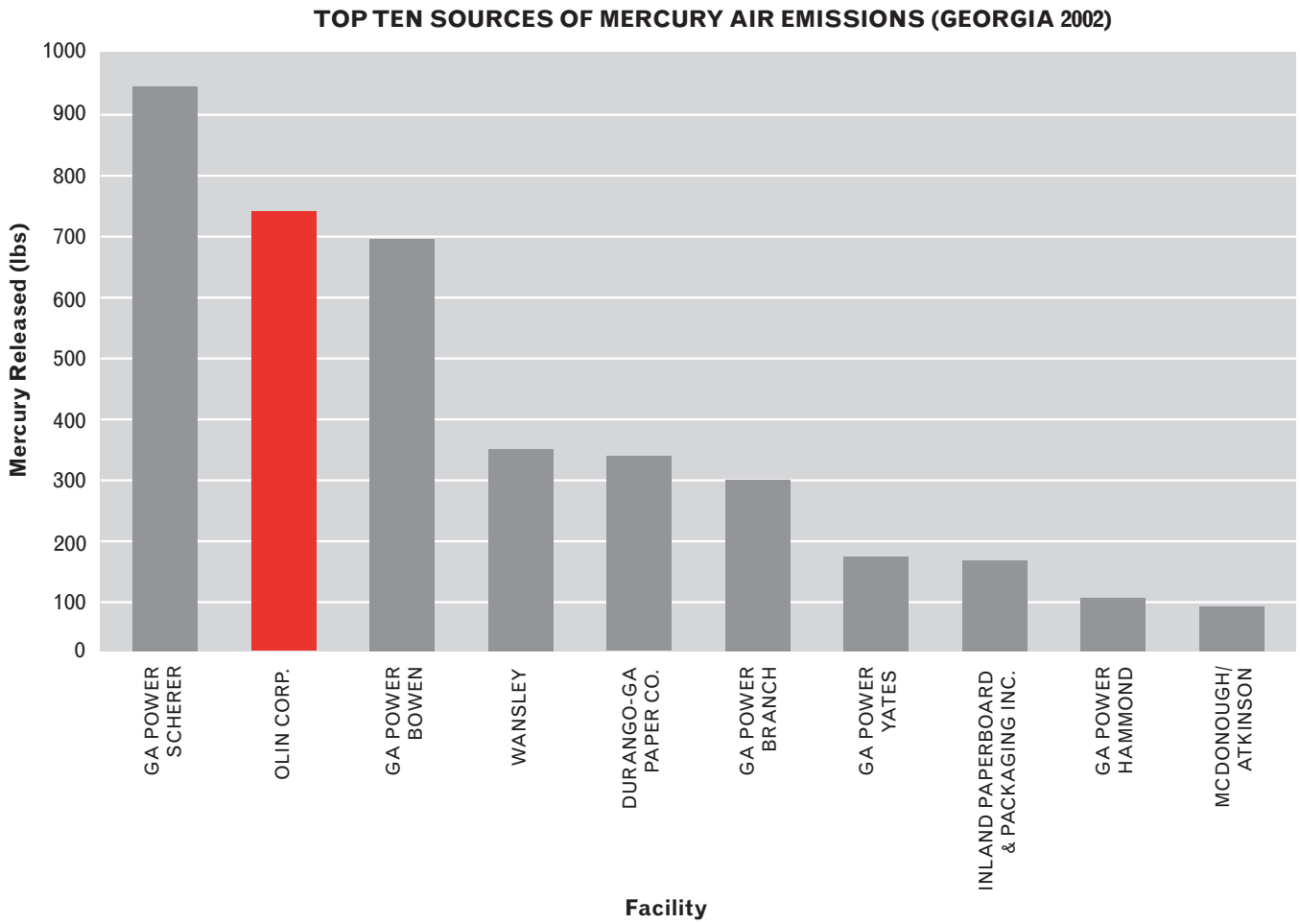
The only mercury-cell chlorine plant still operating in Georgia is the second largest single source of mercury pollution in the state.[196]

The Olin Chemicals plant is located in Augusta, Georgia, near the Savannah River.[197]

Key statistics for Olin's Augusta plant (in 2002)[198]

- #2 source of mercury released to the air in Georgia
- #2 source of total mercury pollution in Georgia
- Responsible for 17% of mercury released to air in Georgia
- #39 source of mercury released to the air in the United States
- #69 source of total mercury pollution in the United States
- RCRA hazardous waste Corrective Action Site[199]

In 2002 this plant released 739 lbs (336 kg) of mercury to the air and 6.7 lbs (3.0 kg) into the water and disposed of 282 lbs (128 kg) off-site (primarily to landfills). Of the air emissions, 585 lbs (266 kg) of the mercury came from fugitive emissions while only 154 lbs (70 kg) were measured and released as stack emissions.[200]



Source: Oceana based on EPA Toxics Release Inventory Data

Mercury Contamination

This Olin plant has leaked and released enough mercury into its surrounding environment to qualify as a RCRA Corrective Action Site.[201] Throughout 2003 and 2004, the plant failed to monitor waste releases to groundwater as required by its RCRA permit.[202]

Additionally, LCP, a division of Hanlin Group (Allied) operated a mercury-cell plant in Brunswick, GA from 1957 to 1994. The Brunswick site, the majority of which is tidal marsh, is a Superfund site.[203] EPA estimates that more than 380,000 pounds (over 170,000 kg) of mercury were "lost" in the area during the period of operation of the plant.[204] Mercury and polychlorinated biphenyls (PCBs) have been detected in aquatic life at levels sufficient to produce a ban on commercial fishing in these areas and a seafood consumption advisory for part of the river and all of the creek.[205]

2004 Mercury-Related Fish Advisories[206]

Georgia issued 178 fish consumption advisories – relating to 40 different rivers and 34 lakes and ponds.

Near the Olin plant, in the Savannah River Basin, there were 24 advisories, affecting five rivers and seven lakes and ponds.

In the Purvis Creek area near the Brunswick Superfund site, Georgia currently recommends eating no more than one meal per week of red drum, and one meal per month of blue crab, spotted seatrout, Southern kingfish (whiting), and sheepshead, due to mercury contamination.[207] These recommendations are based on data collected in 2002, three years after EPA excavated the vast majority of on-site soil and waste piles.[208] The previous year's (2003) consumption guidelines based on ecological data collected in 1995 were more restrictive (for example, it was not safe to eat red drum), which indicates that mercury levels may have decreased following the cleanup.[209] The state also has issued mercury warnings for the whole estuary (St. Simon's Estuary).

Georgia, Florida and South Carolina jointly issued an advisory recommending that no one eat king mackerel more than 39 inches long (15 –17 lbs.), and that pregnant women, nursing mothers and children restrict their consumption of smaller fish (33 – 39 inches) to one meal per month. The states also recommended that other adults limit their consumption of smaller King Mackerel (33 – 39 inches) to one meal per week.

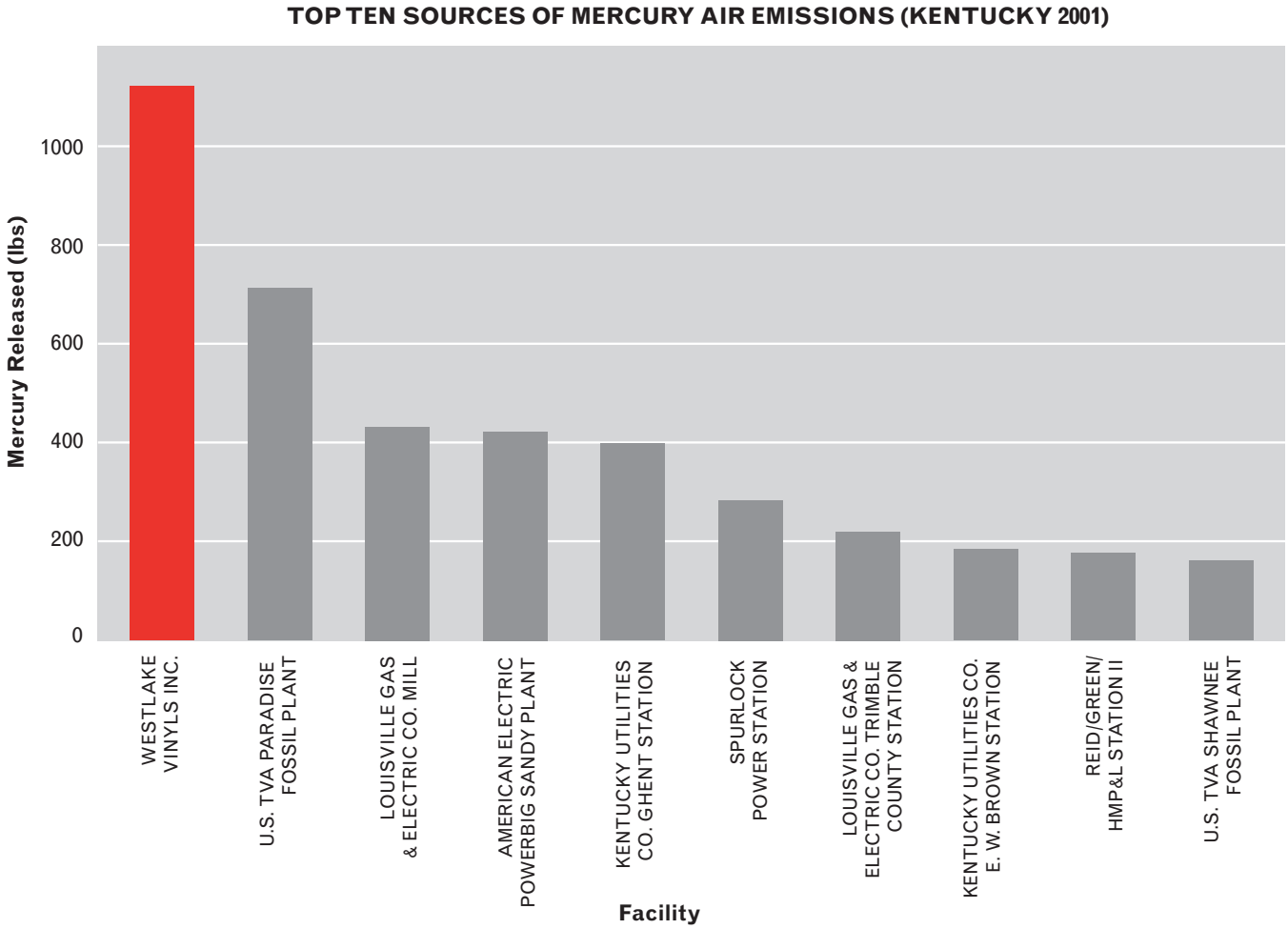
KENTUCKY

In 2001, a mercury-cell chlorine plant in Kentucky was the largest source of mercury air pollution in the state, responsible for 68 percent of the total mercury releases in the state.[210] The plant was operated by Westlake Vinyls. The mercury cells stopped operation in 2002 and the plant was converted to membrane technology which went online in January, 2003. The mercury cells were decommissioned by June, 2003.[211]

Key statistics for Westlake Vinyls' Calvert City plant (in 2001 when using mercury-cell technology)[212]

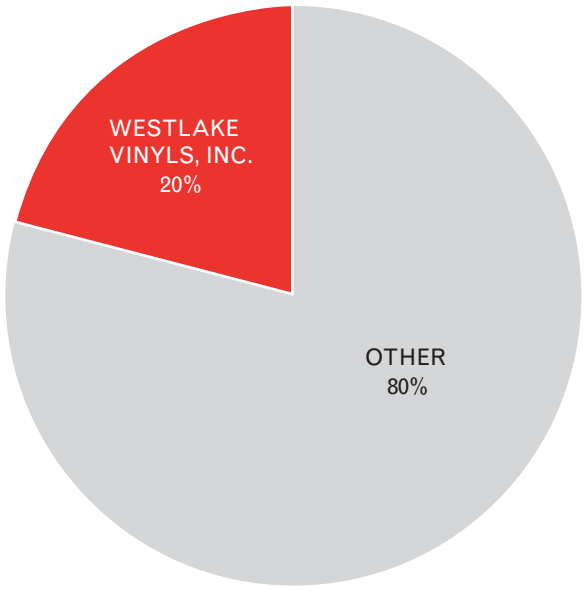
- #1 source of mercury released to the air in Kentucky
- #1 source of total mercury pollution in Kentucky
- Responsible for 21% of air mercury emissions in Kentucky
- Responsible for 68% of total mercury emissions in Kentucky
- #14 source of mercury released to the air in the United States
- #13 of total mercury pollution in the United States
- RCRA Corrective Action Site
- Landfill is a Superfund site[213]

