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Mercury in Europe's environment

A priority for European and global action

European Environment Agency

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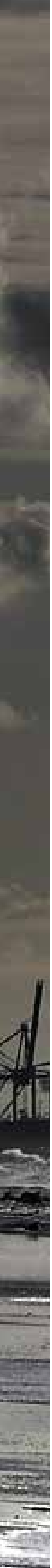

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Summary

Mercury presents a significant risk to both the global environment and human health. While mercury has been mined and used by humans for thousands of years, only in more recent decades have the risks it poses been fully understood. Mercury's properties mean that once it is released into the environment it can remain in circulation for thousands of years. Furthermore, once in the air it can travel long distances, meaning that emissions have a global impact. This movement is known as the 'global mercury cycle'. Over hundreds of years, the quantities of mercury in this cycle have increased as a result of activities such as gold mining, fossil fuel burning and industry.

Mercury in rivers, lakes and oceans presents the biggest risk, as this is converted into a particularly toxic form called methylmercury, which is easily absorbed by animals and moves up the food chain until it reaches humans. This is the main way in which humans are exposed to mercury.

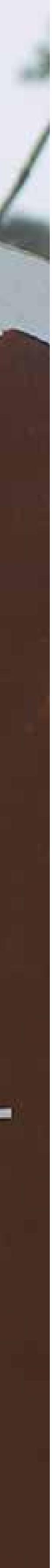
Historically, Europe's mercury use and emissions have been high. However, recent decades have seen measures taken to minimise these through, for example, limiting or banning the use of mercury and imposing limits on emissions. Unfortunately, on a global scale emissions have been increasing from activities such as coal burning and gold mining. These emissions have an impact on the European environment because of the global nature of mercury pollution: around 50 % of the anthropogenic mercury deposited annually in Europe originates from outside Europe, with 30 % originating from Asia alone.

Concerted international action is required to address mercury pollution. The Minamata Convention on Mercury is intended to bring about some of the necessary changes through a consistent, global approach to reducing use, releases and impacts of mercury. Nearly 130 parties have now signed the Convention. However, even with immediate global actions, it will take a very long time for mercury in the environment to decline to pre-industrial levels.

European legislation on mercury is already more stringent than the requirements of the Convention, and will contribute to minimising the impacts of mercury. Individual actions can also be taken to minimise personal exposure and to support European legislation, for example, being aware of national food safety advice on fish consumption, and responsibly managing mercury containing wastes such as lamps and batteries.

This EEA report aims to increase understanding and knowledge of global mercury pollution among both policymakers and the general public. The report provides background information and context, before setting out the current status of global and European mercury pollution and the challenges that remain in addressing this global issue.


WARNING
HEALTH HAZARD
DO NOT EAT MORE THAN ONE BASS PER WEEK, PER ADULT
DUE TO HIGH MERCURY CONTENT.
CHILDREN AND PREGNANT WOMEN SHOULD NOT
EAT BASS.
AVISO
PELIGRO CONTRA LA SALUD



About mercury

Although mercury is a useful raw material, it is also highly toxic to both humans and the wider environment. The various human uses of mercury have resulted in large quantities being released into the environment. Once mercury is released it can circulate in the environment for up to 3 000 years in a process known as the 'global mercury cycle'.

What is mercury?

Mercury is a naturally occurring element that is present in the Earth's crust. It is the only metal that is liquid at room temperature and, because of this, it is also known as 'quicksilver' and by the Latin term *hydrargyrum*, which means 'water silver'. In the periodic table it is represented by the symbol Hg.

When people think of mercury, they tend to think of its pure, elemental, silver liquid form. However, in nature it is rarely present in this form and is more generally found in compounds such as cinnabar, a red mineral that also contains sulphur. Cinnabar was commonly used as a pigment (vermillion) and is the main ore that is mined, even today, to produce elemental mercury. These naturally occurring forms do not present a significant environmental risk, as the mercury content is not freely distributed or mobile in the environment.

The fate of mercury in the environment

Mercury's unique properties make it highly versatile; over millennia it has been used for many different purposes, and it is still widely used today. It is this anthropogenic (i.e. originating in human activity) use of mercury that has resulted in the global release of large amounts into the air, into oceans and onto land. Once mercury is freely available in this manner, it presents a significant risk to human health and the environment.

While the risks associated with localised, personal mercury exposure have been known or suspected for a very long time, it is only in the last 60 years that the global significance and scale of mercury pollution caused by humans has been understood. This has come about as scientists have learned more about how mercury behaves in our environment, unearthing the damaging legacy created by centuries of man-made emissions. It is estimated that, over the past 500 years, human activity has resulted in the release of between 1 and 3 million tonnes of mercury into the environment (Streets et al., 2017).

Scientists now understand that mercury circulates in the environment for as long as 3 000 years (Selin, 2009) and that it moves through water, air and land continuously, following what is known as the global mercury cycle. For example, it may initially be released into air and then deposited in water. Eventually it will be 're-released' from the water into the air and then travel long distances before being re-deposited onto land or in water, where the cycle starts again.

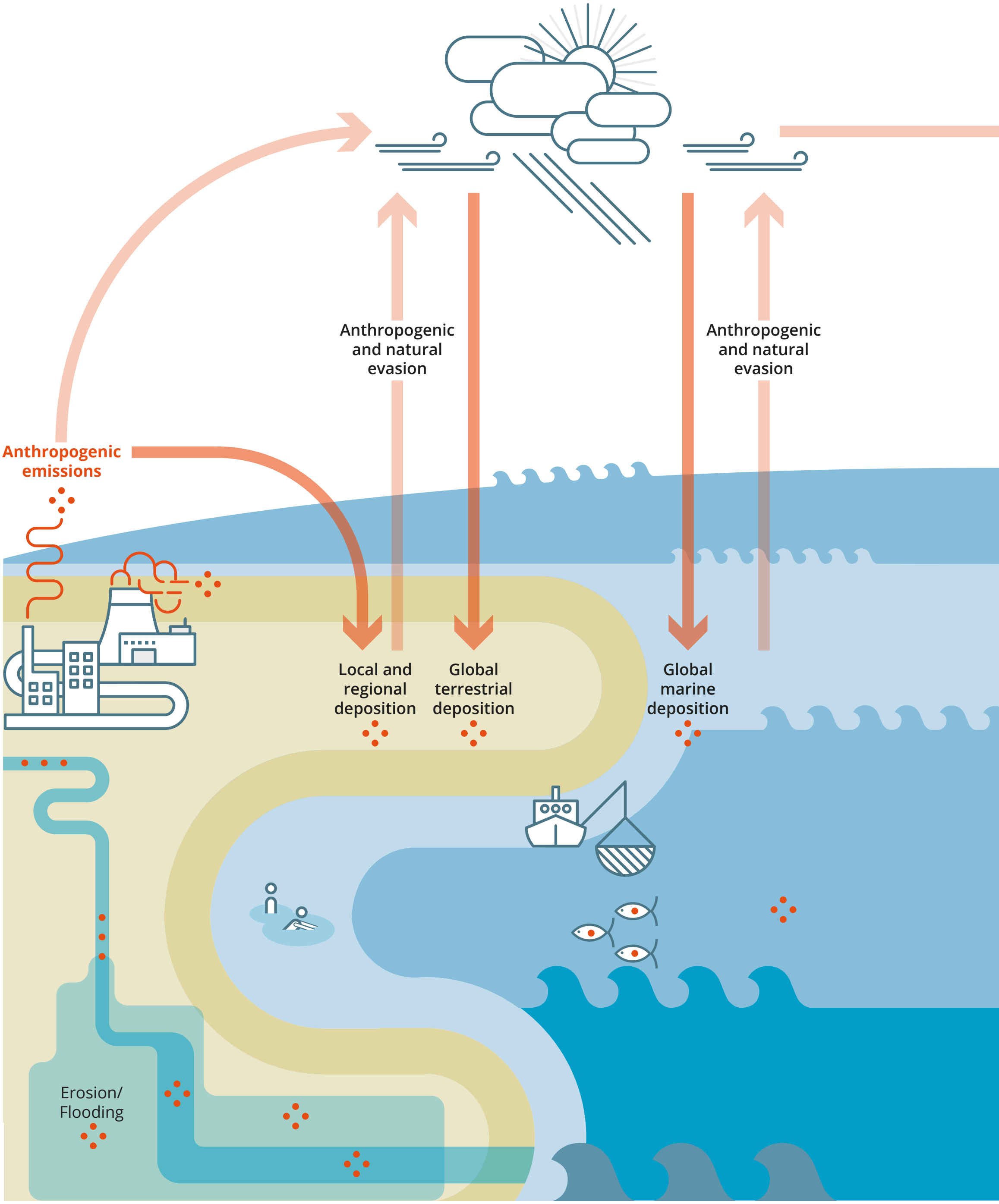
The global cycling of mercury effectively means that, even if anthropogenic sources stopped today, it would take many centuries for mercury levels in the environment to reduce significantly.

Types of mercury

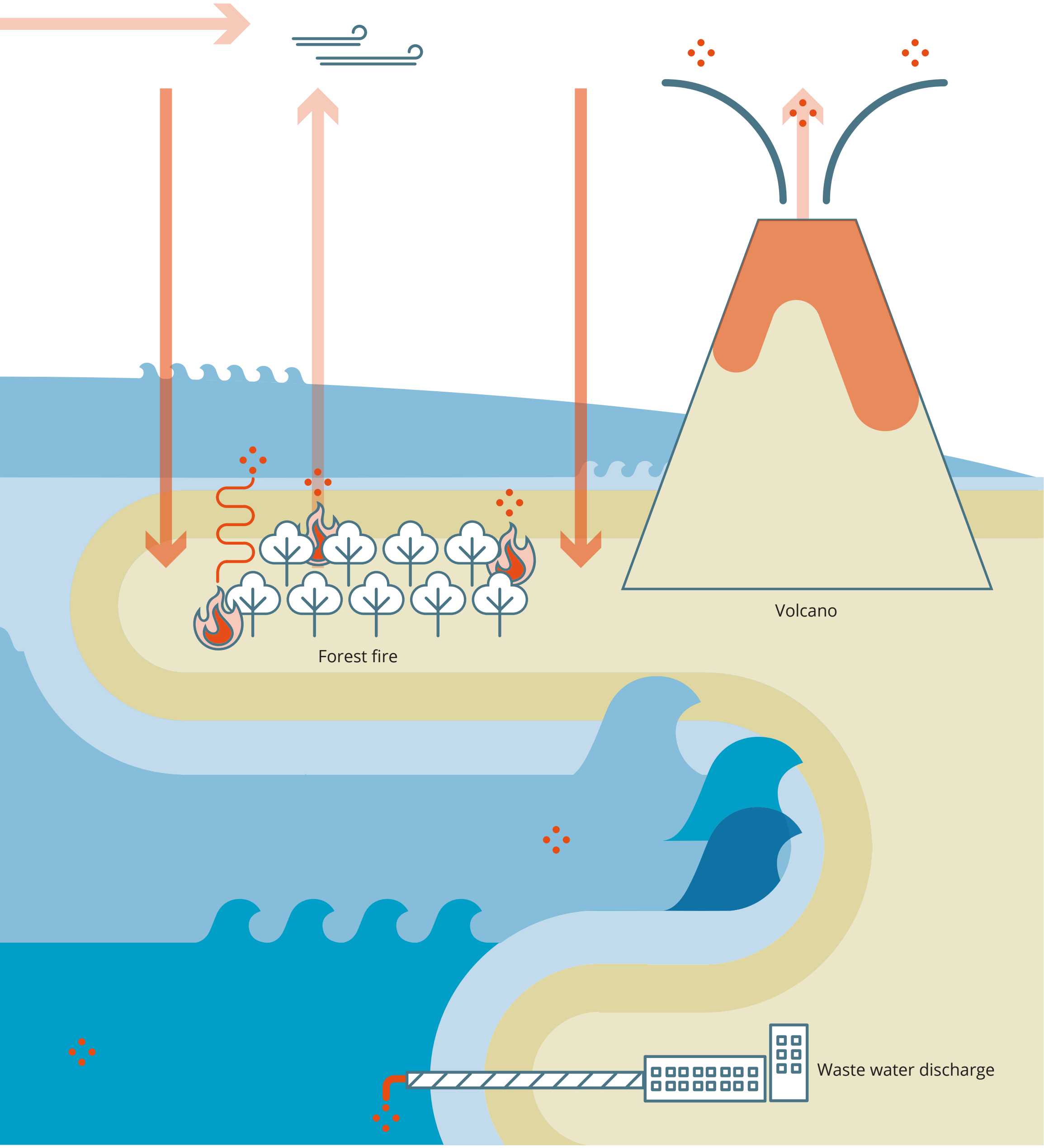
To understand the environmental flows of mercury, and the processes involved, it is important to know that mercury is found in the environment in three main forms, which are not equally harmful.

- **Organic mercury.** The most potentially harmful form of mercury is the highly toxic methylmercury, the most common organic form in the environment. It is found mainly in inland waters and the marine environment, where mercury entering the water is converted to methylmercury by bacterial action. Living organisms such as ocean plankton can easily absorb methylmercury, removing it from the aquatic system, but unfortunately this introduces it into the food web, where it can find its way into food consumed by humans and animals.
- **Elemental mercury.** This is mercury in its pure form, which is commonly used in human activities. If it is not contained, mercury slowly evaporates into the air, forming a vapour. It can remain in the atmosphere for around one and a half years and it can travel long distances. Elemental mercury can eventually react in the atmosphere to form inorganic mercury, which is then typically deposited on land or in water.
- **Inorganic mercury.** Inorganic mercury compounds are formed when mercury combines with inorganic elements, examples being mercury sulphide (HgS) and mercury oxide (HgO). Most of these are coloured powders or crystals. They tend to stay in the atmosphere for a shorter time than elemental mercury because they are more soluble in rainwater and more reactive.