In 2001, this plant released 1130 lbs (514 kg) of mercury to the air and disposed of 22,172 lbs (10078 kg) off site (primarily in landfills). In 2002, the year it was decommissioned, this plant reported the release of 6 lbs (2.7 kg) of mercury to the air and disposed of 27,777 lbs (12,626 kg) of mercury off-site.[214]

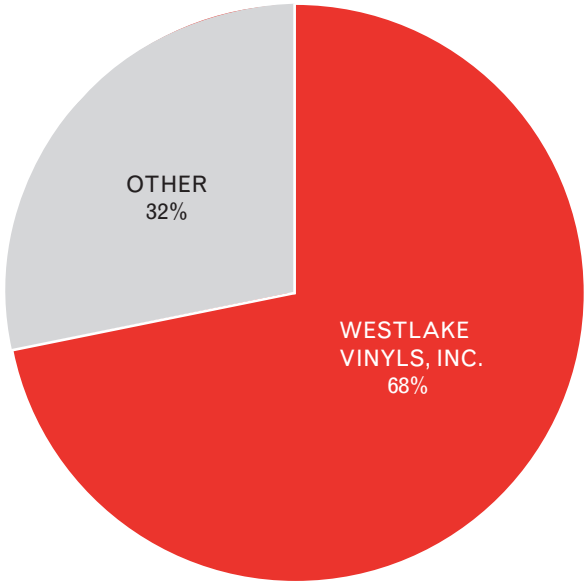


Source: Oceana based on EPA Toxics Release Inventory Data

PERCENTAGE OF MERCURY AIR EMISSIONS (KENTUCKY, 2001)



PERCENTAGE OF TOTAL MERCURY RELEASES (KENTUCKY, 2001)



In 2001 the mercury air emissions for the state of Kentucky totaled 5256 lbs. In 2002, after the plant was converted, the state's mercury air emissions were reduced to 3727 lbs: a decrease of almost 30 percent. The plant's conversion accounted for nearly 74% of this decline (the plant reduced its mercury air emissions by 1,124 lbs compared to the overall state decline of 1,529 lbs).

Mercury-Related Fish Advisories[215]

In 2000, a statewide fish consumption advisory was issued. Women of child-bearing age and children are advised to eat no more than one meal per week of freshwater fish from Kentucky (including the Ohio River) because of mercury. Also, five ponds in the West Kentucky Wildlife Management Area are under fish consumption advisories because of mercury.

LOUISIANA

The two mercury-cell chlorine plants still operating in Louisiana are the top two sources of mercury air emissions in the state.[216]

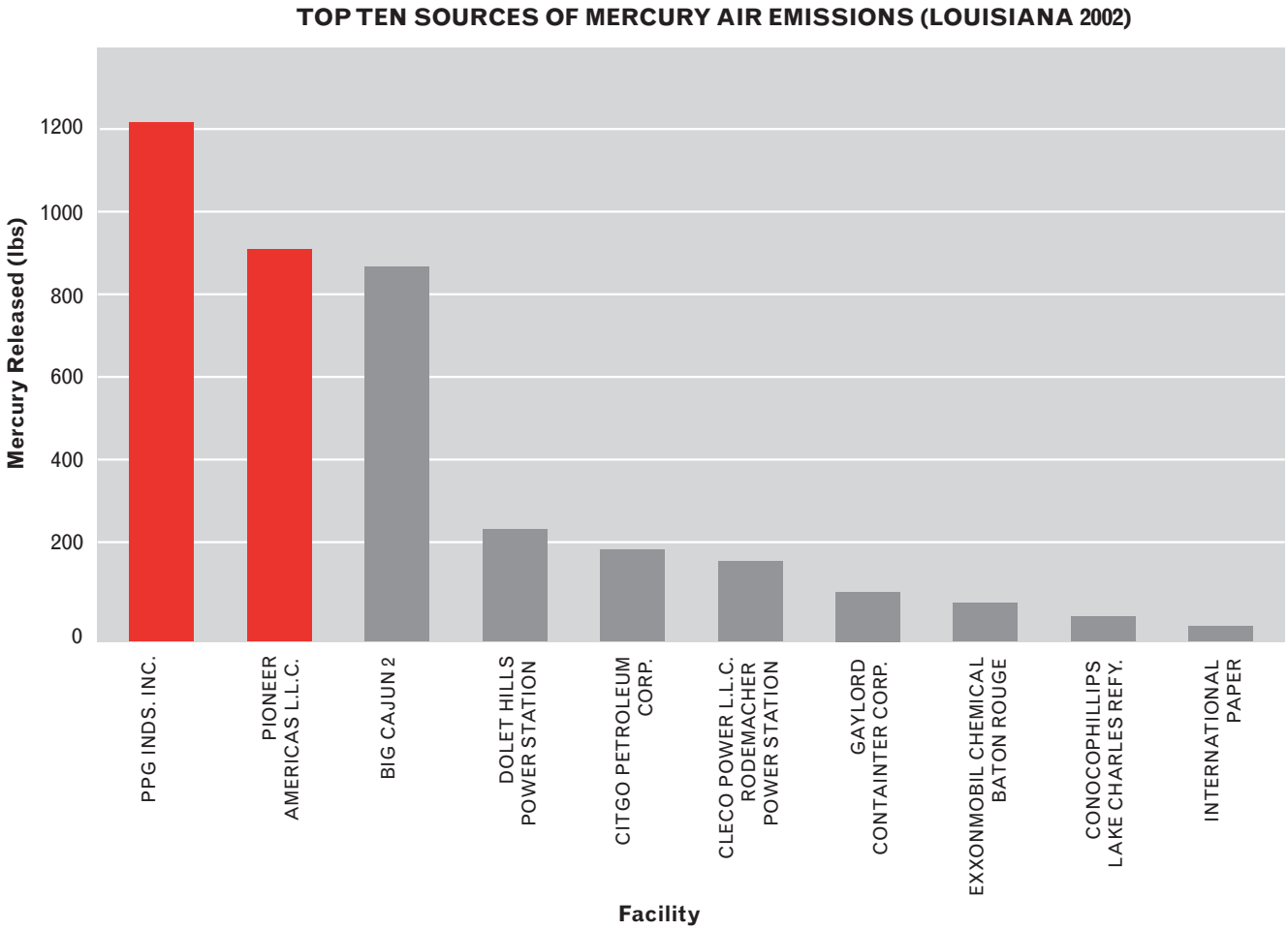
The two plants, owned by PPG and Pioneer, are located in Lake Charles and St. Gabriel, respectively. Together, they produce more than 50% of mercury pollution to air in Louisiana.[217] Two other plants once operated in the towns of Geismar and Plaquemine.

Lake Charles is in Calcasieu Parish. It is nestled on the Calcasieu River some 30 miles upstream from the Gulf of Mexico. The lake itself is connected to the Gulf via a deep-water ship channel and is the seat and port of entry of Calcasieu Parish. The PPG plant is located near Bayou d'Inde and the Calcasieu River Estuary.[218]

Pioneer's St. Gabriel facility is located on a 300-acre site near Baton Rouge, in Iberville county. The plant sits on the Mississippi River. This facility was the last mercury-cell plant built in the U.S.[219]

Key statistics for PPG's Lake Charles plant (in 2002)[220]

- #1 source of mercury air pollution in Louisiana
- #5 source of total mercury pollution in Louisiana
- Responsible for 30% of the mercury air pollution in Louisiana
- #13 source of mercury released to the air in the United States
- #29 source of total mercury pollution in the United States
- RCRA Corrective Action Site[221]



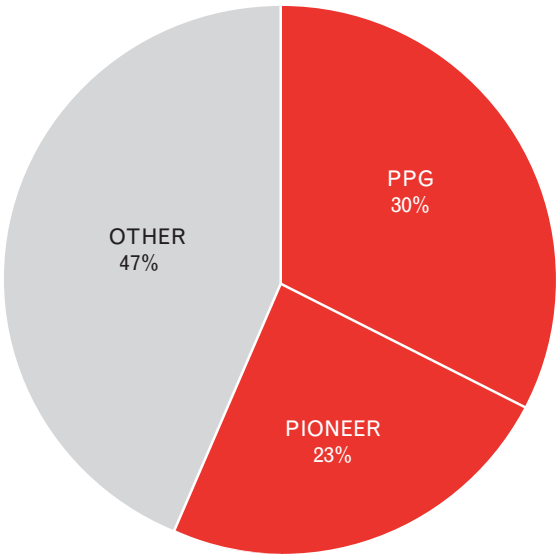
Source: Oceana based on EPA Toxics Release Inventory Data

The PPG plant released 1222 lbs (555 kg) of mercury to the air, 7 lbs (3 kg) to water, and disposed of 231 lbs (105 kg) in landfills in 2002. Of the air emissions, 1045 lbs (475 kg) of the mercury came from fugitive emissions while 177 lbs (80 kg) were measured and released stack emissions.[222]

Key statistics for Pioneer's St. Gabriel plant (in 2002)[223]

- #2 source of mercury air pollution in Louisiana
- #6 source of total mercury pollution in Louisiana
- Responsible for 23% of the mercury air pollution in Louisiana
- #25 source of mercury released to the air in the United States
- #60 source of total mercury pollution in the United States
- Proposed RCRA Corrective Action Site[224]

PERCENTAGE OF MERCURY AIR EMISSIONS (LOUISIANA, 2002)



In 2002, the Pioneer plant released 910 pounds of mercury to the air, 13 pounds to the water, and disposed of 261 pounds in landfills. Of the air emissions, 862 lbs (392 kg) of the mercury came from fugitive emissions while 48 lbs (22 kg) were measured and released as stack emissions.[225]

Together, these two facilities are responsible for more than half (53%) of the mercury emissions to air in Louisiana.

Because of contamination, the PPG site is a RCRA Corrective Action Site, while the Pioneer plant has been proposed for such a listing.[226]

Violations

In the last two years Pioneer's Louisiana Plant has been subject to three formal state enforcement actions and fines totaling $57,557 for violations of the Clean Water Act.[227]

PPG's Lake Charles plant has been the subject of three enforcement actions under RCRA in the last two years and has paid a total of $48,446 in penalties. The EPA also fined the facility $99,000 for violations of the Clean Air Act in 2003 and a total of $4500 in 2002 and 2003 for violations of the Comprehensive Environmental Response Compensation and Liability Act (the Superfund law).[228]

2004 Mercury-Related Fish Advisories[229]

Louisiana issued 36 mercury advisories, 35 for inland bodies of water and one for the Gulf of Mexico. The most common inland prohibition is on bowfin for all adults and children. As with Georgia, Louisiana has a no-consumption advisory for King Mackerel for the entire coast for fish over 39 inches, and limited consumption for smaller fish.

Each county containing an operating chloralkali plant has one specific advisory. In Calcasieu County, women of childbearing age and children under 7 should not eat largemouth bass, bowfin, or freshwater drum, while the rest of the populations should limit meals to two per month combined from the Calcasieu River. In Iberville, women of childbearing age and children under 7 should limit consumption of largemouth bass, black crappie, and bowfin to no more than one meal per month combined, and no more than four meals combined for the rest of the population (from the I-10 Canal). In Ascension Parish, home to the former BASF plant, there is one specific warning on bowfin for the Blind River.