The global mercury cycle



 Note: Evasion refers to the process of re-emission of gaseous mercury from surfaces such as soil and water.


Volcano
Forest fire
Waste water discharge

Mercury in Sweden

In the early 1950s, Swedish scientists noted that the population of seed-eating birds had decreased, with very high levels of mercury found in the bodies of those that had died. In the early 1960s, predatory birds and fish were also found to have very high levels of mercury in their systems. Several factors contributed to this contamination, including local pollution sources such as paper manufacturing and agricultural activities (e.g. treating seeds with mercury-based dressings to prevent seed-borne diseases in crops), in addition to the impact of mercury from Europe and globally (Egan, 2012).

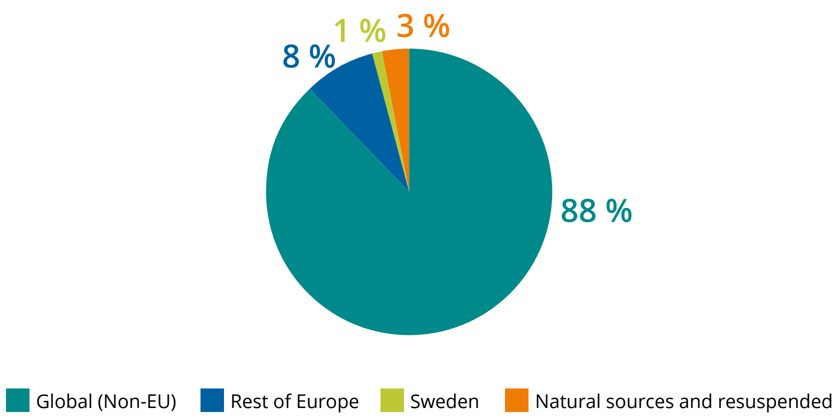
Sweden has since taken a series of innovative steps to address mercury pollution, including developing a national strategy to reduce emissions and effectively banning mercury in products and services such as dentistry (Naturvardsverket, 2013).

The latest river monitoring in Sweden indicates that more than 23 000 water bodies are still affected by mercury pollution (EEA, 2018) and fish in thousands of rivers and lakes have mercury levels that necessitate issuing health advisory guidelines for fishermen and consumers.

Unfortunately, reduced emissions in Sweden have been offset by increased emissions globally. Most of the mercury now having an impact on Sweden comes from outside Europe (88 %), with only 1 % estimated to be generated in the country (EMEP, 2016).

Sweden is not unique in being affected in this way, as mercury is a problem in every country in the world. However, it has been at the forefront of identifying, promoting and managing this issue.

Origin of mercury deposited in Sweden in 2014



Source: Provided by Swedish EPA, based on EMEP, 2016.

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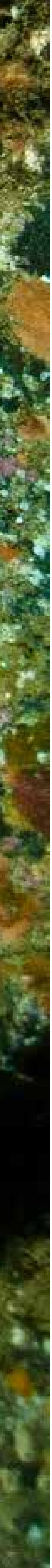

The environmental behaviour and impacts of mercury

Mercury released into the environment results in the exposure of animals, humans and the wider environment. Methylmercury in water is the key concern, as this accumulates in, and harms, marine life. Mercury in marine life subsequently results in human exposure through consuming seafood, the primary means of exposure for people in Europe. In humans, mercury has an impact on the nervous system and presents a particular and significant risk to the neurological development of babies in the womb, as well as young children.

Mercury's behaviour in the environment

The atmosphere is the main 'vehicle' by which mercury is transported around the globe and deposited on land and in water. Mercury in the atmosphere and in soil does not pose a significant direct risk to human or animal health. The water environment is more important because it acts as a longer term store of mercury and, more significantly, mercury in the aquatic environment is converted into methylmercury.

The lifetime of mercury in the upper ocean is estimated to be 30 years, while in the deeper ocean it will remain for centuries. This means that mercury released from human activities hundreds of years ago is still in the oceans now. Mercury present in shallower waters is eventually released from the ocean back into the atmosphere, where at some point in the future it will re-enter the ocean (or be deposited on land). As mercury's removal from water is much slower than that from the atmosphere, reductions in atmospheric emissions will not be reflected in concentrations in oceans for many years (UNEP, 2013).

It is estimated that up to 350 000 tonnes of mercury is stored in oceans worldwide, around 60 times more than the total amount stored in the atmosphere (Sunderland and Mason, 2007). About two thirds of the mercury in oceans is the result of releases from human activities (Lamborg et al., 2013).

Mercury deposited on land can also enter the food web, an example being the consumption of rice or rice products grown in mercury-contaminated soils. Because rice tends to be grown in water, methylmercury can form in this environment and be absorbed by the rice (Rothenberg et al., 2014).

Impacts of mercury on wildlife

Mercury can have a wide range of negative health effects on many animals. Toxic effects include reduced fertility, impaired development of embryos, changes in behaviour and negative effects on blood chemistry (NJ DEP, 2002). The extent of mercury's impact on animals is still poorly understood, as studies have tended to focus on human impacts. However, more recent studies indicate that doses well below lethal levels can still have substantial effects on animal health. One study showed that higher mercury concentrations are associated with reduced breeding frequency in black-legged kittiwakes (an Arctic bird species) in Svalbard, Norway (Tartu et al., 2013). This is probably because mercury affects the levels of reproductive hormones in these birds. In fish, mercury in the aquatic system has been found to negatively affect hatching times and the survival rates of offspring (Bridges et al., 2016). Another study showed that in the Great Lakes region of the United States, the population of bald eagles (a fish-eating species) is at risk of mercury-related brain damage (Rutkiewicz et al., 2011).

The impact of mercury on the health and well-being of animals appears to be equal to, if not greater than, the impact on that of humans.

In aquatic ecosystems, methylmercury tends to accumulate in organisms to much higher concentrations than those in the surrounding environment. Zooplankton (microscopic animals eaten by fish) often contain many hundred times more methylmercury than the water in which they live. As the process of mercury excretion is usually slower than the process of uptake, mercury tends to accumulate in organisms during their lifetime in a process called bioaccumulation. Mercury concentrations usually increase when moving up the food web, as predatory animals eat prey that have already accumulated mercury in their bodies. This process of 'biomagnification' within the food web is well understood and it occurs with a variety of pollutants, including mercury. There is also evidence that biomagnification can be more significant in colder waters (Lavoie et al., 2013).

The highest mercury concentrations have been found in toothed whales, sharks, swordfish and tuna. Limits on the mercury content of fish for consumption are defined to protect human health. The maximum safe mercury content specified is 0.5 milligrams per kilogram for most fish species, and 1 milligram per kilogram for some predatory species such as tuna and swordfish (EU, 2006). In addition, European and national food safety authorities provide advice on fish consumption with a view to minimising mercury intake.

The position of a species in the food web, for example whether it is a predator such as a bluefin tuna or a lower-end species such as a sardine, is not the only determinant of the mercury concentrations in aquatic organisms. Regional differences in concentrations are also found. In Europe, the highest concentrations tend to be found in fish caught in the Mediterranean Sea (Višnjevec et al., 2014). This seems to be related to the fact that conditions in the Mediterranean are favourable to the generation of methylmercury (Cossa and Coquery, 2005).


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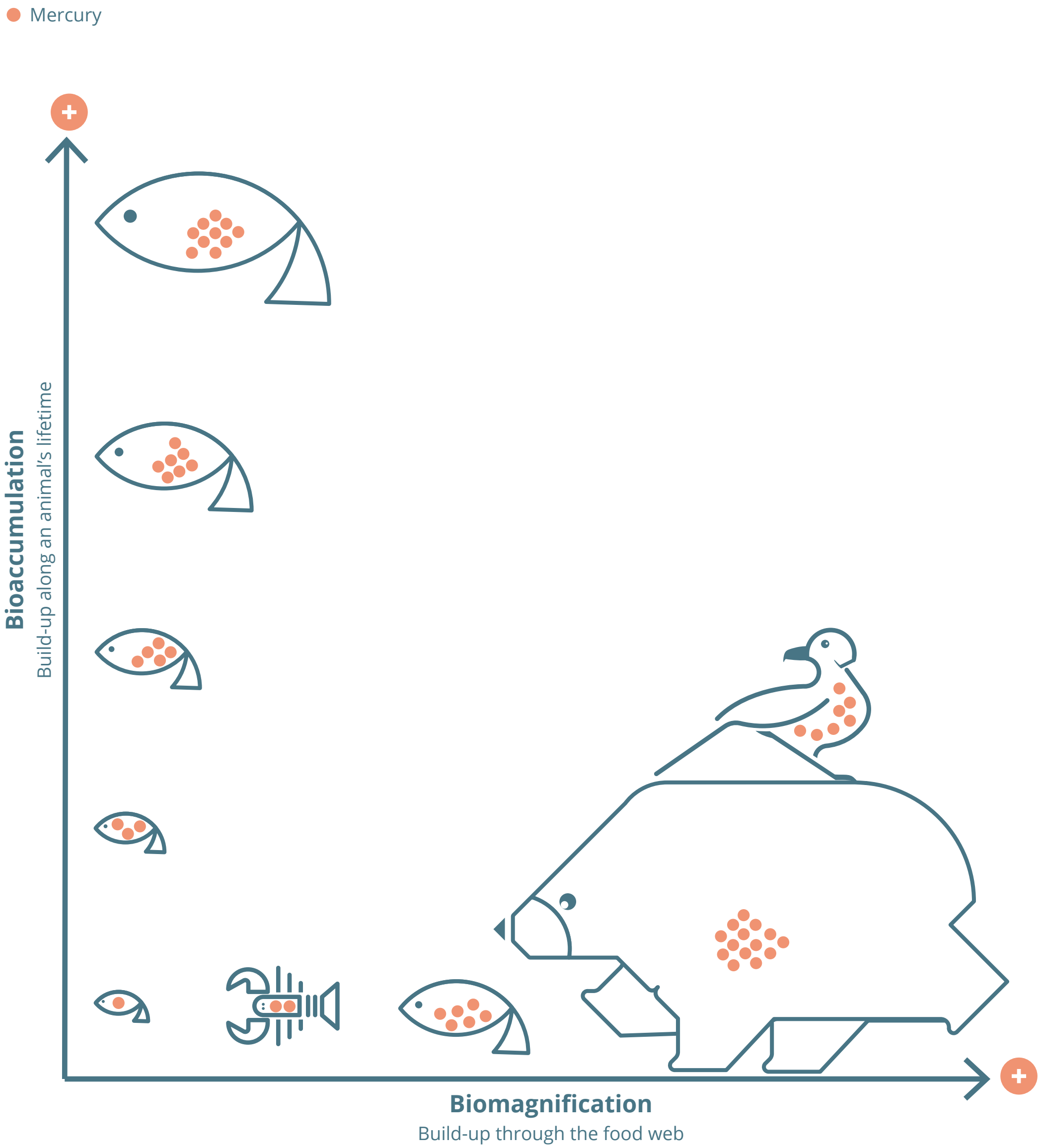
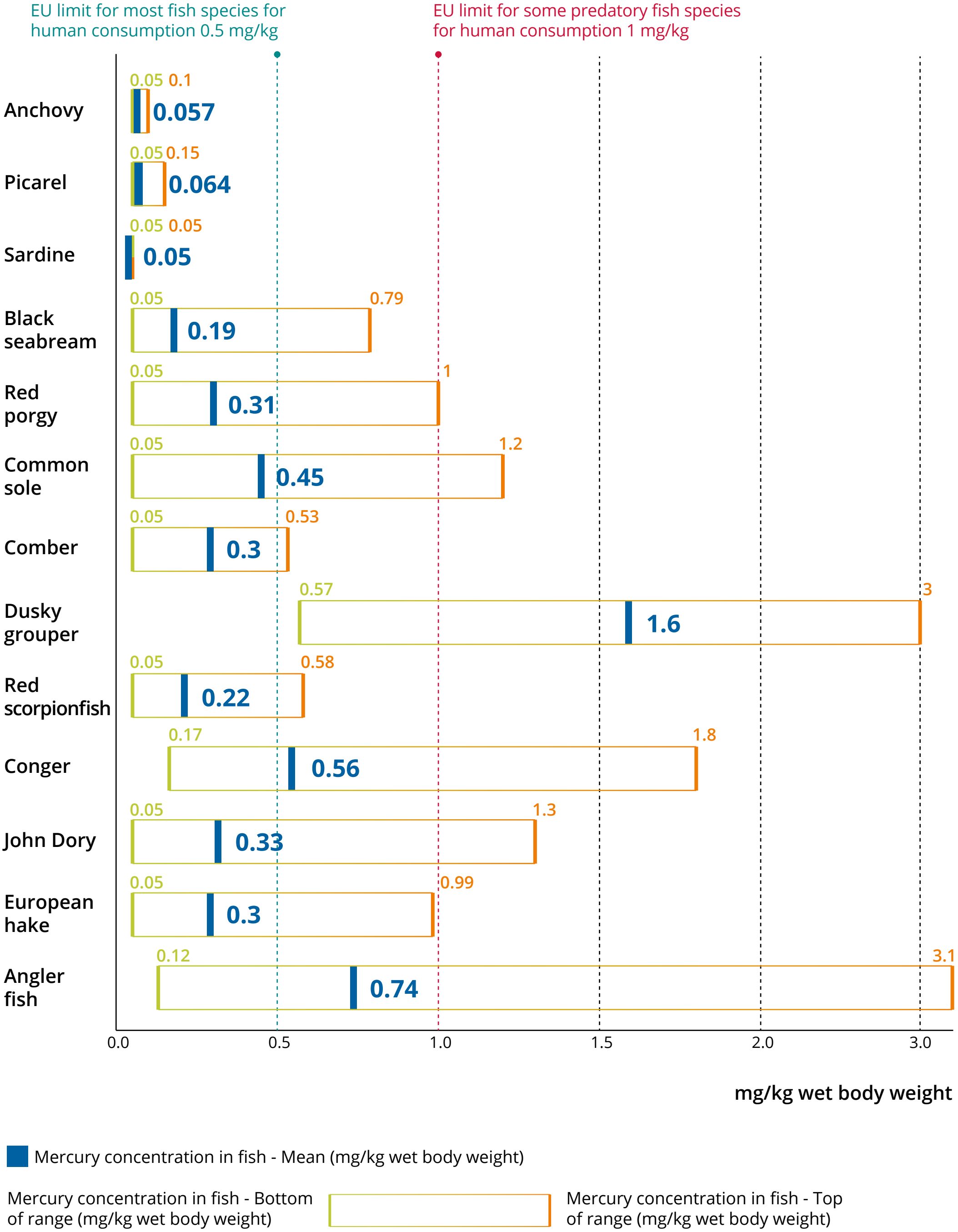
Bioaccumulation of mercury within species and biomagnification in the food web



Mercury concentration range in fish caught in the western Mediterranean



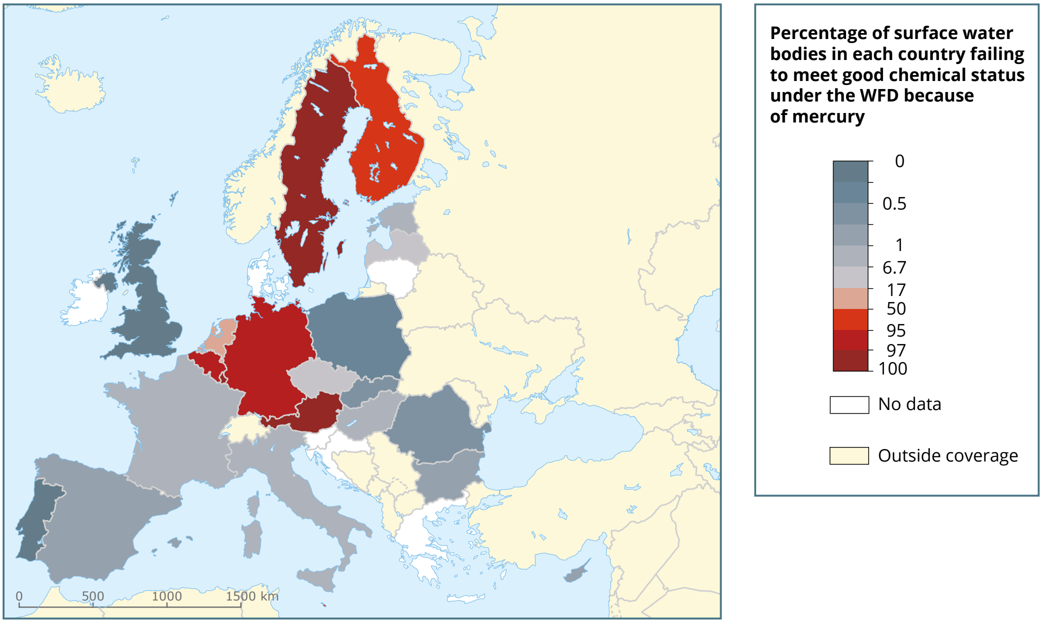
Source: Llull et al., 2017.
Note: For the fish species presented above, the higher European limit of 1 mg/kg applies only to angler fish.

Evidence of mercury impacts on water quality

The EU Water Framework Directive (WFD) requires EU Member States to take action to ensure that water bodies achieve good chemical and ecological status. Specific criteria are used to define what constitutes 'good status' and countries are required to assess compliance in water bodies.

The most recent data, provided as part of the second river basin management plan reporting, indicate that nearly 46 000 surface water bodies in the EU (out of a total of approximately 111 000) exceed the mercury concentration set to protect fish-eating birds and mammals. In some countries, mercury levels measured in biota cause failures in almost all surface water bodies (Austria, Belgium, Germany, Luxembourg, Slovenia and Sweden). Different interpretations of mercury compliance assessments across Member States influence the substantial variations in compliance rates between countries, this is further explained in a recent EEA assessment report on European waters (EEA, 2018a).

Impact of mercury on European water quality



Source: EEA, 2018b. **Note:** Map results based on WISE-SoW database including data from 22 Member States (EU-28 except Croatia, Denmark, Greece, Ireland, Lithuania and Slovenia).

Will climate change affect levels of mercury in the environment?

The general consensus within the scientific community is that the consequences of climate change will increase the risk presented by mercury to our environment (Krabbenhoft and Sunderland, 2013). Flooding will result in erosion of soils and release of mercury into the environment, while increased rainfall will cause greater deposition of mercury from the atmosphere.

The thawing of frozen soil (permafrost) is also an important future source of mercury emissions. Permafrost stores large amounts of mercury, which may be released if the permafrost thaws over the next century (Schuster et al., 2018).

Other anticipated climate change impacts, such as more forest fires, will result in mercury's release into the atmosphere (as wood contains small amounts of mercury that are released during burning). Most importantly, evidence suggests that climate change effects, specifically increases in ocean temperatures, may result in increased mercury levels in marine animals (Dijkstra et al., 2013).

Human exposure and diet

The most significant route of human exposure to mercury is diet. The highest blood mercury concentrations are found in people who consume a lot of fish, such as those living near the coast and in Arctic communities who traditionally have higher fish intakes. People ingest more mercury when consuming predatory fish than when consuming smaller (younger) specimens or species that are lower in the food web. However, although eating fish can lead to health problems from mercury exposure, it also provides many health benefits. Most countries have therefore developed appropriate dietary advice for maintaining a balanced diet and gaining the health benefits associated with seafood.

Mercury exposure from other, non-dietary routes is very small. Low levels of mercury are present in ambient air. Our bodies do absorb mercury from inhaled air very efficiently, but the typical mercury concentration in outdoor air is too low to be harmful to our health.

Other potential minor pathways of exposure include mercury-based dental fillings, as well as mercury released from (broken) mercury-containing products; however, the risks are not generally considered to be as significant as those from diet. Thimerosal, a mercury-containing organic compound, was historically used as a preservative in several human vaccines, but its use in Europe is now very limited, and studies have shown in any case, that thimerosal in vaccines was not harmful (European Centre for Disease Prevention and Control, 2018).

Apart from the general exposure pathways mentioned above, local communities living near mercury-polluted sites such as former mercury mines may face some additional health risks. So far, however, the health effects of local mercury pollution on these communities seem to be relatively limited. A study investigating the effects in Idrija (Slovenia), where mercury has been mined for more than 500 years, found that the exposure of school-aged children in that area was no higher than that of children from other rural or urban areas (Kobal et al., 2017). However, it has been shown that foodstuffs produced in Idrija do contain increased mercury concentrations. This is especially the case for fish, mushrooms and chicory (Miklavčič et al., 2013).

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Monitoring human mercury levels — The DEMOCOPHES study

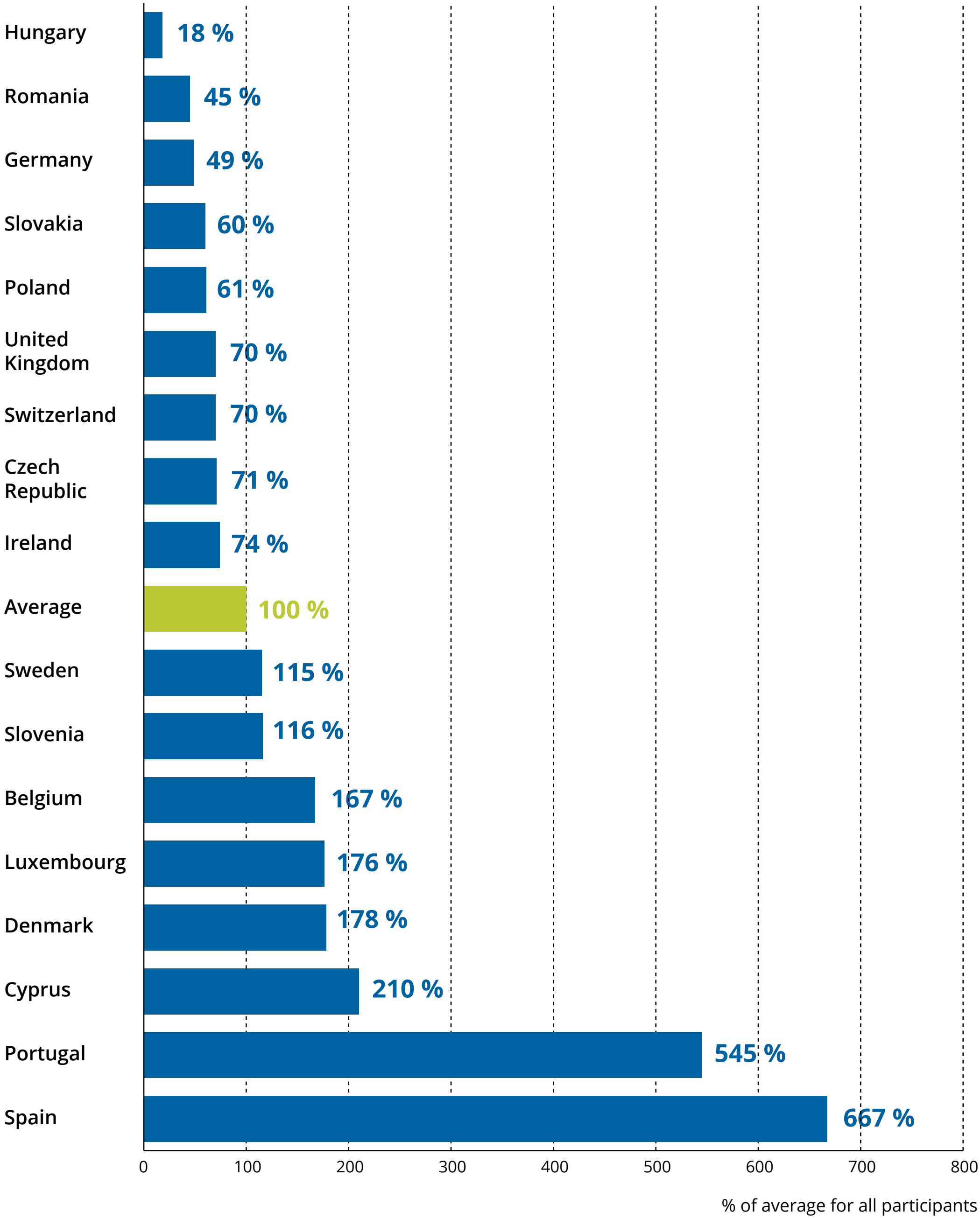
DEMOCOPHES was a Europe-wide, EU-funded human biomonitoring study carried out between 2010 and 2012. The aim was to demonstrate and refine a common approach to completing biomonitoring studies across Europe so that data would be comparable between countries.

Human biomonitoring is an approach used for assessing the levels of contaminants in the human body. As part of the study, the mercury levels of children and their mothers in 17 countries were assessed by analysing hair samples, a common way to assess mercury exposure.

The mercury levels of the participating mothers in the 17 countries indicate that women in countries with a higher average fish intake have higher levels in their bodies. Spanish and Portuguese mothers had by far the highest levels, typically five to seven times above the average. Interestingly, the results indicated that other countries with high levels of fish consumption (e.g. Cyprus) have lower mercury levels, as people there tend to eat less predatory fish.

This work is being further developed through the European Human Biomonitoring Initiative (HBM4EU; www.hbm4eu.eu). This type of information on exposure levels will assist in developing strategies for minimising mercury exposure while maximising the benefits of eating seafood.

DEMOCOPHES study — Mercury levels in hair of mothers as a percentage of the Europe-wide average



Source: Based on data from the DEMOCOPHES study, Den Hond et al., 2015.

Dietary advice to pregnant women in Denmark

A high mercury intake by women during pregnancy can have negative impacts on children's development. A study carried out in Denmark (Kirk et al., 2017) attempted to find out if giving pregnant women proactive, focused and balanced dietary advice could help to lower their mercury intake without having an impact on their overall consumption of fish.

The women completed a questionnaire on their dietary habits, including fish intake, and an initial sample of their hair was taken for mercury analysis. At the same time, they were provided with balanced dietary information that highlighted the benefits of fish but also explained how exposure to mercury could be reduced through their choice of seafood, in particular by avoiding eating large predatory fish.

Based on the initial hair sample, 22 % of the women had mercury levels above the safe limit recommended by experts. A follow-up sample taken after 3 months showed that this figure had reduced to 8 % and that the average mercury level across all participants was significantly lower. The overall fish consumption levels remained the same, indicating that the changes in mercury levels were due to changing the types of fish eaten.

A separate study (Bellanger et al., 2013) estimated that, every year throughout Europe, nearly 1.9 million babies are born with mercury levels above the recommended safe limit. This is approximately one third of all births, although countries with higher levels of fish consumption (e.g. Greece, Portugal, and Spain) had proportionately more babies born with mercury levels above the limit.

The potential impact on children's brain development is considered to be lifelong and can result in a significant reduction in Intelligence Quotient (IQ). The authors estimated the annual economic cost of this damage to be at least EUR 9 billion.