OHIO

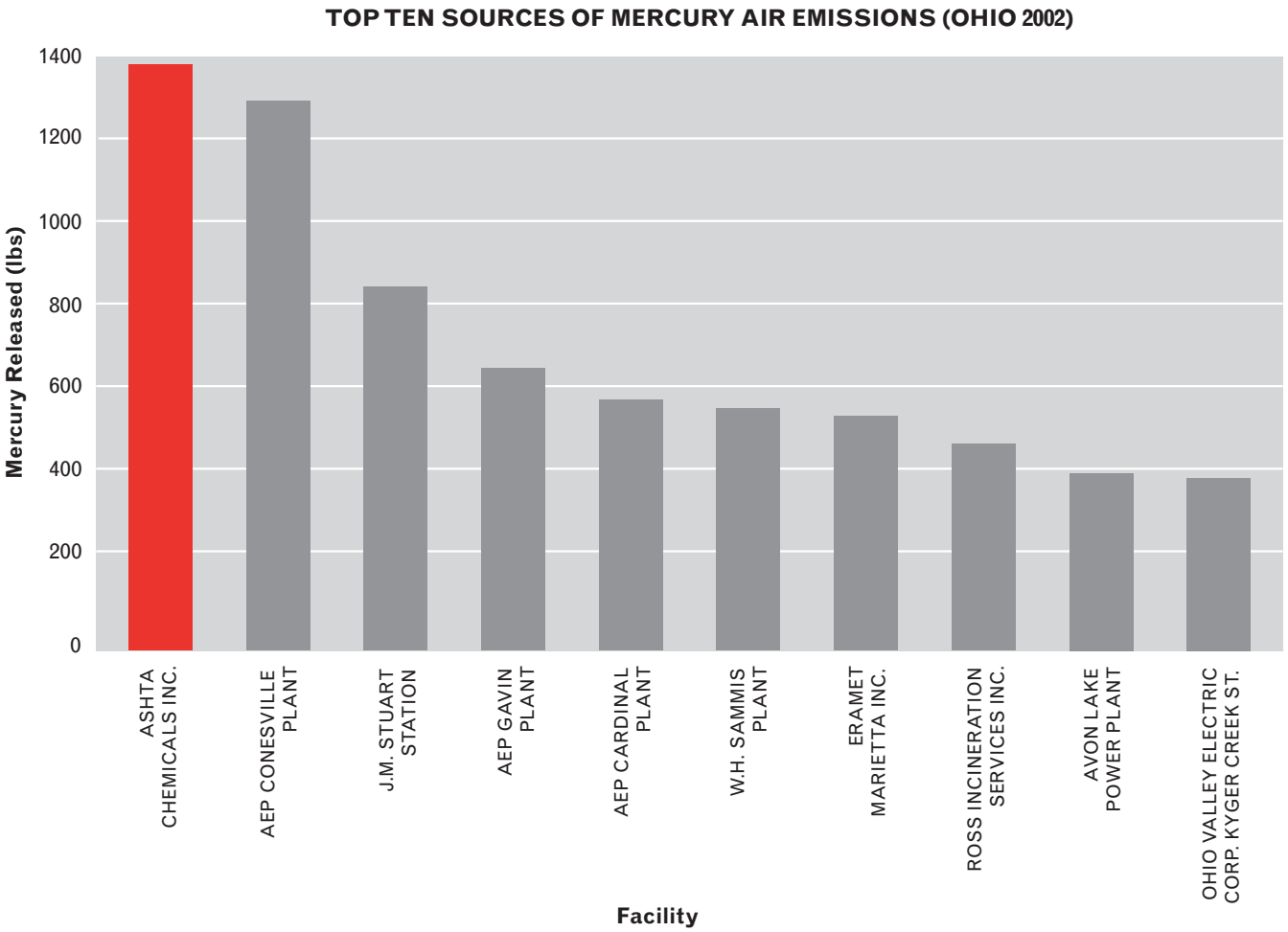
The only mercury-cell chlorine plant still operating in Ohio is the largest source of mercury air pollution in the state and the fifth largest source of mercury air pollution in the nation. Only one power plant in the United States releases more mercury to the air than ASHTA's Ohio chlorine plant.[230]

The ASHTA Chemicals facility is located in Ashtabula, near Lake Erie and the Ashtabula River, which is an EPA Area of Concern.[231]

Key statistics for ASHTA's Ashtabula plant (in 2002)[232]

- #1 source of mercury air pollution in Ohio
- #3 source of total mercury pollution in Ohio
- This facility is responsible for 13% of the mercury air pollution in Ohio
- #5 source of mercury air pollution in the United States
- #44 source of total mercury pollution in the United States

In 2002, the ASHTA plant released 1395 pounds of mercury to air and disposed of 173 pounds off-site (primarily in landfills). Of the air emissions, 1046 lbs (475 kg) of the mercury came from fugitive emissions while 349 lbs (158.6 kg) were measured and released as stack emissions.



Source: Oceana based on EPA Toxics Release Inventory Data

Violations

In 2001, EPA filed an administrative complaint against ASHTA for violating emissions limits; failure to properly operate and maintain an emissions control system; failure to maintain mercury emissions records; failure to meet requirements of air pollution control technology; producing a pesticide in an unregistered establishment; keeping incomplete records; distributing false, misleading and misbranded pesticide products; and failing to submit annual pesticide reports for 1996, 1997 and 1998. In the settlement of the case, without conceding the factual allegations, ASHTA paid $239,800 in penalties.[233]

In 2004, Ohio EPA agreed to offset a $1.54 million fine for alleged violations of ASHTA's wastewater discharge permit at its Ashtabula plant in exchange for the company's agreement to install air emissions control systems designed to reduce mercury air emissions by 1320 lbs. annually. Additionally, ASHTA has agreed to collect and treat stormwater runoff from the facility, and to pay stipulated penalties if the improvements are not completed on schedule (by the end of 2006).[234]

2004 Mercury-Related Fish Advisories

Ohio has a statewide advisory that warns adults and children not to eat more than one meal a week of fish caught in **any body of water** in Ohio because of mercury pollution.[235]

Statewide there are stricter fish consumption advisories on 51 bodies of water limiting consumption of certain fish to one meal per month.[236] Four of these advisories are in Ashtabula County, including the Ashtabula River from Hilldom Road to the mouth at Lake Erie.[237]

TENNESSEE

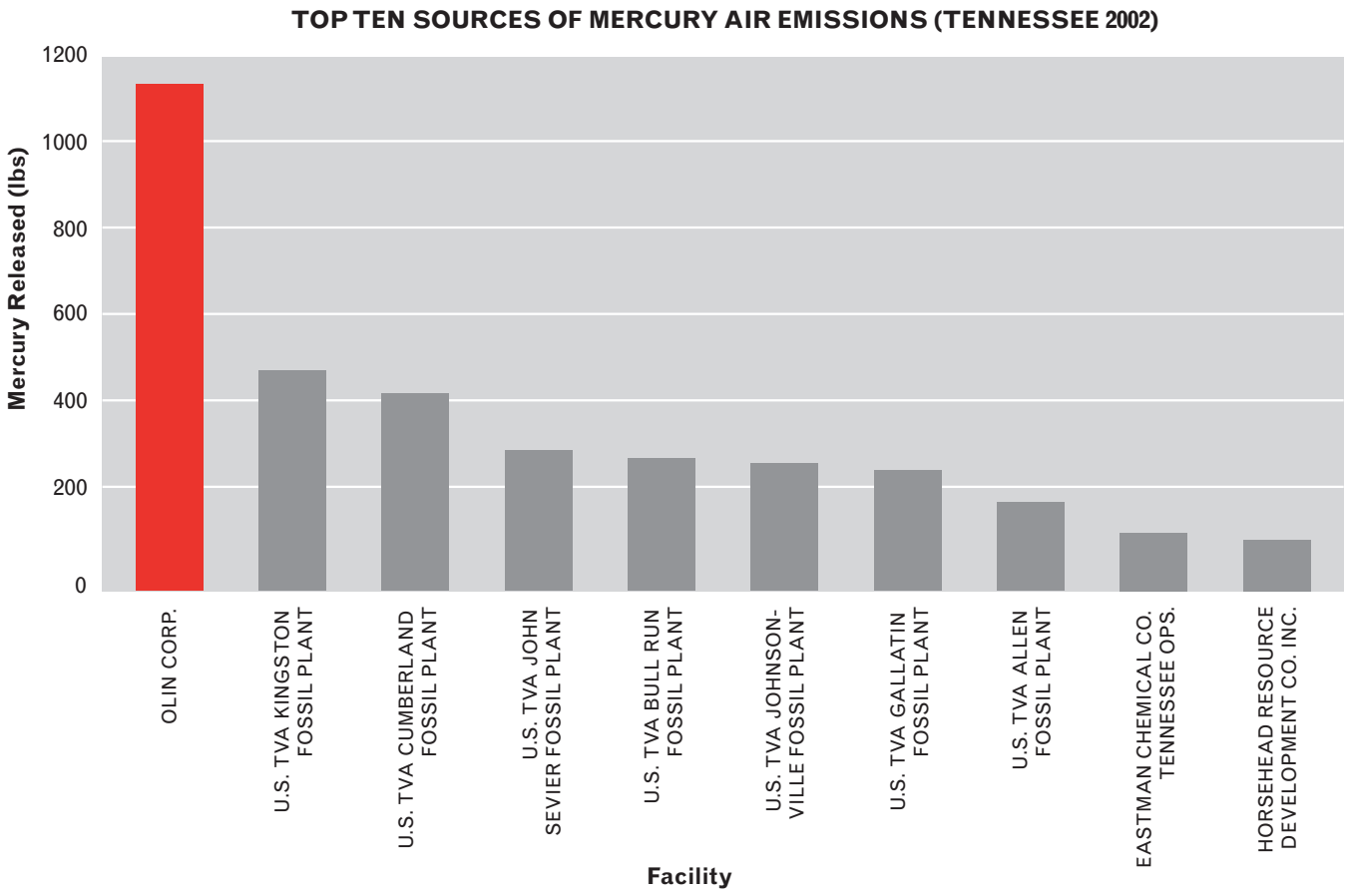
The only mercury-cell chlorine plant still operating in Tennessee is the largest source of mercury air pollution in the state.[238]

The Olin plant is located in Charleston, in the foothills of the Smoky Mountains, near the Hiwassee River.[239]

Key statistics for Olin's Charleston plant (in 2002)[240]

- #1 source of mercury air pollution in Tennessee
- #3 source of total mercury pollution in Tennessee
- Responsible for 31% of the mercury air pollution in Tennessee
- #15 source of mercury air pollution in the United States
- #24 source of total mercury pollution in the United States
- RCRA Corrective Action Site[241]

In 2002, the Olin plant released 1130 lbs (514 kg) of mercury to the air, 14 lbs (6 kg) to water and 1368 lbs (622 kg) to landfills. Of the air emissions, 1045 lbs (475 kg) of the mercury came from fugitive emissions while 85 lbs (39 kg) were measured and released as stack emissions.[242]



Source: Oceana based on EPA Toxics Release Inventory Data

Violations

In1994, Olin agreed to pay $1 million in civil penalties to settle a federal case filed in 1991 by the United States, which alleged that the company failed to minimize leakages of mercury and mercury-contaminated waste from the cells of its Charleston plant for approximately 17 months, in violation of the Clean Air Act.[243] In 2002, the plant violated its Clean Water Act discharge permit by releasing mercury at levels 117% above allowances. Between July and September of 2003, mercury emissions levels at their highest exceeded Olin's permit by 704%.[244]

2004 Mercury-Related Fish Advisories[245]

Tenessee issued two mercury-related advisories, warning citizens not to eat fish caught in the east fork of Poplar Creek (in Anderson and Roane counties) or in the north fork of Holston River (in Sullivan and Hawkins counties).

TEXAS

Texas' last mercury-cell chlorine plant, an OxyVinyl plant located in Deer Park and owned by Occidental Chemicals Corporation, was temporarily closed ("idled") in 2001 because of financial constraints.[246] Though not currently operating, the plant could resume operations in future.

Key statistics for OxyVinyl's Deer Park plant (when operating in 2001)[247]

- #4 source of mercury released to the air in Texas
- #1 source of total mercury pollution in Texas
- Responsible for 7% of the mercury air pollution in Texas
- #19 source of mercury released to the air in the United States
- #40 source of total mercury pollution in the United States

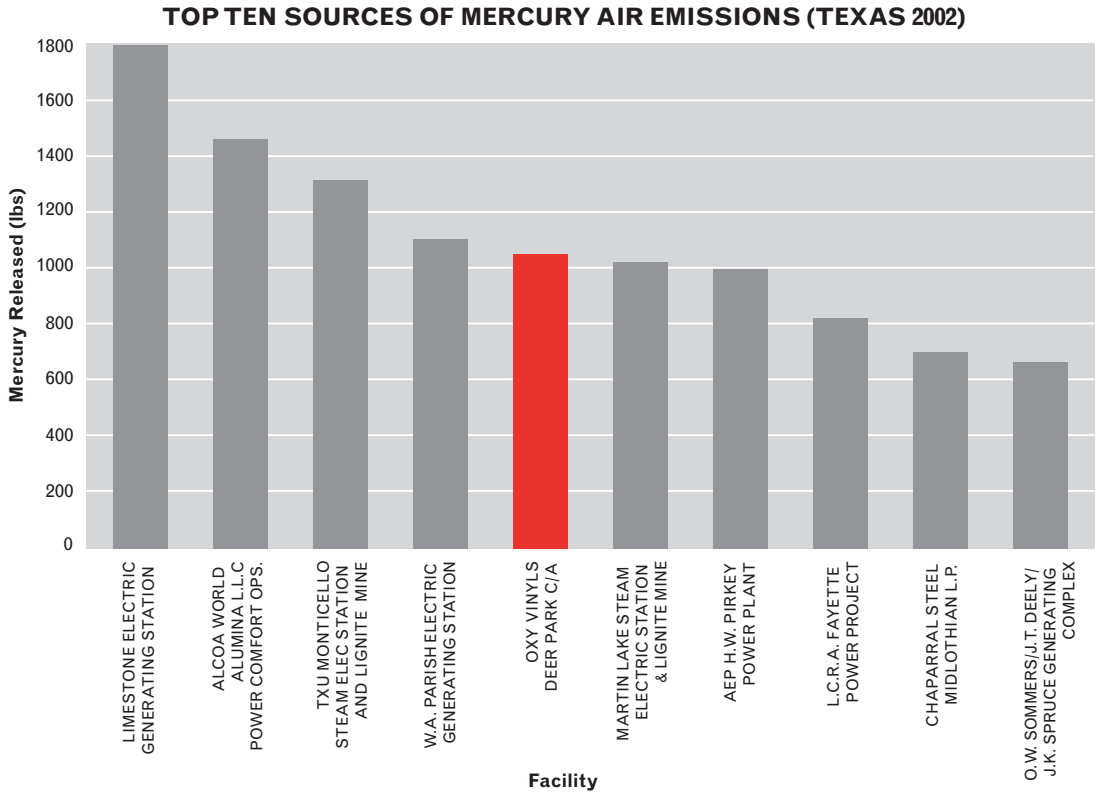
In 2001, this plant released 1095 lbs (497.7 kg) of mercury to the air, 2 lbs (0.9 kg) to water and disposed of 2233 lbs (1015 kg) off site (primarily in landfills). Of the air emissions, 1048 lbs (476 kg) of the air pollution came from fugitive emissions while 47 lbs (21.4 kg) were measured and released as stack emissions.[248]

Even while closed in 2002 it reported a considerable amount of mercury releases to the EPA.

Key statistics for OxyVinyl's Deer Park plant (in 2002)[249]

- #5 source of mercury released to the air in Texas
- #4 source of total mercury pollution in Texas.
- Responsible for more than 6% of the mercury air pollution in Texas
- #21 source of mercury released to the air in the United States
- #36 source of total mercury pollution in the United States

In 2002, this plant reported releasing 1046 lbs (475 kg) of mercury to the air and disposed of 768 lbs (349 kg) off site (primarily in landfills). In 2003, the plant reported a minimal amount of mercury releases to the air.[250]



Source: Oceana based on EPA Toxics Release Inventory Data

2004 Mercury-Related Fish Advisories[251]

The Texas Department of Health issued twelve advisories for mercury pollution. There is one no-consumption advisory in Upper Lavaca Bay while the rest are for limited consumption. Like Georgia and Louisiana, they have a Gulf-wide advisory for King Mackerel. In Texas, King Mackerel over 43 inches should not be consumed. For fish between 43 and 37 inches, adults should only eat one eight ounce meal per week, while women of child-bearing age and children should only eat one meal per month.

WEST VIRGINIA

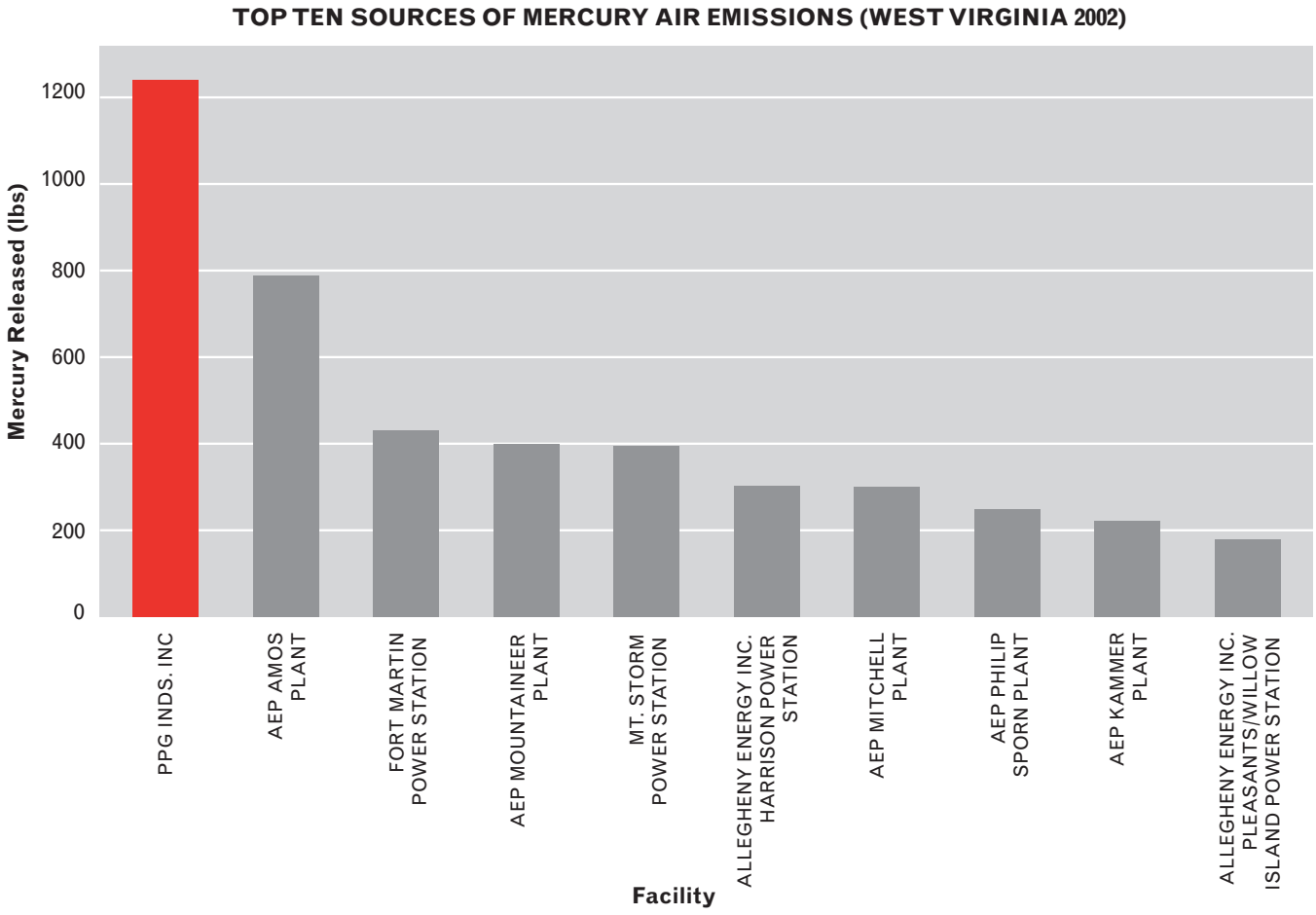
The only mercury-cell chlorine plant still operating in West Virginia is the largest source of mercury pollution in the state.[252]

The PPG plant is located in Natrium/New Martinsville, near the Ohio River.[253]

Key statistics for PPG's New Martinsville plant (in 2002)[254]

- #1 source of mercury air pollution in West Virginia
- #1 source of total mercury pollution in West Virginia
- Responsible for 24.2% of the mercury air pollution in West Virginia
- #12 source of mercury air pollution in the United States
- #29 source of total mercury pollution in the United States

In 2002, the PPG plant released 1233 pounds of mercury to the air, 34 pounds to the water, and disposed of 900 pounds in landfills. Of the air emissions, 1045 lbs (475 kg) of the mercury came from fugitive emissions while 188 lbs (85.5 kg) were measured and released as stack emissions.[255]



Source: Oceana based on EPA Toxics Release Inventory Data

Violations

The PPG site in West Virginia has been in violation of RCRA from October 2002 to present, and the Clean Water Act from April 2003 to January 2004.[256] The state filed compliance orders for the RCRA violations, but financial penalties have not been assessed.

2004 Mercury-Related Fish Advisories[257]

In December 2004, West Virginia issued mercury-related fish consumption advisories for eleven fish – caught in the state. They include:

- Black bass (smallmouth, largemouth, spotted less than 12 in.), Sauger, Channel catfish over 17 inches, all suckers / 2 meals per month
- Black bass (smallmouth, largemouth, spotted greater than 12 in.), Walleye, Saugeye, White bass, hybrid striped bass / one meal per month
- Rainbow Trout / no limit
- Channel catfish under 17 inches and all other species / one meal per week

In addition, there are stronger advisories for fish in twelve bodies of water.