Together, these two studies clearly show that there are very significant health, social and economic benefits of providing proactive public information on managing dietary exposure to mercury.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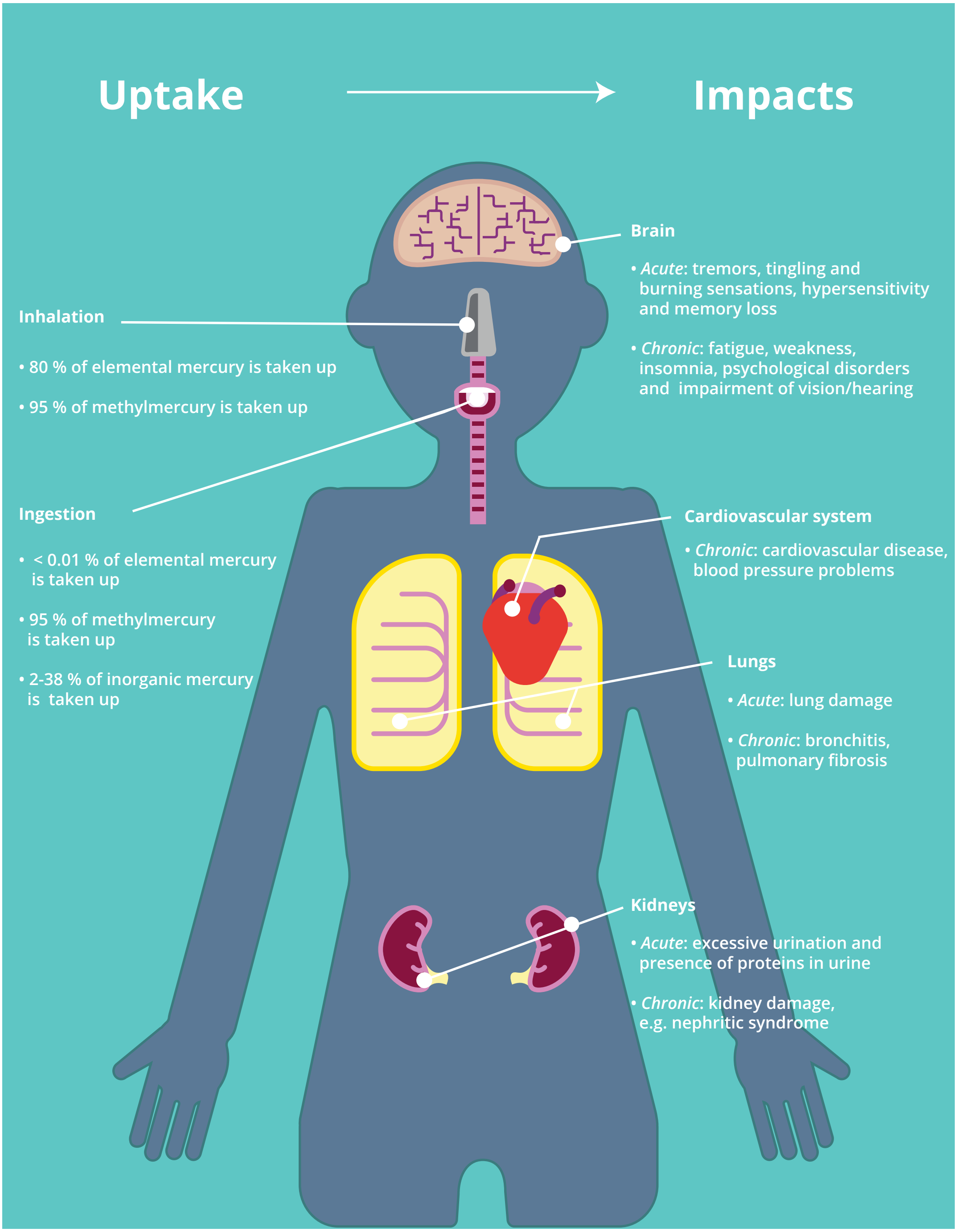
The behaviour and impacts of mercury in the human body

As with all toxic substances, mercury's effects are dose related; they depend on the amount consumed and how much our body absorbs. Different forms of mercury stay in our tissues for different lengths of time and some parts of our body tend to accumulate it more easily. Methylmercury is absorbed easily by our bodies and remains there the longest (Miklavčič et al., 2013).

Mercury affects mainly the brain/nervous system, the kidneys and, when inhaled, the lungs. Importantly, methylmercury crosses the blood-placenta barrier 10 times more efficiently than other forms of mercury and, as a result, presents a significant risk to developing embryos (Young-Seoub et al., 2012). Mercury exposure in the womb or in infancy affects the development of the brain and nervous system. High levels of exposure can result in symptoms such as vision and hearing problems, impaired motor skills, delays in language development and memory/attention deficits (Bose-O'Reilly et al., 2010; Grandjean and Herz, 2011). Breastfeeding women should also follow relevant dietary advice on fish consumption, as mercury levels in the body have an impact on levels in breast milk (Grandjean et al., 1994).

Recent studies have also shown that, in older adults, mercury exposure can increase the risk of cardiovascular disease (Karagas et al., 2012) and blood pressure problems (Genchi et al., 2017).

Mercury's human uptake potential and relevant impacts



Source: Bernhoft, 2012; Karagas et al., 2012; Park and Zheng, 2012; Genchi et al., 2017.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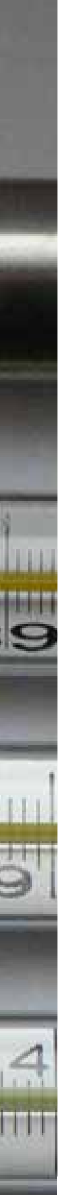
exatherm

Production and use of mercury

The trends in producing and using mercury in anthropogenic activities differ significantly between Europe and other regions. Asia is now by far the biggest regional user of mercury. The EU's use is continuing to decline, now accounting for only 5 % globally. Global use is likely to continue to be environmentally significant in the medium term; however, there are some signs of future reductions in key global regions.

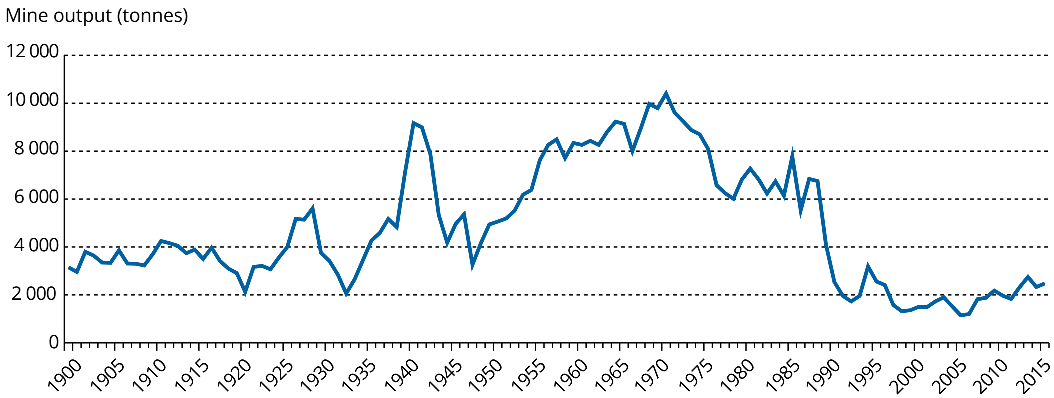


Where does mercury come from?

Mercury ores have been mined for thousands of years on a relatively small scale, but this increased significantly in the 16th century, when mercury was used to process silver ores. The use of mercury rose further in the mid-1800s with the commencement of large-scale gold mining and the industrial revolution in Europe. Mine production of mercury peaked in the early 1970s, and, before that, in the 1940s as a result of the Second World War, during which mercury was used in military equipment such as explosives.

After the 1970s, mine output reduced significantly, although it has increased slightly in recent years and some mines have reopened. Currently, mercury is mined in only four countries, namely China, Indonesia, Kyrgyzstan and Mexico (Selin et al., 2018). Essentially, the main commercial mercury production and trading hubs have moved to areas of greatest demand, as other regions such as North America and Europe have placed restrictions on trading, producing and using mercury. This increase in output is concerning, and is primarily fuelled by increasing demand for mercury in certain activities, including small scale gold mining and vinyl chloride production.

Global mine production of mercury from 1900 to 2016



Source: USGS, 2018.

A brief history of mercury use

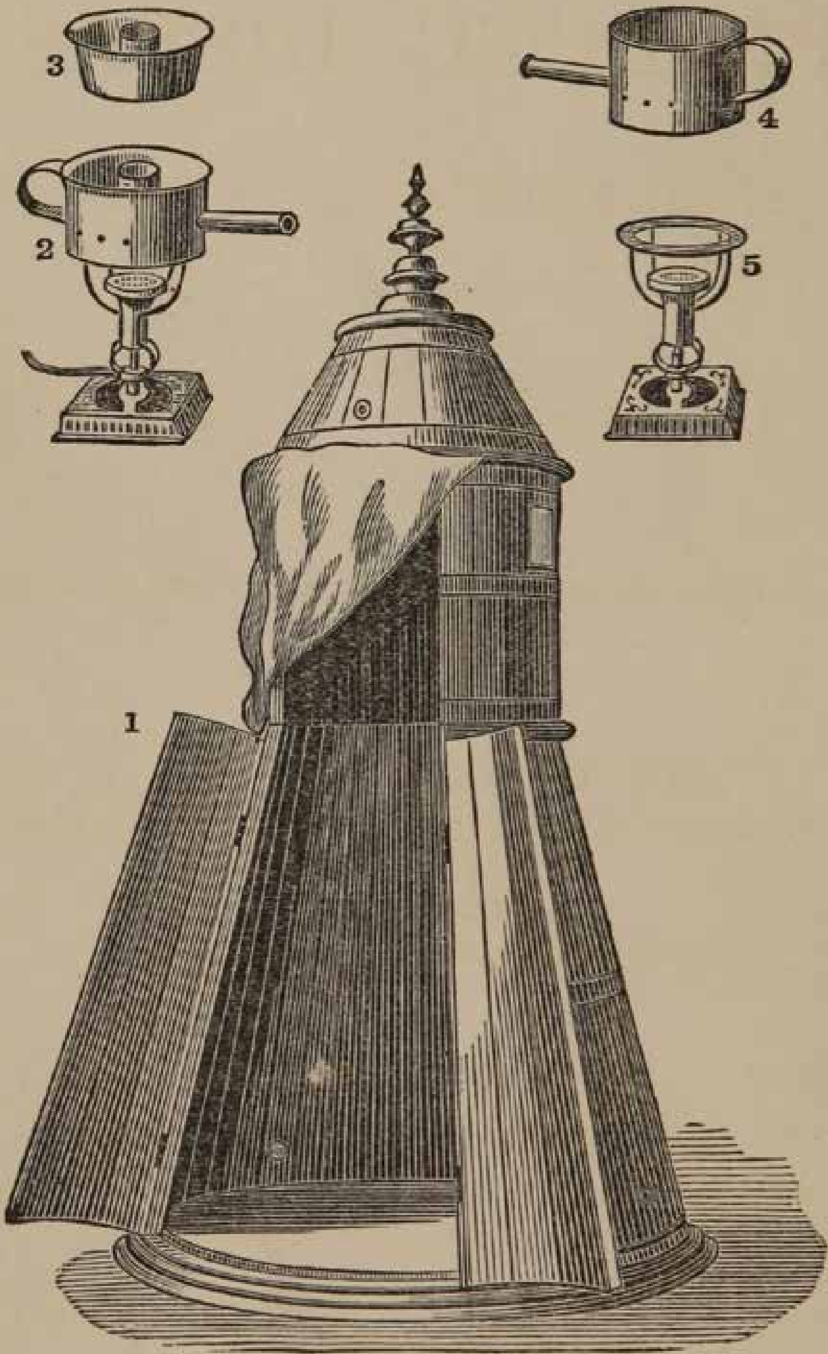
Mercury has fascinated humans since ancient times, when it was hailed as having a multitude of mystical properties, including medicinal powers. Mercury-based health treatments, developed in the early days of formal medicine, included consuming mercury-containing medicines and having external treatments such as mercury 'vapour baths'. Mercury vapour treatment was recommended to cure syphilis and various skin conditions, as well as for internal discomfort, including pains during pregnancy (Swiderski, 2008). Mercury-based treatments were often claimed to have miraculous effects, but much less attention was given to their sometimes fatal consequences. The potential side effects of consuming mercury (nausea, strange behaviour, tremors) were in some cases looked upon as proof that the 'medicine' was driving out the patient's illness (Swiderski, 2008).

Mercury was commonly used in alchemy, an early form of chemistry that attempted to purify or transform certain materials. This included preparing life-giving potions (elixirs) and transforming base metals into gold.

Mercury was also used in industrial activities, one of the earliest being silver and gold mining, where it was used to separate precious metals from other materials. Over 2 000 years ago, the Romans imported large quantities of mercury from the Iberian Peninsula into Italy to process gold ores (Lacerda and Salomons, 1998). In more modern times, mercury was extensively used during the California Gold Rush (which started in 1848). Millions of kilograms of mercury were released into the Californian environment, the impacts of which are still evident today (Alpers et al., 2005).

The Industrial Revolution resulted in mercury being used in many industrial processes, including in the production of chemicals such as chlorine. Chlorine is produced globally in very large quantities and is used to make everyday materials such as plastics, disinfectants, medicines and paints, as well as in important processes such as the disinfection of drinking water. In addition, mercury was (and, to some extent, still is) used in consumer products such as thermometers and electrical equipment.

MERCURIAL VAPOUR BATH;



FOYE'S FUMIGATING APPARATUS.

Source: Parker et al., 1874.