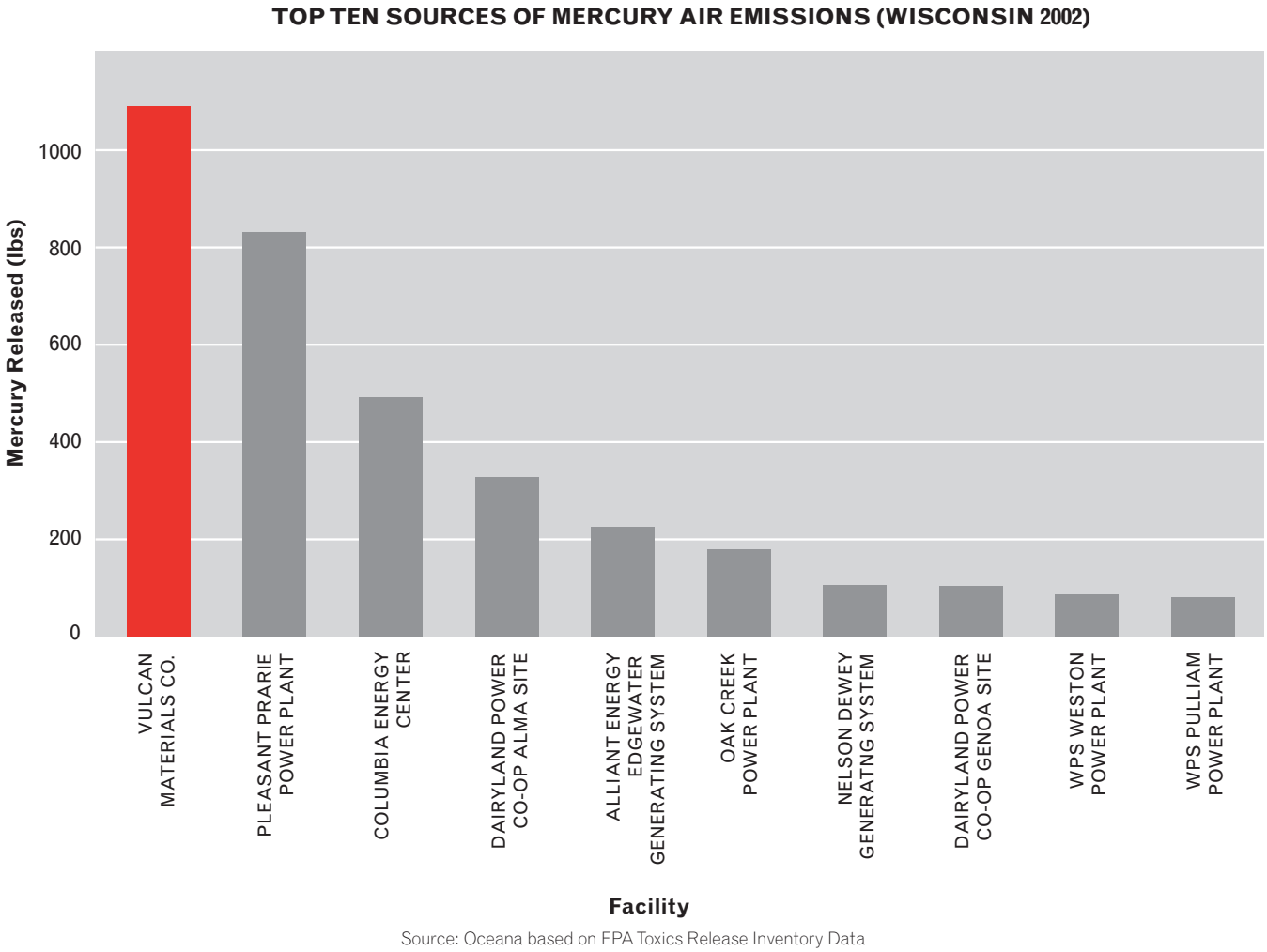
WISCONSIN

The only mercury-cell chlorine plant still operating in Wisconsin is the largest source of mercury pollution in the state.[258] The Vulcan Chemicals plant is located in Port Edwards, in Wood County near the Wisconsin River.[259]

Key statistics for Vulcan's Port Edwards plant (in 2002)[260]

- #1 source of mercury air emissions in Wisconsin
- #1 source of total mercury pollution in Wisconsin
- Responsible for 28% of mercury air pollution in Wisconsin
- #18 source of mercury air emissions in the United States
- #48 source of total mercury pollution in the United States
- RCRA Corrective Action Site[261]

In 2002, the Vulcan plant released 1082 lbs (492 kg) of mercury to the air, 2 lbs (0.9 kg) to the water and disposed of 377 lbs (171 kg) off-site (primarily to landfills). Of the air emissions, 1054 lbs (479 kg) of the mercury came from fugitive emissions while only 28 lbs (13 kg) were measured and released as stack emissions.[262]



Source: Oceana based on EPA Toxics Release Inventory Data

Violations

Between April and June, 2002, the plant violated its discharge permit under the Clean Water Act, releasing wastes with mercury levels exceeding the permitted amount by 135 percent. Six months later, they exceeded their level by two percent.[263]

2004 Mercury-Related Fish Advisories

Mercury has become a serious pollution problem in Wisconsin. Warnings about mercury levels in fish have been issued for all of its lakes and rivers.[264] According to the Wisconsin Department of Natural Resources, there is mercury in every single one of Wisconsin's 15,057 lakes.[265] The statewide advisory says that women of childbearing years, nursing mothers and all children under 15 should limit themselves to one meal per month of walleye, northern pike, smallmouth bass, largemouth bass, channel catfish, flathead catfish, white sucker, drum, burbot, sauger, sturgeon, carp, white bass, rock bass or other species, and one meal per week of Bluegill, sunfish, black crappie, white crappie, yellow perch or bullheads. Muskellunge should not be eaten by women of child bearing age and children due to high mercury content.[266]

Women beyond their childbearing years and men should limit themselves to one meal per week of walleye, northern pike, smallmouth bass, largemouth bass, channel catfish, flathead catfish, or other species.[267]

In 83 bodies of water, there are stricter fish consumption advisories for mercury.[268] The majority of these say that women of child-bearing age and children should not eat certain species of fish (with size restrictions) from that body of water. The most common species to avoid is walleye, based on size. There are also additional species for which consumption should be limited to one meal per week.[269]

APPENDIX II

[EUROPE]

ANALYSIS OF MERCURY CONTAMINATION FROM MERCURY-CELL CHLORINE PLANTS FOR SELECTED COUNTRIES

There are 53 mercury-emitting chlorine plants in Europe (44 in Western Europe, seven in the EU 2004 accession countries, and two in the EU 2007 accession countries).[270] They are located in Belgium, the Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, The Netherlands, Poland, Slovenia, the Slovak Republic, Spain, Sweden, Switzerland, and the United Kingdom.[271]

The following information is largely based on 2001 data from the European Pollutant Emission Register (EPER), provided the European Commission. Data were downloaded in December, 2004.

BELGIUM

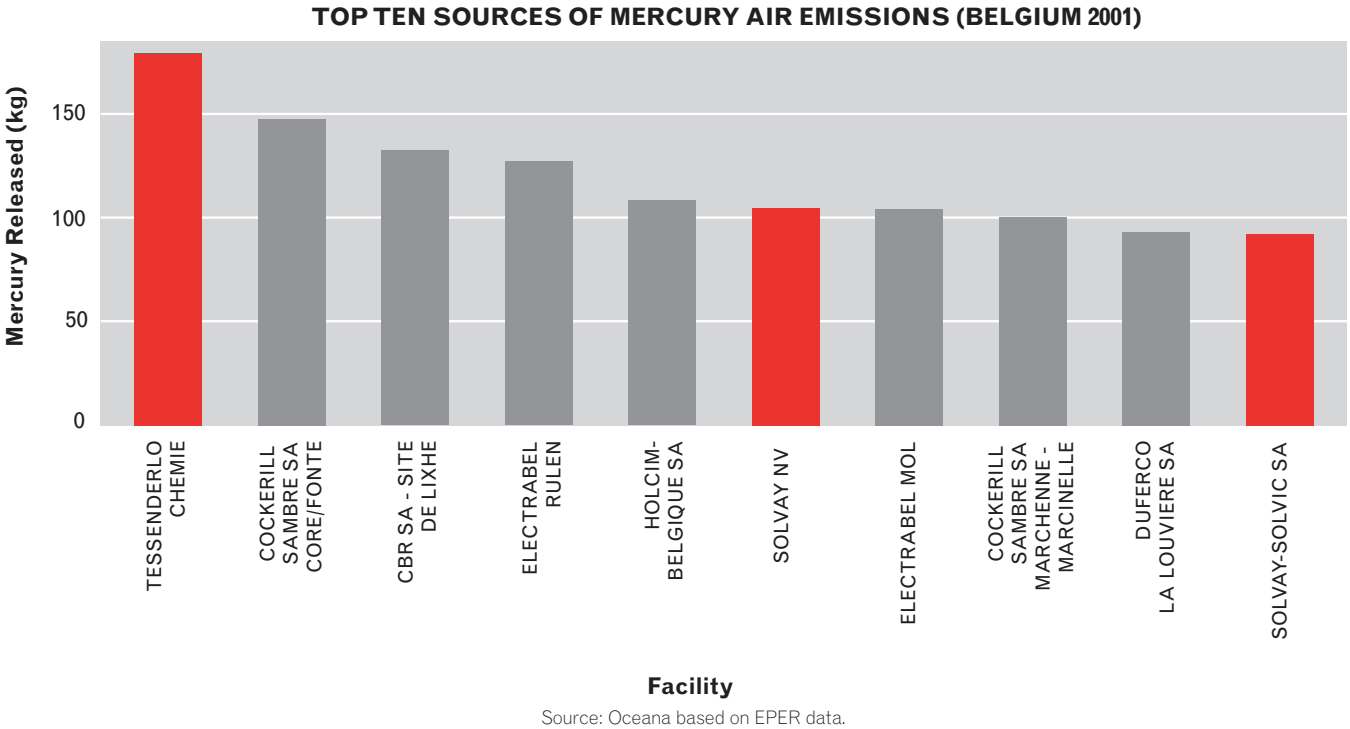
In Belgium in 2001, there were three plants in operation that use mercury-cell technology. All three rank in the top ten for mercury emissions in Belgium.

Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions (kg)
Solvay Solvic SA	Jemeppe	88	89.7	177.7
Tessenderlo Chemie	Tessenderlo	172	2.6	174.6
Solvay NV	Anterwerpen / Lillo	109	4	113

Of the three mercury-cell chlorine factories operating in Belgium, Solvay S.A. – Solvic S.A.in Jemeppe ranked first in mercury emissions with 177.7 kg (391 lbs). Tessenderlo Chemie in Tessenderlo followed with 174.6 kg (384 lbs) released. Solvay NV in Antwerpen (Lillo) came in third with 113 kg (249 lbs).

According to the EPER database, these facilities account for 22% of the mercury air emissions and 26% or mercury emissions overall.

Compared with all sources reporting to EPER in Belgium, Solvay S.A. – Solvic S.A ranked 1st, Tessenderlo Chemie ranked 2nd and Solvay NV ranked 6th for total mercury releases. For mercury air releases, Tessenderlo Chemie ranked first, Solvay NV was number six and Solvay S.A. – Solvic S.A. ranked tenth.



Source: Oceana based on EPER data.

General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

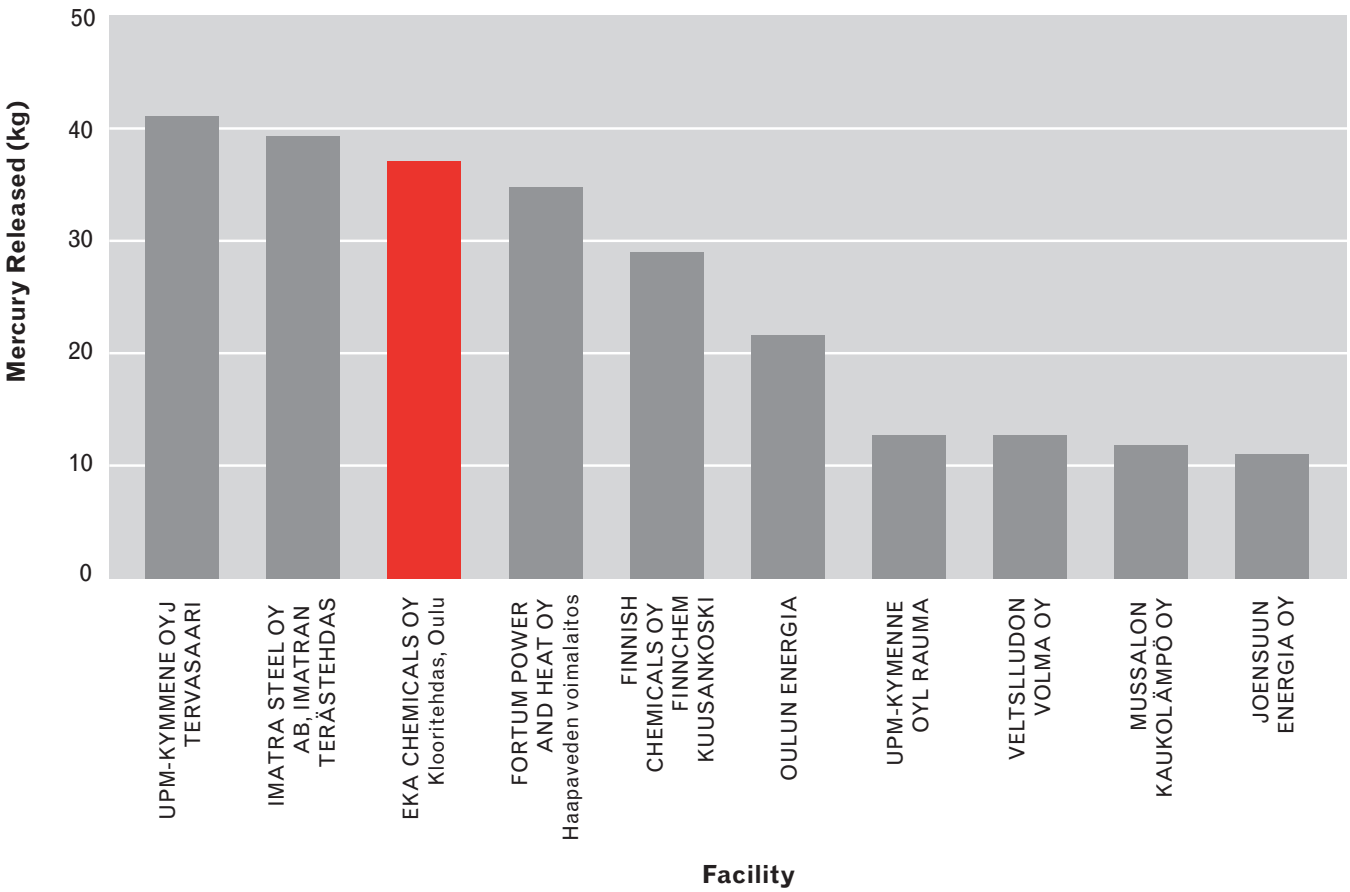
FINLAND

In Finland, as of 2001 there was one mercury-cell plant owned by Eka Chemicals in Oulu. Eka Chemicals was the 2nd largest source of total mercury pollution in Finland. It was the third largest source of mercury pollution to the air.

Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions (kg)
Eka Chemicals Oy	Klooritehdas, Oulu	36.6	5.3	41.9

Overall, Eka Chemicals was responsible for more than 12% of the mercury releases to air and more than 13% of the mercury released overall in Finland in 2001, the most recent year for which data were available. This plant is expected to stop mercury-based operations in 2010 according to the OSPAR Commission.

TOP TEN SOURCES OF MERCURY AIR EMISSIONS (FINLAND 2001)



Source: Oceana based on EPER data.

General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

FRANCE

In 2001, there were seven active mercury cell plants in France, operated by Atofina (3), PC de Loos, Solvay, Albemarle PPC and SPC Harbonnières.

Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions (kg)	Rank for total emissions
Solvay Electrolyse	Lavaux	202	11.6	213.6	#3
Atofina	St Auban	170	25	195	#4
Atofina	Lavera	147	14	161	#5
Atofina	Jarrie	109	35.4	14.4	#6
Albemarle PPC	Thann	80	45	125	#7
PC Loos (Tessenderlo Chemie)	Loos	11	0	11	#64

Emissions data is available for all of the facilities except for SPC Harbonnières.

Of the seven mercury-cell chlorine factories in France, Solvay in Tavaux ranked first in mercury emissions with 213.6 kg (470 lbs). Atofina in St Auban followed with 195 kg (429lbs) released. Atofina in Lavera came in third with 161 kg (354 lbs).

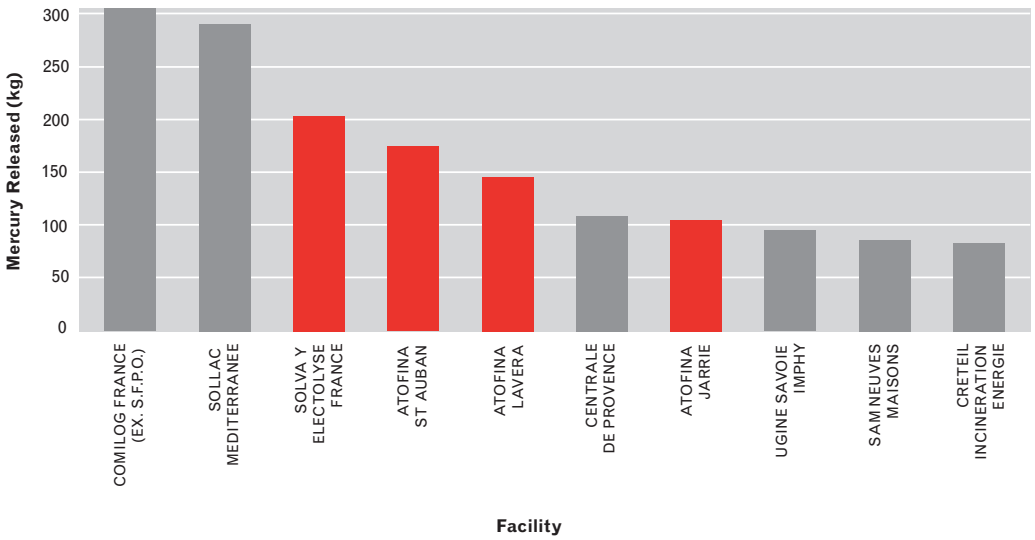
These six facilities account for 23% of the mercury air emissions, 38% of the mercury emissions to water and almost 25% of mercury emissions overall.

The PC de Loos plant had low mercury emissions in 2001 of 11 kg (24 lbs) but the plant produces smaller amounts of chlorine.

Of all sources, chlorine plants ranked in top ten for mercury air emissions.

Facility	Rank for mercury air emissions
Solvay Electrolyse	#3
Atofina St Auban	#4
Atofina Lavery	#5
Atofina Jarrie	#7

TOP TEN SOURCES OF MERCURY AIR EMISSIONS (FRANCE 2001)



Source: Oceana based on EPER data.
General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

GERMANY

In Germany in 2001, there were ten plants in operation that use mercury cell technology, according to the OSPAR Commission.

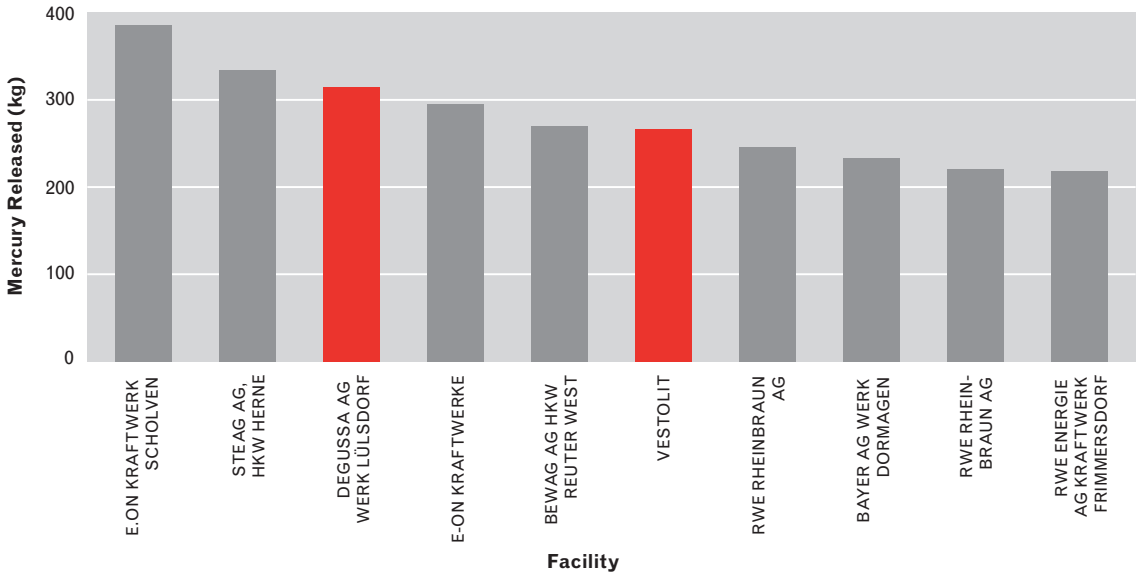
Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions (kg)	Rank for total emissions
Degussa AG Werk	Lülsdorf	308	4	312	#3
Vestolit	Marl	273	0	273	#6
Vintron	Knapsack	186	0	186	#12
BASF AG Hg + D	Ludwigshafen	163	2	165	#14
Bayer AG	Leverkusen	130	16	146	#17
LII Europe	Frankfurt	142	0	142	#20
Bayer AG (uses both mercury and membrane)	Krefeld-Uerdingen	127	6.4	133.4	#21
Vinnolit	Gendorf	107	0	107	#24
ECI Elektro-Chemie	Ibbenbüren	63.6	0	63.6	#34
ICI ChlorChem (Ineos)	Wilhelmshafen	61.1	0	61.1	#36

Of the 10 mercury-cell chlorine factories in Germany, Degussa AG Werk (Degussa-Huls) in Lülsdorf ranked first in mercury emissions with 312 (686 lbs). Vestolit in Marl followed with 273 kg (601 lbs) released. Vintron in Knapsack came in third with 186 kg (409 lbs).

These ten facilities account for 21.4% of the mercury air emissions and 21.4% of mercury emissions in Germany overall.

Compared with all sources, Degussa AG Werk (Degussa-Huls) in Lülsdorf was the number three source of mercury emissions to the air and total releases (to the air and water) in 2001. Six of the plants fell in the top twenty for both air emissions and total releases, out of 112 facilities reporting in Germany.

TOP TEN SOURCES OF MERCURY AIR EMISSIONS (GERMANY 2001)



Source: Oceana based on EPER data.
General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

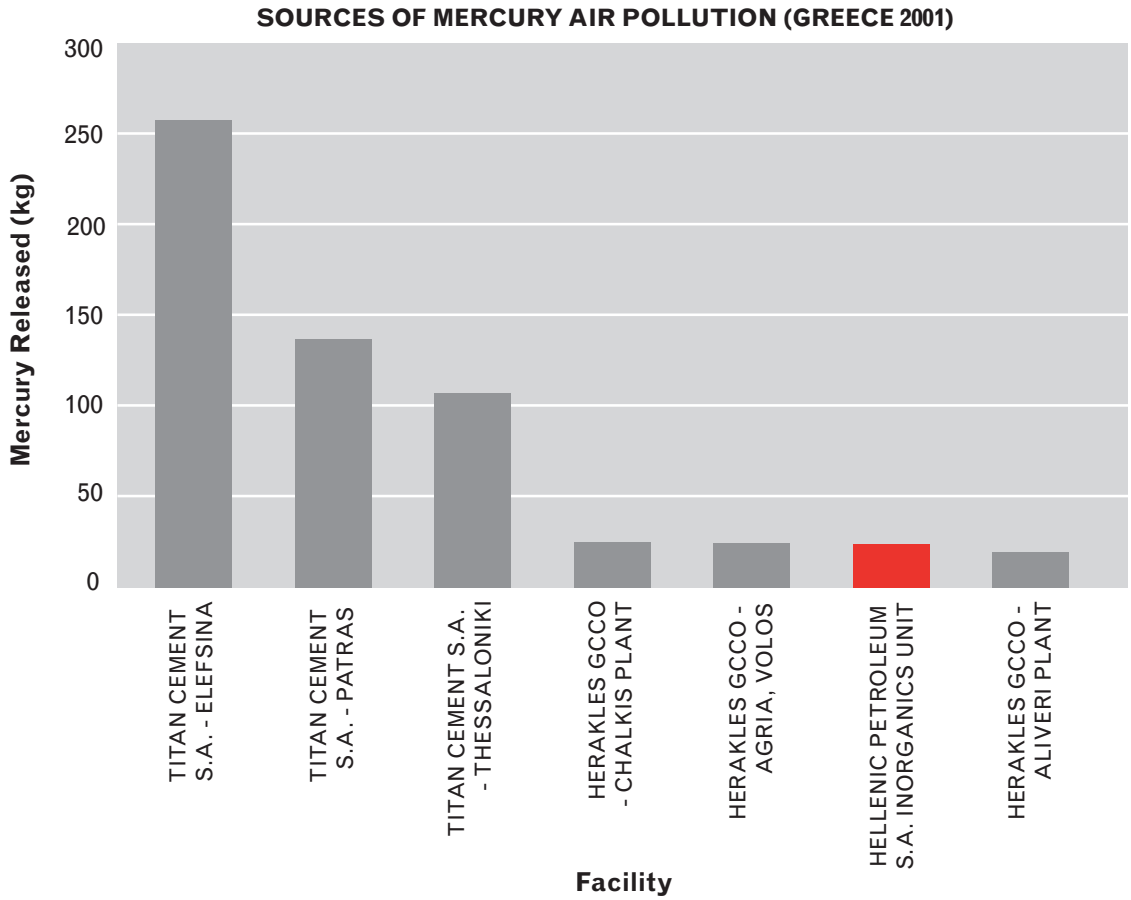
GREECE

In Greece, there was one plant in operation that uses mercury cell technology, according to Euro Chlor.

Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total emissions
Hellenic Petroleum S.A. Inorganics Unit	Thessaloniki	20.2	4.1	24.3

Compared with all other sources of mercury, Hellenic Petroleum's inorganics chemicals unit in Thessaloniki is the sixth source of air and fifth largest source of total mercury emissions in the country based on EPER data. It is the number one source of mercury pollution to water.

This facility accounts for 3% of the mercury air emissions, 24% of mercury releases to water and 4% of mercury emissions overall.



Source: Oceana based on EPER data.

General Sources: Euro Chlor "Western European chlor-alkali industry plant & production data," Brussels Dec 2002 and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

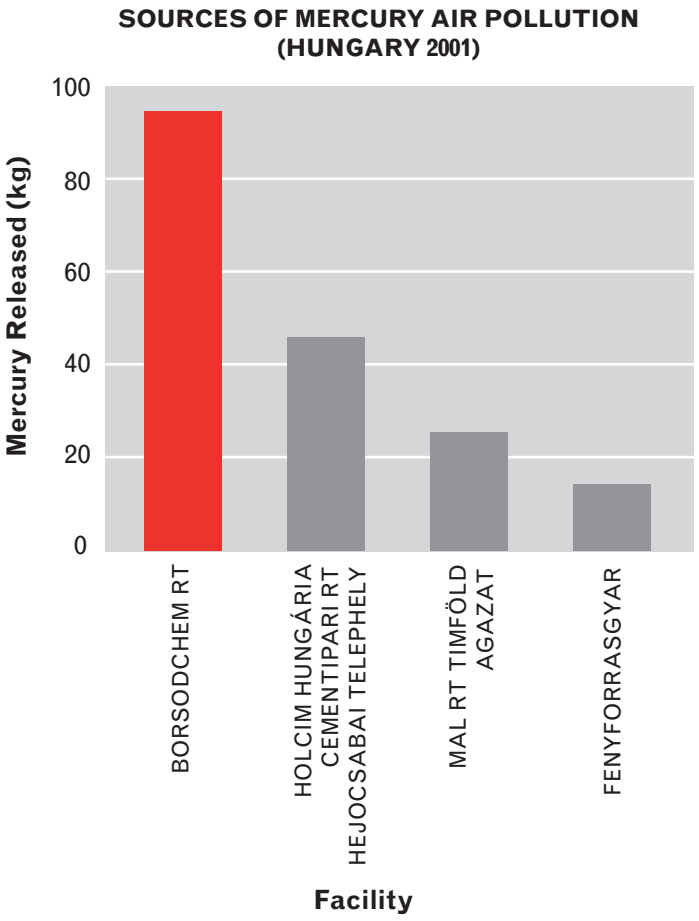
HUNGARY

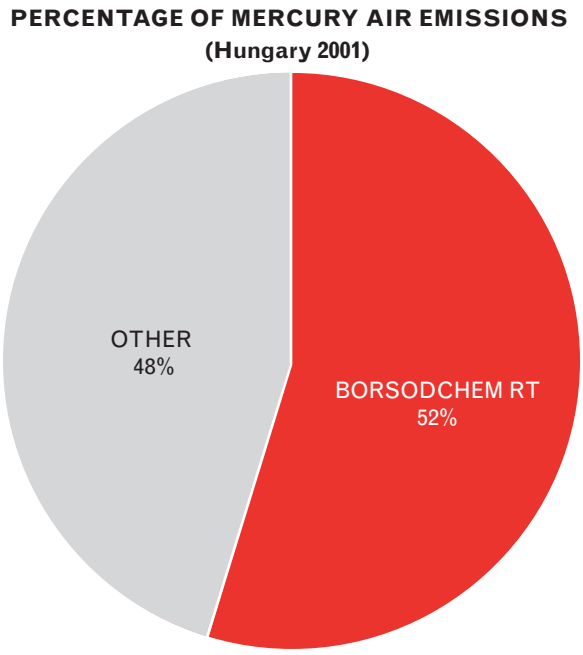
In Hungary, there was one plant in operation that uses mercury cell technology, according to Euro Chlor.

Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total emissions
Borsodchem Rt	Kazinbarcika	94	3	97

Compared with all other sources of mercury, Borsodchem Rt is the largest source of air emissions and second largest source of total mercury emissions in the country based on EPER data.

This facility alone accounts for 52% of the mercury air emissions and 27% of mercury emissions overall.





Source: Oceana based on EPER data.

General Sources: Euro Chlor "Western European chlor-alkali industry plant & production data," Brussels Dec 2002 and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

ITALY

In Italy in 2001, there were eight plants in operation that use mercury cell technology, according to Euro Chlor.

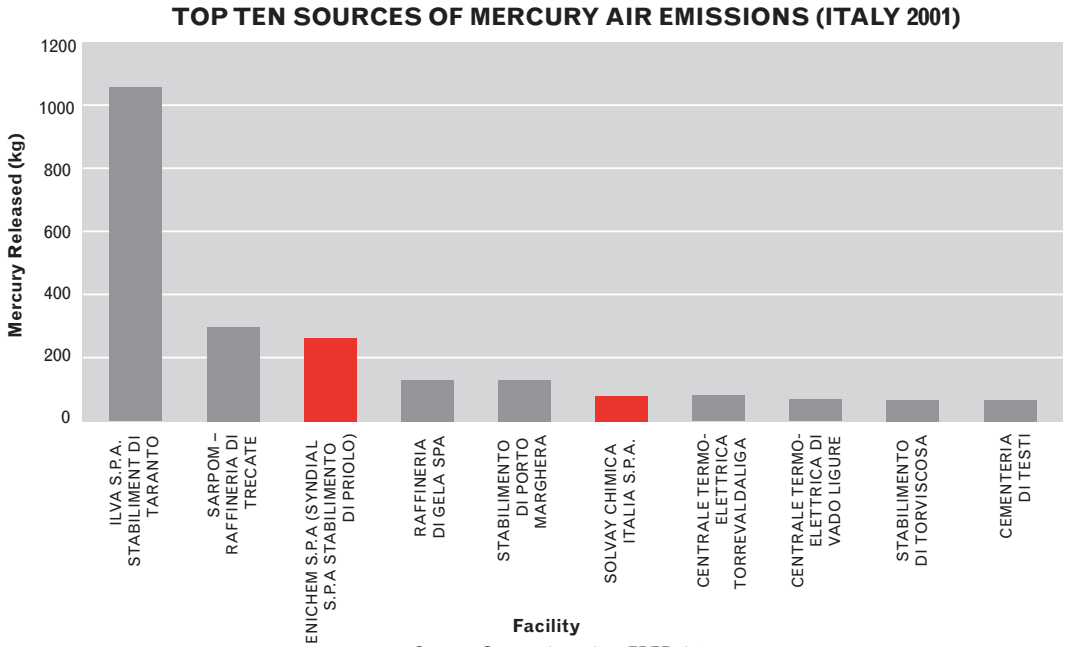
Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions (kg)
EniChem S.p.A.(Syndial S.p.A – Stabilimento di Priolo)	Priolo	250	15	265
Solvay Chimica Italia S.p.A.	Rosignano	84	71	155
Solvay Solexis S.p.A. – Stabilimento di Bussi	Bussi	44	22	66
Tessenderlo Italia SRL	Pieve Vergonte	28	5	33
Saline di Volterra (PI) (Stabilimento sito)	Volterra	30	0	30
Caffaro S.p.A. – Stabilimento di Brescia	Toreviscosa	0	6.3	6.3
Enichem (Syndial SPA Stabilimento di Assemini)	Porto Marghera	0	2.3	2.3

In 2001, only seven of the eight operating plants reported their releases to the EPER. There were no data for the Eredi Zarelli facility in Picinisco.

Of the 8 mercury-cell chlorine factories with data in Italy, EniChem S.p.A.(SYNDIAL S.p.A) in Priolo ranked first in mercury emissions with 265 kg (583 lbs). Solvay Chemica Italia S.p.A. in Rosignano followed with 155 kg (341 lbs) released. Solvay Solexis S.p.A. in Bussi came in third with 66.5 kg (146.3 lbs).

Compared with all sources in Italy, EniChem S.p.A.(SYNDIAL S.p.A) in Priolo was the number three source of mercury emissions to the air in 2001, while Solvay Chemica Italia S.p.A. in Rosignano was number six.

These seven facilities account for 15% of the mercury air emissions and 14% of mercury emissions overall.



Source: Oceana based on EPER data.

General Sources: Euro Chlor "Western European chlor-alkali industry plant & production data," Brussels Dec 2002 and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

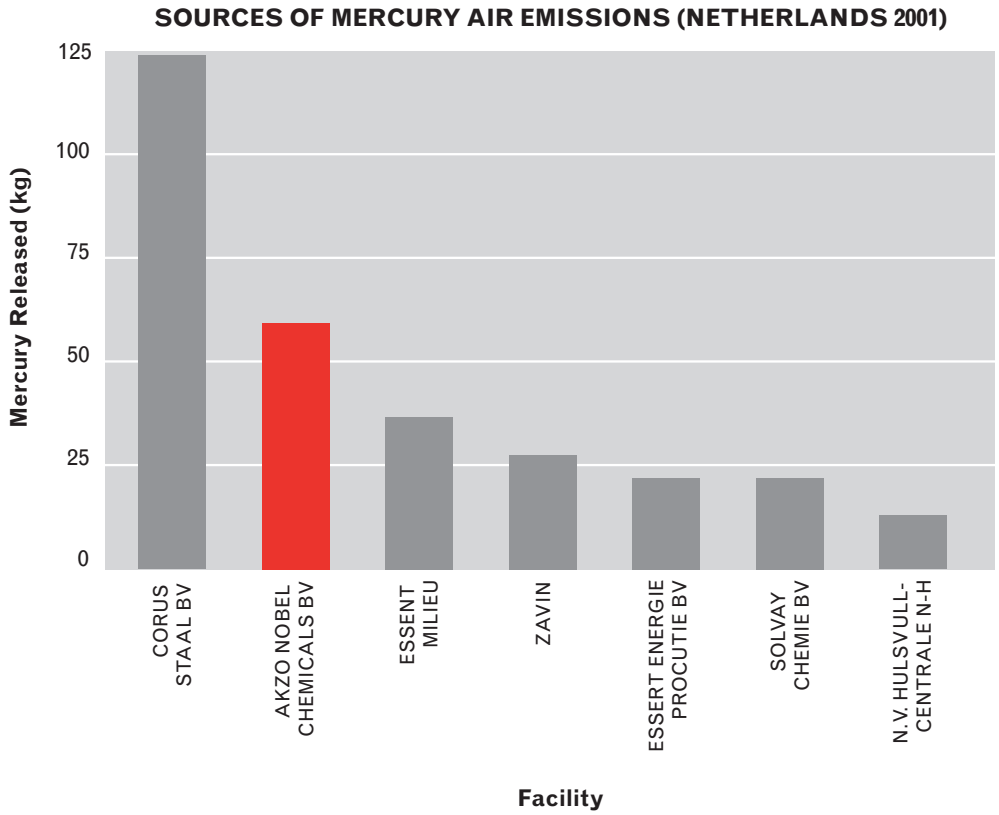
THE NETHERLANDS

The Netherlands decommissioned one mercury cell plant in 2000 and the country's remaining plant is scheduled to be converted before 2010. The remaining plant is operated by Akzo Nobel in Hengelo.