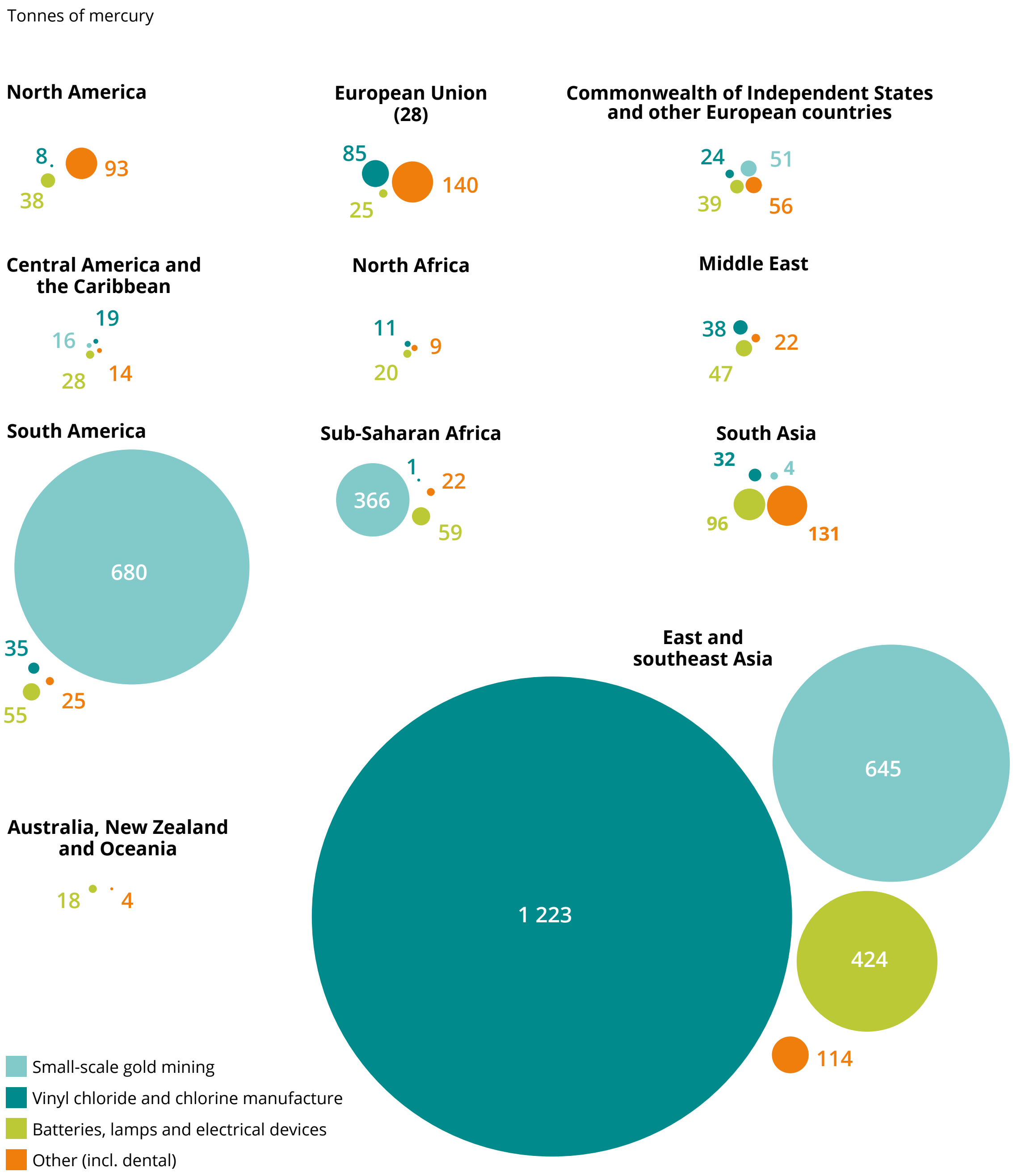
The current global uses of mercury

Mercury is mostly used as a raw material in a range of industrial processes. Estimates for 2015 (UN Environment, 2017a) indicated that 4 716 tonnes of mercury were consumed. Comparing this with the estimates for 2005 and 2010 suggests that consumption rose from 2005 to 2015, mainly from use in small-scale gold mining and vinyl chloride manufacturing. Note that estimates of use from different years must be compared with caution, as the methodologies used to estimate emissions are refined over time.

Globally, small-scale gold mining (37 %) and vinyl chloride production (26 %) are the main uses of mercury (UN Environment, 2017a) (vinyl chloride is used to manufacture PVC (polyvinyl chloride) plastics). Mercury is also used in the production of chlorine-based chemicals and in everyday products such as dental fillings, batteries and light bulbs.

The increase in mercury use in vinyl chloride production is due mainly to demand from some developing countries for products such as plastic window frames. The countries producing this (primarily China) tend to use a process that relies on mercury, whereas other producers (e.g. in Europe) now use mercury-free technologies. Current indications are that China is taking action to address this (UN Environment, 2017a).

Mercury consumption by region and activity, 2015



Source: UN Environment, 2017a.

Replacing mercury in small-scale gold mining

Artisanal and small-scale gold mining (ASGM) relates to individuals or small groups of people mining gold relatively simply and at low cost. Basic methods are used to refine and extract gold from the mined ore. The process is commonly carried out in Asia, Africa and Central and South America. A significant number of people are involved, as gold is still very valuable and they see the potential to provide for their families through this largely unregulated, low-cost activity. At least 100 million people depend on ASGM for their livelihood (AMAP and UNEP, 2008).

Mercury is used to separate the gold from other materials in the mined ores. The mercury amalgamates with the gold; then, by heating this gold/mercury mixture, the mercury evaporates and the gold is left behind. Practically all of this mercury is released into the environment.

The Geological Survey of Denmark and Greenland (GEUS) and the University of Copenhagen have carried out various studies on the technical, socio-economic and cultural aspects of small-scale gold mining. One of these projects examined the potential of an alternative, mercury-free process for extracting gold from ores (Appel and Na-Oy, 2014). This separation process uses borax (also known as sodium borate).

The method is relatively simple and does not require specialist equipment or expertise. It also takes approximately the same amount of time as the mercury method. Experiments carried out using this method indicate that higher yields of gold are generated than when using mercury.

Although this method has been applied to some extent in the Philippines, it has yet to find widespread favour in other countries. Borax can also have health and environmental impacts and needs to be managed properly; however, when used efficiently it appears to present a viable and safer alternative.

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Current uses of mercury in the EU

From a European perspective, significant efforts have been made to stop using mercury in industrial activities as well as in consumer products. Mercury is no longer used in small-scale gold mining (apart from in French Guiana, part of France), while mercury in vinyl chloride manufacturing is limited to one plant in Slovakia, which must cease using it by 2022.

EU data for 2015 (UN Environment, 2017a) show that mercury was mainly used in the industrial manufacture of chlorine products (known as the chlor-alkali industry, 85 tonnes consumed) and in dental applications (56 tonnes consumed). However, the use of mercury in industrial chlorine production in the EU was banned at the end of 2017 and hence dental applications are now the single biggest user of mercury in Europe. Overall, EU use of mercury, estimated at 249 tonnes in 2015 (UN Environment, 2017a), accounts for 5 % of the global amount. This compares with 2 407 tonnes in East and Southeast Asia in the same year (UN Environment, 2017a).

The current status of mercury use in European dentistry

Mercury-containing fillings have been used to fill cavities in human teeth since the 1800s because they are relatively cheap and very hardwearing. These fillings are approximately 50 % mercury (COWI, 2008). With around 75 % of the 500 million EU inhabitants having fillings, it is estimated that 1 500 tonnes of mercury is held in human bodies, which presents a potential exposure route through, for example, the process of cremation.

The main alternative to mercury fillings is composite fillings, which are already widely used in many European countries. In Denmark, Norway and Sweden, mercury in dentistry has effectively been banned. Finland, Hungary, the Netherlands and Switzerland have implemented measures that have reduced the use of mercury in dental restorations to very low levels. The main factor limiting the use of composite fillings is their higher cost. In lower income countries, the use of mercury continues and may even increase as healthcare systems improve.

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The outlook for EU and global mercury use

The global use of mercury has been increasing over the last 10 years, mostly because of small-scale gold mining and vinyl chloride production. The estimate for 2015, at 4 716 tonnes (UN Environment, 2017a), is 38 % higher than that for 2005, at 3 415 tonnes (UNEP, 2006); however, these figures should be compared with some caution, as calculation methods have improved over time. The global estimate in 2015 is also approximately twice the mine production output for that year, indicating that the supply from existing mercury stocks is bridging the gap between output from mining and current demand.

An analysis of the main drivers of current use, namely vinyl chloride production and small-scale gold mining, provides an indication of future trends:

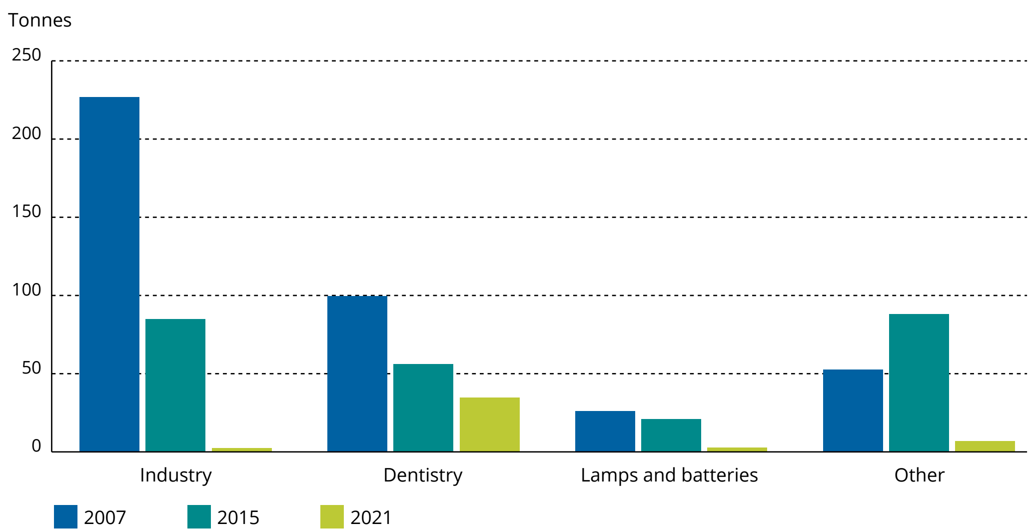
- **Vinyl chloride.** China is the biggest user of mercury in vinyl chloride production, with around one third of the global output. The amount of mercury China consumed in this process in 2014 was estimated at 1 216 tonnes (UN Environment, 2017a). As China is a signatory to the global Minamata Convention on Mercury (which seeks to reduce the impacts of mercury), it must work towards a target of reducing mercury use by 50 % per unit production in 2020 (compared with 2010 figures). Efforts are being made in China to replace the existing process with a less harmful alternative (Peplow, 2017). While progress is being made, it remains to be seen whether the Minamata Convention targets will be achieved by 2020.

- **Small-scale mining**. Millions of small-scale miners work in unregulated environments around the world. Although many projects have been implemented to reduce mercury consumption (UNIDO, 2013), estimates of mercury use continue to rise. This activity looks set to be the main global consumer of mercury until alternative methods are readily accepted and applied in these communities. This is likely to be very difficult and will require a thorough understanding of local socio-economic and cultural factors (Spiegel, 2009).

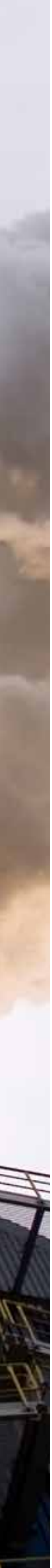
Use patterns in Europe are quite different from the global scenario. The ban on mercury in the manufacture of chlorine products means that consumption will drop below 200 tonnes per annum from 2018. The policies put in place to further control mercury use in Europe (see p.59, What is being done in Europe and globally?) will result in this decreasing to around 50 tonnes by 2021 (European Commission, 2017).

Dentistry will be by far the biggest single user by 2021, with other activities having relatively low demand. Recent European legislation prevents the use of mercury-based fillings in 'baby' teeth, in children under 15 years old and in pregnant or breastfeeding women. Furthermore, these regulations require every EU Member State to publish a plan, by 2019, that outlines its proposed measures to phase out such fillings. The European Commission is then required to report on the feasibility of implementing a complete EU-wide ban in the long term, and preferably by 2030. Overall, the trends in Europe are downward; however, there appears no prospect of a zero-mercury economy in Europe in the medium term.

Estimates of mercury consumption in the EU for 2007, 2015, 2021



Sources: based on data from ICF International, 2015 (2007 data); UN Environment, 2017a (2015 data); and European Commission, 2017 (2021 projections).



Mercury emissions — Trends and outlook

The biggest mercury users do not necessarily result in the largest environmental emissions. In Europe, the largest sources of emissions are actually coal combustion and industrial activities, while, globally, small-scale gold mining is also significant. EU emissions are expected to decrease further over the coming years. Non-EU sources dominate current and future global emissions of mercury, although there are some prospects for reducing global emissions in the medium term.

The main potential sources of mercury emissions

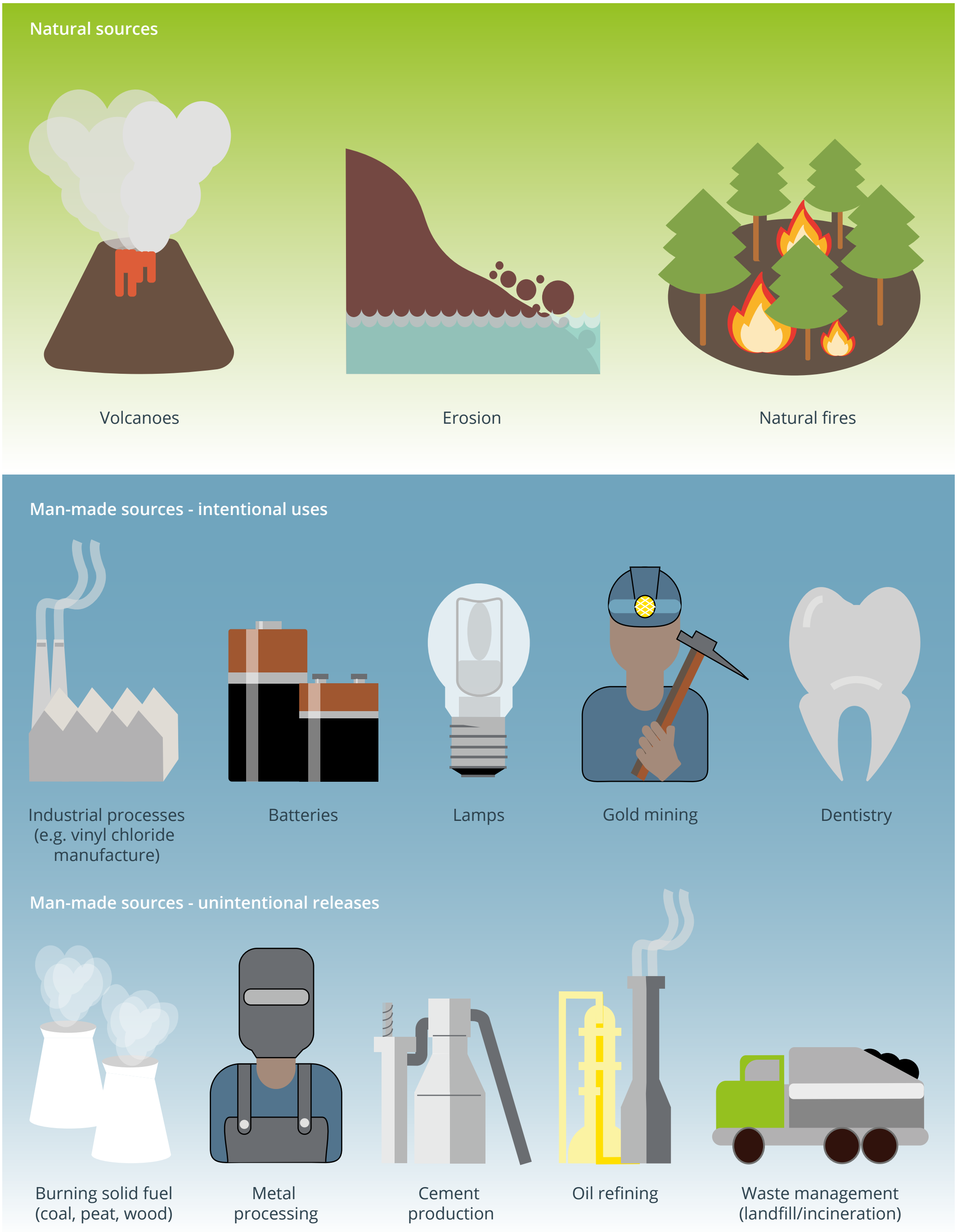
Mercury can be divided into primary emissions and re-emissions (or re-mobilisation). Primary emissions refer to the first time mercury is released into the environment directly from either natural sources (such as volcanoes) or anthropogenic sources. Re-emissions and re-mobilisation, on the other hand, refer to mercury re-entering air or water after its earlier removal. For example, mercury in the air is deposited in the ocean and then after a period of time the mercury in the ocean is re-emitted to the atmosphere and, therefore, is not emitted from a 'primary' source such as an industrial activity.

Overall, natural sources account for about 10 % of annual mercury emissions to atmosphere worldwide, while anthropogenic activities account for about 30 % (UNEP, 2013). The remainder, approximately 60 %, is re-emissions, that is, mercury that was previously released into the environment, mainly from human activities.

Mercury-releasing anthropogenic activities can be split into two types:

- Activities that intentionally use mercury, as described in the previous section of this report (e.g. vinyl chloride production).
- Other activities, which do not intentionally use mercury, but nonetheless result in its release into the environment, generally because it is an impurity in a raw material. The prime example is the combustion of solid fuels such as coal, lignite and wood, during which the mercury in the fuel is released. These are referred to as unintentional releases.

Main global potential sources of mercury emissions



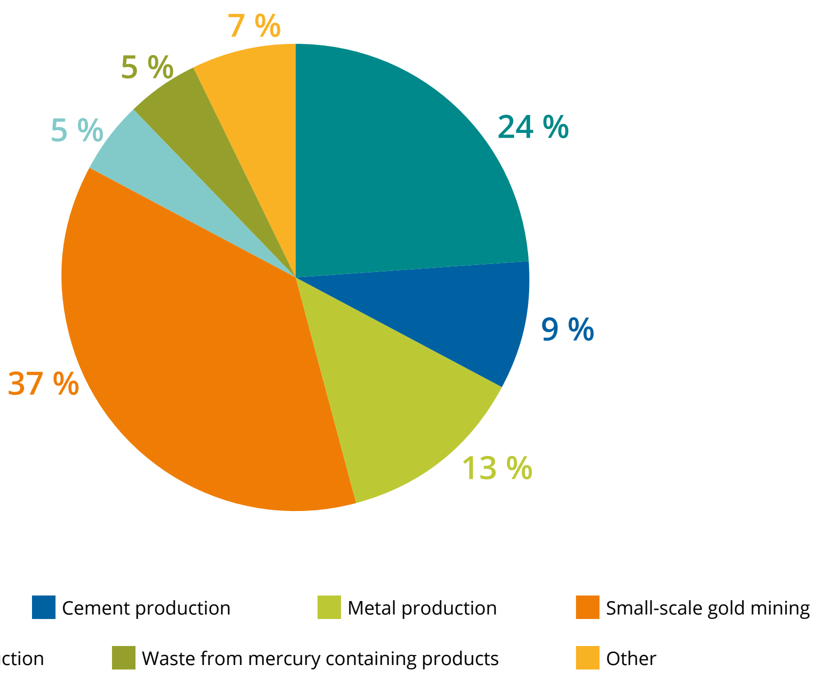
Current global mercury emissions to air

Global air emissions are important as they result in impacts within Europe and vice versa. Mercury emissions from outside Europe contribute about 50 % of the anthropogenic mercury deposited annually within Europe, with nearly 30 % of the mercury deposited in Europe originating in Asia (AMAP and UNEP, 2015).

Globally, coal combustion accounts for around one quarter of emissions to air; other main industrial sources are cement and non-ferrous metal production, which each account for about 10 % (AMAP and UNEP, 2013). None of these three sources specifically uses mercury as part of the process; however, emissions occur because mercury is present in the raw materials/fuels, and hence these are examples of 'unintentional' releases.

While emissions to air from power generation and industry are significant, small-scale gold mining is, in fact, the single biggest source, accounting for more than one third of global releases (AMAP and UNEP, 2013).

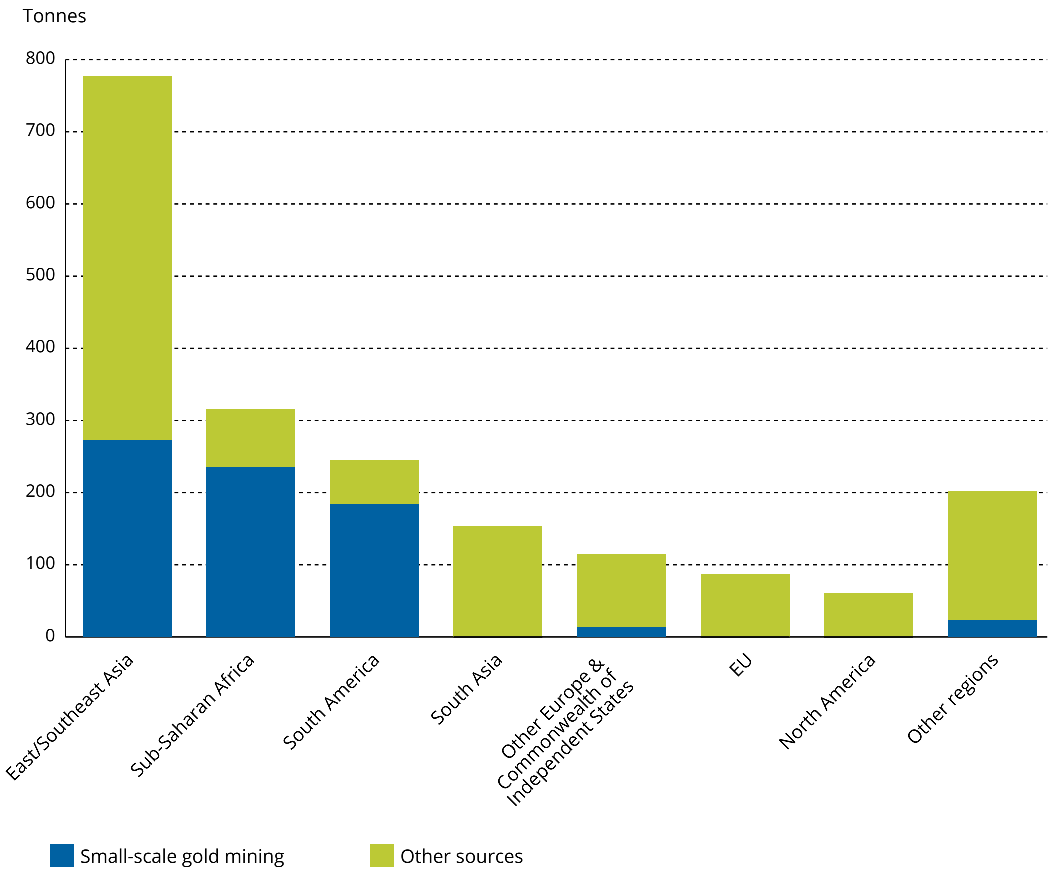
Global mercury releases to air in 2010, by main source



Source: AMAP and UNEP, 2013.

Most estimates of global mercury emissions indicate global releases to the atmosphere of around 2 000-2 500 tonnes per year (AMAP and UNEP, 2008, 2013; Pirrone et al., 2010). Whereas in recent years emissions in Europe and North America have been decreasing, those in Asia, Africa and South America have been increasing. The increased emissions from Asia are linked to ongoing economic development, with associated industrialisation (e.g. increased outputs of metals and vinyl chloride) and higher demands for energy, principally via coal burning. Small-scale gold mining also contributes to the increased emissions in Asia, while it is the dominant source of emissions in South America and Africa.

Global mercury emissions to air in 2010, by region, distinguishing between small-scale gold mining and other sources



Source: AMAP and UNEP, 2013.

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The outlook for global mercury emissions to air

Many experts have estimated future atmospheric mercury emissions, and, in summary, most do not anticipate a short-term reduction (e.g. Sunderland and Selin, 2013; Gworek et al., 2016). Emissions are, at best, estimated to stabilise around current levels, with mercury continuing to be introduced into the environment.

However, one significant area of uncertainty in these assessments is the potential impacts of the Minamata Convention on Mercury (see p.59, What is being done in Europe and globally?). The Convention obliges all parties to apply the concepts of best available techniques and best environmental practices to control and reduce mercury emissions. The discussion of future projections below should be considered in this context, as implementing the Convention is expected to moderate emissions, with the potential for a reduction if the parties to the Convention are ambitious in applying the requirements.

An examination of each of the three main global sources of anthropogenic air emissions suggests that there is some limited evidence of potential future reductions, perhaps in some cases as a result of the Minamata Convention:

- **Electricity generation using solid fuels.** The global use of coal for power is not forecast to decrease between now and 2040 and it may even increase if expected policy measures (to meet the Paris Agreement climate change targets) are not introduced (International Energy

Agency, 2017). The forecast reductions in coal demand between 2016 and 2040 in regions such as the United States (- 16 %) and Europe (- 47 %) will be offset by significant growth in coal demand in countries such as India (+ 114 %) and other Asian countries (International Energy Agency, 2017). Global energy demand between 2016 and 2040 is predicted to grow by approximately 30 %, which is the equivalent of adding another 'India + China' to today's global demand (International Energy Agency, 2017). Therefore, the current prospects for reduced air emissions from power generation do not appear to be positive unless substantial changes are made to the proposed fuels and/or the technologies used to generate power in these countries.