Facility	Emissions to air (kg)	Emissions to water (kg)	Total emissions
Akzo Nobel Chemicals BV	57	1.6	58.6

Compared with all other sources of mercury, this Akzo Nobel facility is the second largest source of air emissions and total mercury releases in the country based on EPER data.

This facility accounts for 19% of the mercury air emissions and 18% of mercury releases overall.



Source: Oceana based on EPER data.

General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

SPAIN

There are currently nine mercury-emitting chlorine plants in Spain. In 2001, only seven of the nine operating plants reported their releases to the EPER. There were no data for the Solvay facility in Martorel or for the Elnosa facility in Lourizan.

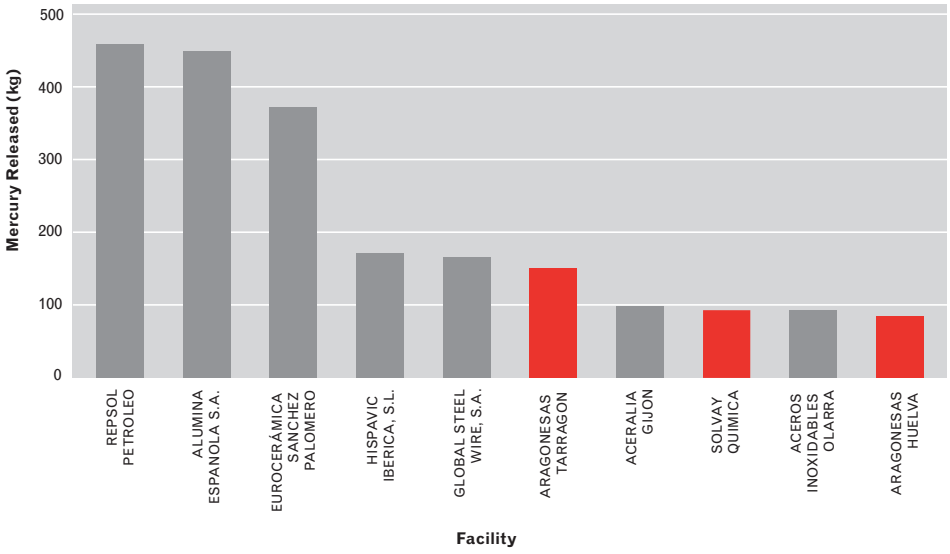
Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total emissions	Rank by air	Rank by total
Solvay Quimica (Fábrica de Torrelavega)	Torrelavega	90	100	190	#8	#5
Aragonesas Industrias Y Energia, SA	Vilaseca, Tarragona	154	8.4	162.4	#6	#7
Aragonesas Industrias y Energía SA Puerto	Huelva	83.9	6.9	90.8	#10	#9
Ercros Industrial, SA	Flix	69.3	13.5	82.8	#11	#12
Quimica del Cinca SA	Monzon	35.8	9.2	45	#15	#16
Electroquimica de Hernani, SA	Hernani	0	28.4	28.4	#36	#16
Aragonesas Industrias Y Energia, SA	Sabinanigo / Huesca	22	0	22	#23	#25

Of the seven mercury cell chlorine factories reporting, Solvay Quimica in Torrelavega ranked first in mercury emissions with 190 kg (418 lbs). Aragonesas in Vileseca followed with 162.4 kg (357.2 lbs) released. Aragonesas in Huelva came in third with 90.8 kg (199.7 lbs).

These seven facilities account for 16% of the mercury air emissions, 46% of mercury released to water and almost 20% of mercury emissions overall. Based solely on the data for these seven facilities reporting, the industry released 455 kg to the air, 166.3 kg to the water for a total of 621.3 kg. These numbers would clearly be higher with the addition of the other two plants.

Compared with all sources, Solvay Quimica in Torrelavega was the number five source of total mercury emissions to the air and water in 2001. Four of the plants fall in the top 15 for total emissions, out of 48 facilities reporting in Spain. Six of these plants made it into the top 20.

TOP TEN SOURCES OF MERCURY AIR EMISSIONS (SPAIN 2001)



Source: Oceana based on EPER data.

General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

SWEDEN

Sweden currently operates two mercury cell plants: Akzo Nobel – Eka Chemical in Bohus and Norsk Hydro/ Hydro Polymers in Stenungsund. In addition, the Akzo Nobel plant in Skoghall, which operates with membrane technology, reported releases of mercury in 2001.

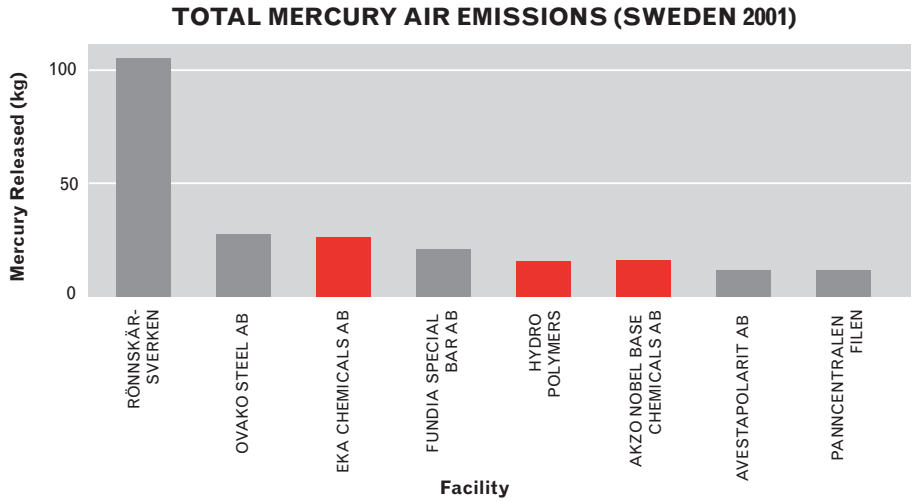
Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions
Eka Chemicals AB	Bohus	29	4.6	33.6
Hydro Polymers	Stenungsund	16.6	0	16.6
Akzo Nobel Base Chemicals AB	Skoghall	15	1.5	16.5

Of the three chlorine factories reporting, Eka Chemicals (operated by Akzo Nobel) in Bohus ranked first in mercury emissions with 33.6 kg (73.9 lbs). Hydro Polymers/Norsk Hydro in Stenungsund followed with 16.6 kg (36.5 lbs) released. Akzo Nobel in Skoghall came in third with 16.5 kg (36.3 lbs).

In Sweden, the mercury based chlorine factory, Eka Chemicals (operated by Akzo Nobel) was the third largest releaser of mercury to the air, and second largest releaser of total mercury in 2001. In September 2004, Akzo Nobel announced they were closing that plant at the end of 2005. This will result in a significant reduction of mercury releases in Sweden.[cclxx]

In 2001, Hydro Polymers/Norsk Hydro in Stenungsund and Akzo Nobel in Skoghall ranked 5th and 6th respectively nationwide for total mercury releases.

These facilities combined released almost 25% of the mercury air emissions, 10% of mercury released to water and 22% of mercury releases overall in Sweden.



Source: Oceana based on EPER data.

Sweden has problems with mercury contamination of land and waterways from mercury chlorine plants. The soil at the Akzo Nobel site in Bohus is contaminated with mercury and other toxic compounds.

Sweden also has a problem with contamination in fish. In 1991, it was estimated that pike weighing one kilogram (2.2 lbs) in over 50% of the lakes in Sweden contained high levels of mercury, over 0.5 mg/kg wet weight. A more recent analysis has shown a 20% decrease in fish contamination since then because of reductions in emissions and deposition of mercury. It is estimated that the country will need to further decrease their mercury emissions by 80% to bring fish concentrations down below this toxic level

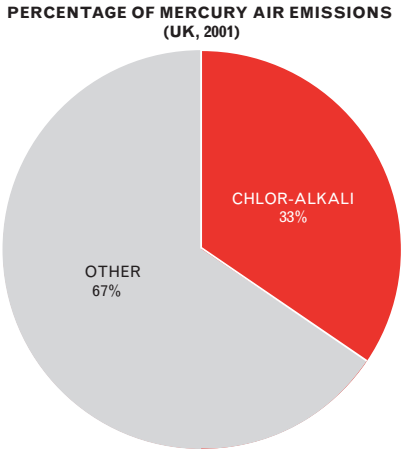
General Sources: Commission of the European Communities, "Consultation Document: Development of an EU Mercury Strategy, Invitation to Comment, Brussels (15 March 2004): 12; European Commission, "Integrated Pollution Prevention and Control (IPPC): Reference Document on Best Available Techniques in the Chlor-Alkali Manufacturing Industry," (December 2001): section 3.2; OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

UNITED KINGDOM

In the United Kingdom in 2001, there were three plants in operation that use mercury cell technology.

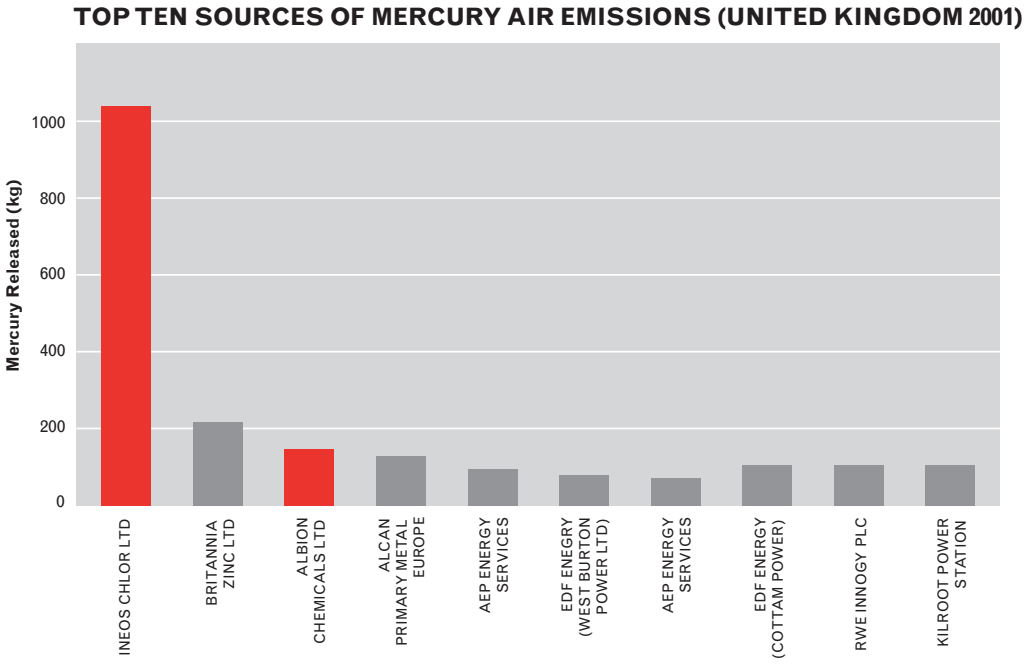
Facility	Location	Emissions to air (kg)	Emissions to water (kg)	Total Emissions
Ineos Chlor LTD	Runcorn	1050	101	1151
Albion Chemicals LTD	Sandbach	171	2.2	173.2
Rhodia Eco Services LTD	Staveley	13.3	1.4	14.7

Of the three mercury cell chlorine factories in the United Kingdom, Ineos Chlor in Runcorn ranked first in mercury emissions with 1151 kg (2532 lbs). Albion Chemicals in Sandbach followed with 173.2 kg (381 lbs) released.



Compared with all 74 mercury releasers in the country, Ineos Chlor ranked first, and Albion ranked third.

These three facilities account for 33% of the mercury air emissions, 46% of emissions to water and 33% of mercury emissions overall.



Source: Oceana based on EPER data.
General Sources: OSPAR Commission 2003. "Mercury losses from the chlor-alkali industry" and 2001 data from the European Pollutant Emission Register (EPER), recently published by the European Commission. Data exported December, 2004.

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