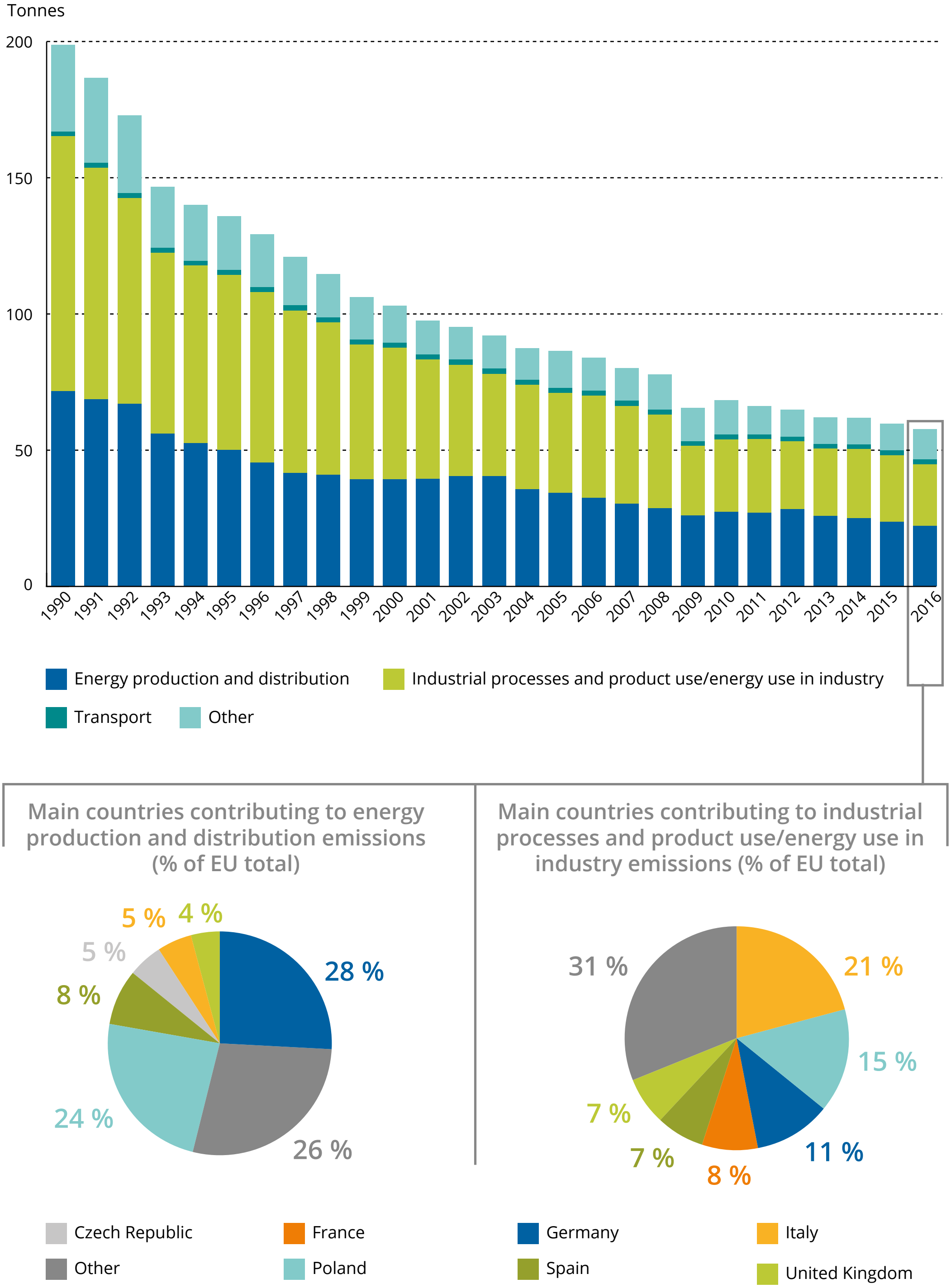
- **Mercury use in small-scale gold mining.** It is already very difficult to estimate current emissions from small-scale gold mining and even more difficult to predict future releases. However, at present there are no indications of a widespread move away from using mercury, and the emissions from this activity are projected to increase (Rafaj et al., 2013) unless more concrete actions are taken in the relevant countries to restrict or ban the use of mercury.
- **Industrial emissions.** Increased economic growth also brings about increased industrial activity such as cement production, chemical manufacturing and vinyl chloride manufacturing. Some assessments indicate that mercury emissions from regions such as Asia will increase (Rafaj et al., 2013). However, more recent evidence shows that countries such as China are implementing measures to reduce the mercury used in activities such as vinyl chloride production (UN Environment, 2017a).

Current European mercury emissions to air

In 2010, European emissions to the atmosphere accounted for about 4.5 % of global releases, with two main sectors dominating, namely electricity generation and industrial activities (e.g. iron and steel production, non-ferrous metal production, cement/minerals and the chemical industry).

Because of ongoing efforts to reduce mercury in certain activities (e.g. industrial chemicals), coupled with more stringent limits on industrial emissions, European mercury emissions to air have decreased consistently over the last 30 years and in 2016 they were 71 % lower than in 1990. Emissions now are mainly from unintentional releases such as fuel combustion and processing of metals.

Trend in EU mercury emissions to air, 1990-2016



Source: EEA, 2018c.

The outlook for European mercury emissions to air

In the coming years, European mercury emissions will decline further due to stricter legislation such as the Industrial Emissions Directive (IED; 2010/75/EU). The IED requires industries to take action to reduce emissions of a range of pollutants, including mercury. Technical requirements to minimise emissions are now set for all large industrial sources, such as cement manufacturing and metal production, and will result in lower mercury emissions from these activities over the coming years.

Power generation using solid fuels will be the main source of mercury emissions to air in Europe for the foreseeable future. However, a number of factors will lead to a reduction over both the short and the medium term:

- As a result of the IED, within the next 3 years large power plants will be required to meet strict emission limits, which will result in a reduction between now and 2021. These plants may have to install additional equipment to remove mercury in combustion gases so that it is not released into the atmosphere. Estimates are that by 2021 mercury emissions from power generation will reduce to below 9 tonnes per annum, compared with 15.5 tonnes in 2013 (Ricardo Energy and Environment, 2017). Emissions in 2021 could be as low as 2.5 tonnes if all EU Member States apply the most ambitious limits (Ricardo Energy and Environment, 2017).
- Over the next 30 years a reduction in mercury emissions is forecast from solid fuel combustion in Europe due to reducing the use of coal for generating power. This is because these fuels are a key contributor to greenhouse gas emissions; however, this reduction will also lower mercury emissions. Current estimates indicate that, by 2050, the use of solid fuels in power generation will have declined by about 70 % compared with 2015 (European Commission, 2016), thereby significantly reducing mercury emissions to the atmosphere.

Mercury in water — Current European and global status

Research on direct mercury releases to water is not as developed as research on emissions to the atmosphere. There are, therefore, limited data available on emissions to water (AMAP and UNEP, 2013).

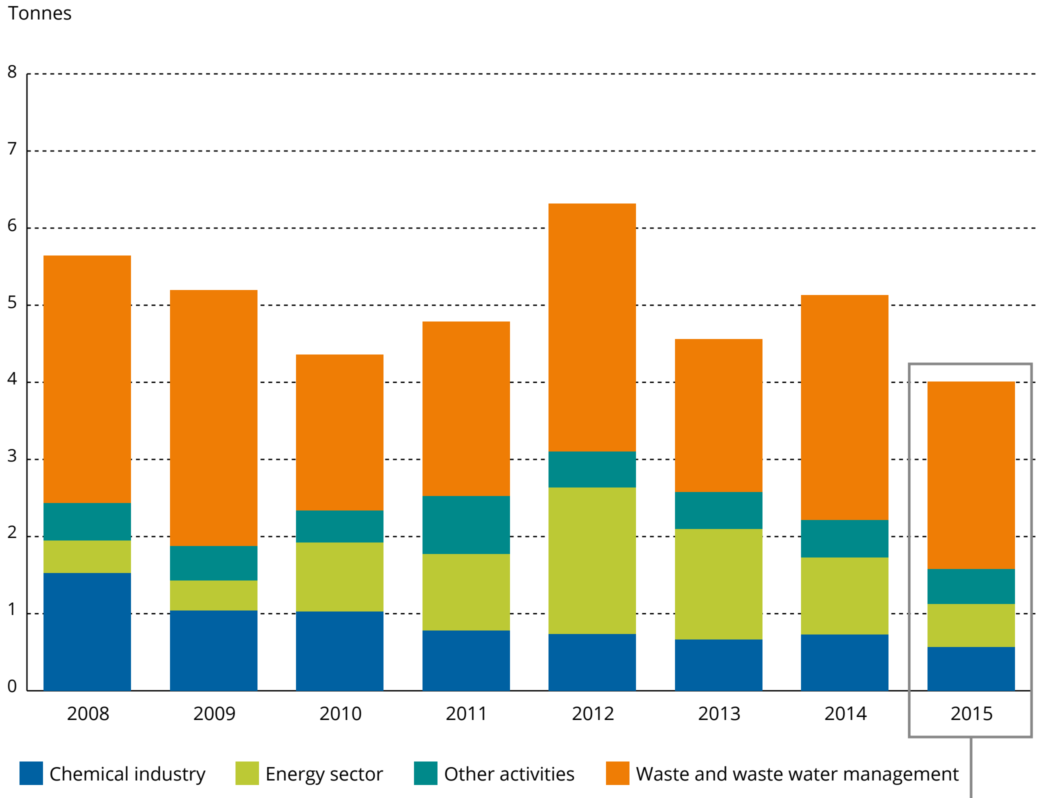
A first attempt to estimate global mercury emissions to freshwaters was completed in the Global Mercury Assessment 2013 (AMAP and UNEP, 2013). Because of a lack of data, the assessment was able to provide estimates for only a limited number of activities, concluding that emissions were around 185 tonnes, but with a possible range of anywhere between 42 and 582 tonnes.

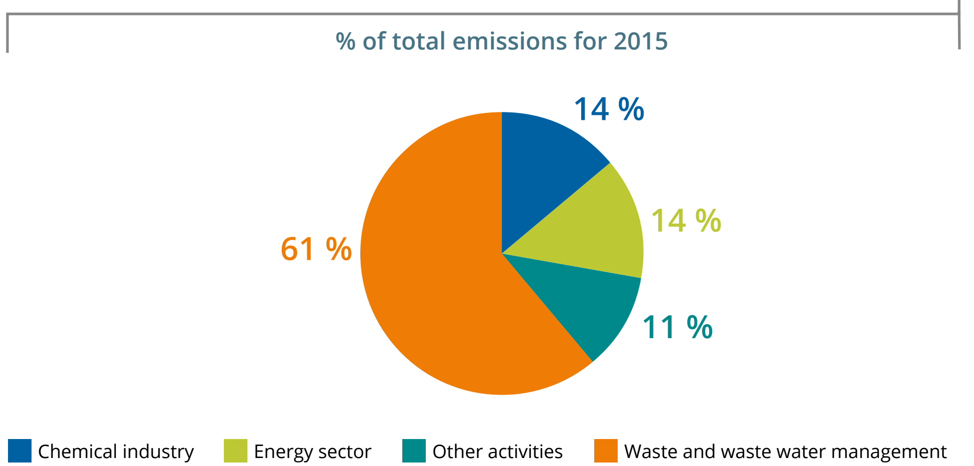
A refined estimate of anthropogenic emissions to water will be included in the next AMAP and UNEP Global Mercury Assessment report, due to be published in late 2018. This will include a more detailed provisional assessment of water emissions for 2015 and an assessment of more sectors, including releases from municipal waste water treatment, coal-fired power plants and coal washing. Excluding small-scale gold mining, the 2015 provisional global estimate has increased to nearly 600 tonnes. The main contributory activities were waste management, municipal waste water discharges, non-ferrous metal production and coal-fired power plants. Compared with 2013, this increase is related to a more refined and comprehensive data analysis rather than to an actual increase in emissions, and hence the 2013 and 2015 figures cannot be compared directly. The uncertainty about releases from small-scale gold mining is high, but the provisional 2015 estimate for this is approximately 1 200 tonnes released to water and land.

Releases to water in Europe are lower than in other regions, primarily because some of the sources of global emissions are not as relevant or significant, including mercury mining, the chlor-alkali industry and small-scale gold mining. Initial estimates for mercury releases to water from direct emissions in Europe amounted to around 8 tonnes (AMAP and UNEP, 2008). This corresponds reasonably well to data from the European Pollutant Release and Transfer Register (E-PRTR).

The E-PRTR contains data on emissions to water from individual large industrial facilities in Europe. These facilities are required to report data on pollutant emissions annually. These data indicate that urban waste water treatment plants are the dominant source of mercury emissions to water. However, the original source is not the treatment plant itself, as the mercury is already in the waste water. Instead, the source is likely to be industrial and commercial activities (e.g. dentistry). Other sectors contributing significantly to emissions to water include chemical manufacturing and power generation.

E-PRTR data on emissions to water from large industrial activities





Mercury in water — The European and global outlooks

Data are very limited on future mercury emissions to water. However, based on the sectors responsible (e.g. small-scale mining, waste water treatment plants, industry and power generation, as well as general atmospheric deposition related to air emissions), a similar global outlook for emissions to water can be inferred as is the case for emissions to air. This suggests that reductions in Europe and North America will be offset by increases in Africa, Asia and South America from small-scale gold mining, increased energy demand and increased industrialisation. However, further research is required in this area to provide greater certainty.

According to E-PRTR data, total emissions to water in Europe are already relatively low. Evidence shows that industrial emissions are decreasing and it is expected that regulatory improvements brought about by the IED and other legislation will drive these down further. For example, dentists are now obliged to install equipment that minimises the mercury released in waste water. If fully implemented, this will prevent the release of several tonnes per year across Europe (Bio Intelligence Service, 2012). Other potential sources of emissions to water include mercury-contaminated land associated with industrial activities, which can have a direct impact on water bodies (Science for Environment Policy, 2017). There are estimated to be at least 340 000 contaminated industrial sites across Europe and, although these are contaminated by a range of pollutants, the evidence gathered to date suggests that heavy metals (including mercury) are a pollutant of concern at a significant proportion (Joint Research Centre, 2014).

Global emissions will also continue to have a negative impact on mercury levels in European waters. For example, more than one quarter of the mercury deposited into the Mediterranean and Black Seas every year originates in Asia (AMAP and UNEP, 2015). Mercury emissions in Asia also have a negative impact on mercury levels in the north Pacific Ocean, with measurements suggesting that levels are increasing over time (AMAP and UNEP, 2013). In fact, levels in the North Pacific are projected to increase by 50 % by 2050 (Sunderland and Selin, 2013). On the other hand, evidence shows that mercury levels in the North Atlantic are slowly decreasing because of reduced emissions in Europe and North America (AMAP and UNEP, 2015). Data from the OSPAR Commission (OSPAR, 2018) also indicate a general downward trend (albeit with some 'hot spots') in mercury levels in marine species in the North-East Atlantic.

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What is being done in Europe and globally?

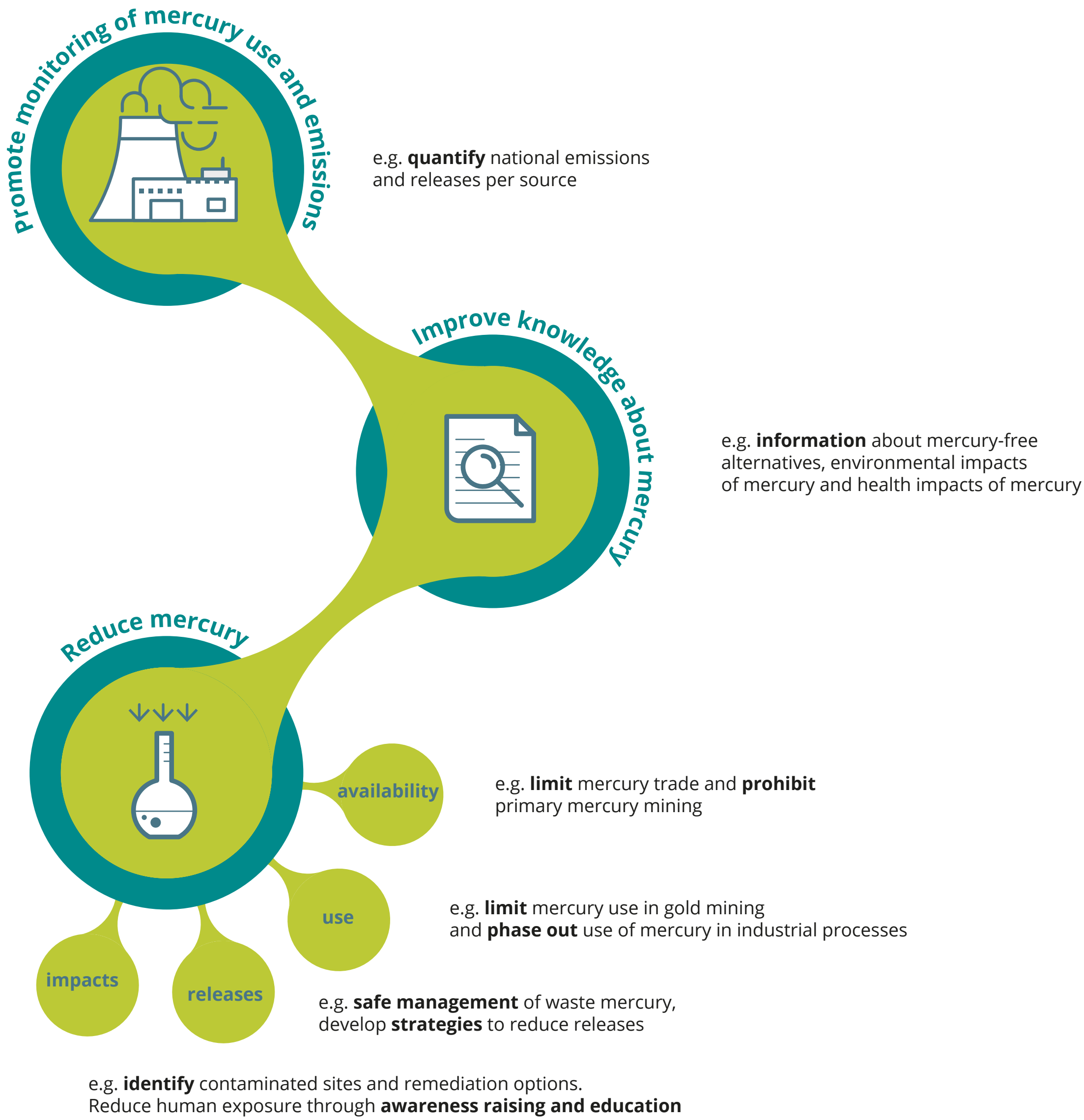
Global action is required to address mercury risks. The Minamata Convention on Mercury has been agreed as a global solution to this problem. Europe has already made significant progress in limiting mercury emissions over recent decades and is focusing on actions that go beyond the Convention's requirements. On an individual level, people can take action to minimise their own exposure to mercury.

Global actions — The Minamata Convention on Mercury

The problem of mercury pollution has been recognised internationally for many decades. In 1998, 33 European and North American countries signed the 1998 Aarhus Protocol on Heavy Metals (UNECE, 1998), which was introduced as part of the Convention on Long-Range Transboundary Air Pollution (CLRTAP). This included requirements to reduce mercury use in products and also to reduce mercury, cadmium and lead emissions to the air from industry, combustion and waste incineration. The Aarhus Protocol came into force in 2001 and, in response, the EU implemented several policies aimed at reducing mercury emissions.

Later, in 2002, the United Nations (UN) commissioned a study to investigate the global impacts of mercury on the environment and on human health (UNEP, 2002). It concluded that mercury posed a significant environmental risk and that further international action was needed. In October 2013, the international agreement, now known as the Minamata Convention (UNEP, 2017), was adopted, and has since been ratified by 98 parties. The widespread adoption of the Convention is a significant step in the global fight against mercury pollution, as it is the first international commitment on this topic that is supported by a significant portion of the international community. The Convention is legally binding, meaning that parties can hold each other accountable for compliance, including through the International Court of Justice. The Convention's objective is to 'protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds', which it does through a number of key focus areas.

Objective and focus areas of the Minamata Convention on Mercury



 Source: UNEP, 2017.

Why is it called the Minamata Convention?

One of the main historical examples of the health impacts of mercury occurred in Minamata, Japan. A factory producing acetic acid released several hundred tonnes of mercury-contaminated effluent into Minamata Bay over many years. The bay was an important local source of food.

In the early 1950s, animals started to behave strangely and in 1956 people started to show symptoms of an unknown neurological disease, which would later be called Minamata disease and which had severe and detrimental impacts on animals and humans, particularly on the central nervous system (UN Environment, 2017b). It was eventually realised that mercury coming from the factory was to blame. Thousands of people suffering from the debilitating effects of Minamata disease still survive today (Kessler, 2013) and hundreds of lives have been lost as a result of this industrial disaster (UN Environment, 2017b).

EU actions

Europe has always been a significant user and emitter of mercury, particularly since its industrialisation in the mid-19th century. However, more recently it has been a frontrunner in implementing legislation to control mercury's environmental and health impacts. Europe has also been instrumental in ensuring that the international community adopts the Minamata Convention. The first mercury policies were adopted almost four decades ago: the first set of regulations have been effective since 1979 and additional measures were implemented in 1998. The initial measures prohibited the use of mercury-containing compounds as pesticides (EU, 1978). However, exporting those compounds to countries outside Europe remained legal for more than 20 years, until they were banned in 2003 (EU, 2003). An export ban on cosmetic soaps containing mercury was also introduced at that time. In 2008, a specific regulation on mercury was adopted that further restricted its export. In addition, industrial emissions are addressed through the regulatory process introduced by the IED (EU, 2010) and its predecessors.

In Europe, the Minamata Convention's requirements were largely addressed by existing legislation. However, further measures were introduced in 2017 to strengthen the EU's mercury laws, going above and beyond the Convention (EU, 2017). These included banning all new uses of mercury, setting deadlines for ceasing all industrial uses of mercury and imposing rigorous waste management provisions.

Actions the EU has taken to minimise mercury in the European environment include:

- banning numerous products containing mercury, such as thermometers, batteries, switches and blood pressure monitors;
- requiring the management and remediation of mercury-contaminated sites;

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- capping the mercury content of light bulbs/lamps;
- requiring dentists to install high-efficiency filters to prevent mercury releases;
- limiting the use of mercury-based fillings in dentistry and assessing the feasibility of an outright future ban;
- banning all industrial processes using mercury and placing emission limits on other environmental emissions (e.g. from coal burning at power generation sites).

Local actions — What can I do?

National authorities have a responsibility to raise awareness of the risks posed by mercury and to highlight the actions that citizens can take to minimise release and exposure. This will allow people to make informed decisions. There are many individual actions that can be taken to contribute to the ongoing global and European activities to reduce mercury pollution, based around the following two areas:

- **Managing personal exposure.** To be affected by mercury, people first need to be exposed to it and to absorb it into their bodies. People can take certain measures to manage their level of exposure, for example through following advice about eating fish that may contain high levels of mercury.
- **Prevent releases to the environment.** People can help to prevent the release of mercury, thereby reducing the impact on the environment and on others. For example, people should carefully dispose of waste that may

contain mercury, such as batteries or light bulbs, so as not to add to the levels in the environment (e.g. by ending up in a landfill site or another inappropriate disposal location). Care also needs to be taken when handling mercury-containing products, such as thermometers, fluorescent lamps or other light bulbs, to prevent accidental release. Choices in home heating (e.g. not using coal or wood) can also help to reduce emissions.

Diet is the primary way in which people in Europe are exposed to mercury. EU Member State food safety agencies provide a range of advice on how people can maximise the nutritional benefits of eating fish, while also minimising the risks from mercury in seafood. The European Food Safety Authority (EFSA) advises limiting the consumption of fish species with a high mercury content and also that countries carry out their own national reviews of fish consumption patterns. Each country can then provide specific and relevant advice (EFSA, 2015).


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Examples of food safety advice on fish consumption from EU Member States

United Kingdom

Children under 16 years old should avoid eating shark, swordfish or marlin.

Pregnant women and women who are trying to get pregnant should not eat more than four tins of tuna per week. They are also advised not to eat swordfish, shark or marlin. Other adults are advised to eat no more than one portion per week.

Spain

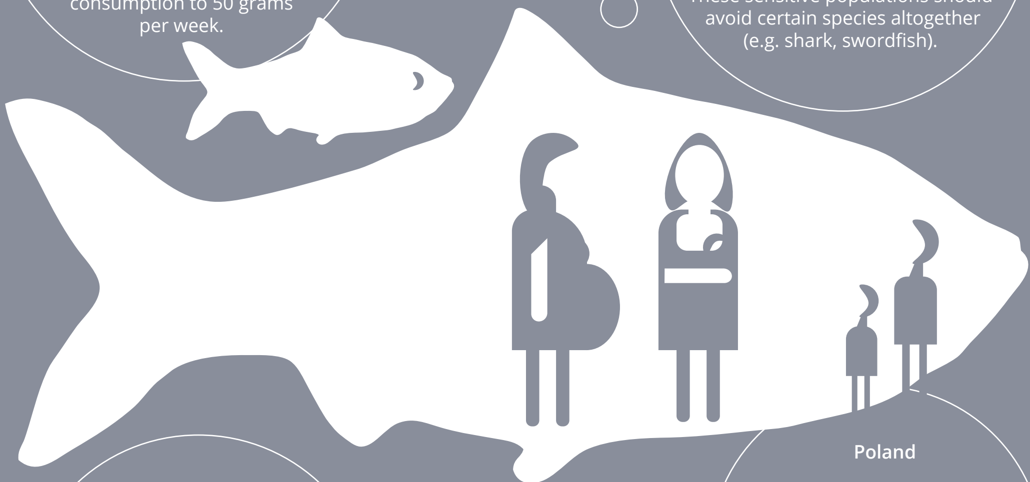
Pregnant and breastfeeding women, and women who may become pregnant, should avoid consuming certain predatory fish species.

Very young children should avoid certain fish species while older children should limit their consumption to 50 grams per week.

France

Pregnant women, breastfeeding women and young children (under 30 months) should limit their consumption of certain species to 150 grams per week for women and 60 grams per week for children.

These sensitive populations should avoid certain species altogether (e.g. shark, swordfish).



Poland

Pregnant women and young children should avoid eating Panga fish. It is also recommended that pregnant women and young children do not eat swordfish, shark, tuna and tilapia.

Ireland

Pregnant and breastfeeding women, women who are trying to become pregnant and young children should not eat swordfish, shark or marlin and they should limit their consumption to one fresh steak or two mediums cans of tuna per week.

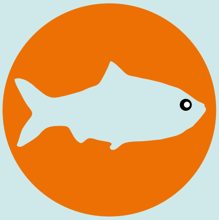
Netherlands

Women who are pregnant, breastfeeding or trying to become pregnant should not eat predatory fish such as swordfish, pike, zander, shark, eel and tuna. This applies to fresh and canned fish.

Everyone should limit their consumption of swordfish and shark.

Sources: Spain — AECOSAN, 2011; United Kingdom — NHS, 2015; France — Anses, 2016; Ireland — FSAI, 2017; Netherlands — NVWA, 2016, Voedingscentrum, 2018; Poland — Serwis Zdrowie, 2018.

Examples of individual actions to minimise exposure to and release of mercury

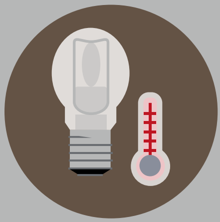


Be aware of dietary advice on fish consumption and know which fish may have higher mercury levels. This is especially relevant for children and pregnant women.

When fishing, particularly in freshwater areas, be aware of any local guidance or limitations on consumption of fish due to mercury contamination.

Handle light bulbs and fluorescent lamps carefully to prevent breakages and possible mercury exposure.

Dispose of old thermometers, light bulbs, fluorescent lamps, electrical equipment or other mercury containing equipment or products appropriately so that the mercury is safely recovered.



Where cleaner alternatives are available, avoid use of potential mercury containing fuels for home heating, such as coal. Burning wood also results in mercury emissions.

Do not engage in practices which could result in mercury emissions to the environment, for example the burning of land areas to clear it for agricultural purposes.

Ask your dentist about the options for fillings, and consider the use of non-mercury based dental fillings where available.

Climate change is likely to have a negative impact on mercury levels in the environment.

Support relevant actions which seek to minimise climate change effects.

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Mercury in Europe's environment

The use of mercury by humans over thousands of years, and particularly in the last 500 years, has led to a significant increase in the quantity of mercury in the environment. This presents a significant risk to both the global environment and human health. Actions are being taken at European and global levels to reduce mercury use, prevent emissions, and protect citizens and ecosystems from the impacts of mercury already in the environment.

This report provides a non-technical overview of the environmental and human health risks presented by mercury, its main uses and sources and the measures that are being taken to protect global and European citizens from the effects of mercury pollution.

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