

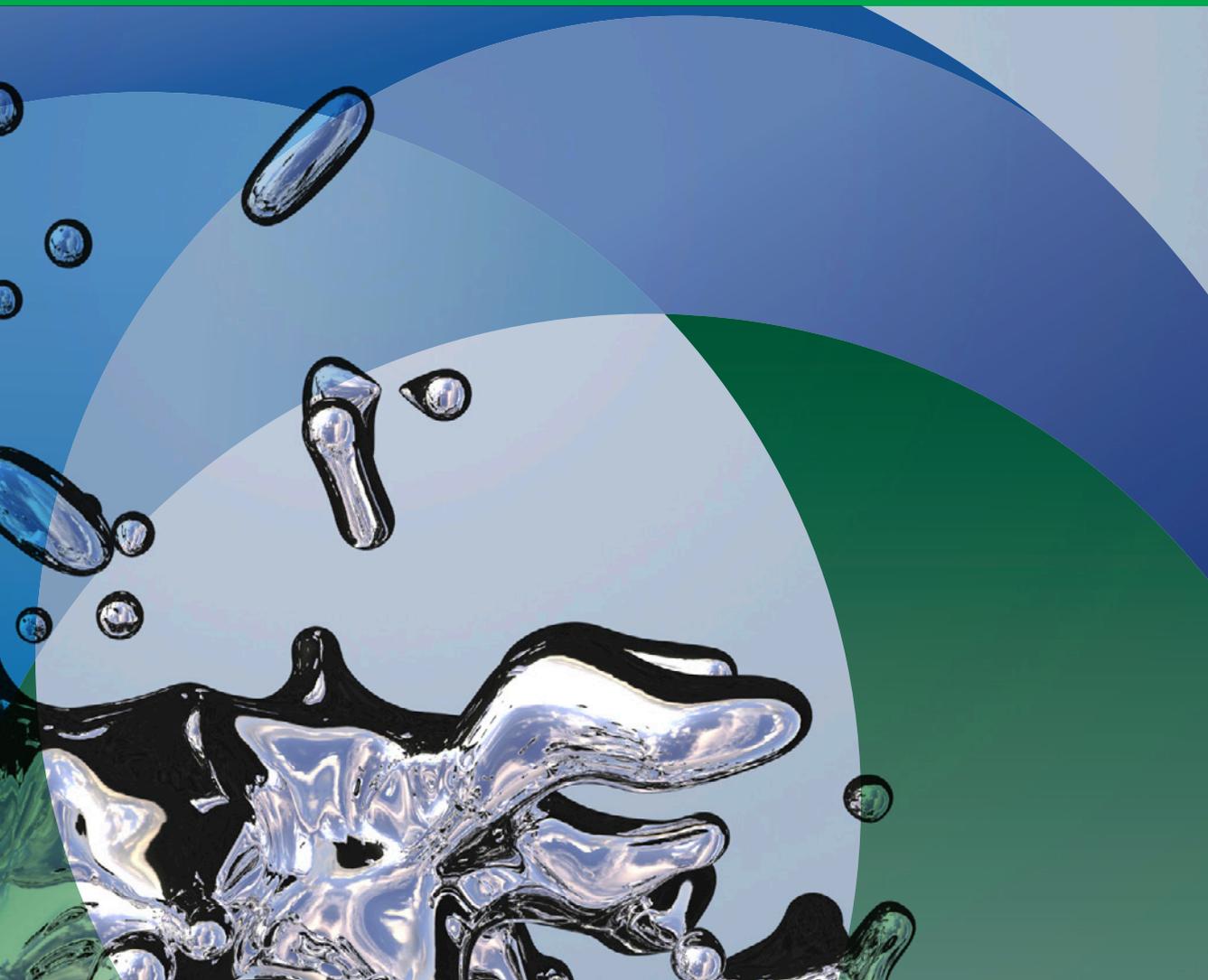


CLIMATE AND
POLLUTION
AGENCY

THE MERCURY PROBLEM

Reducing and eliminating mercury pollution in Norway

2674
2010



THE MERCURY PROBLEM

Mercury pollution is a serious threat to human health and the environment. In humans, mercury intake and contact with various mercury compounds may cause permanent brain damage or raise heart rate and blood pressure, resulting in cardiovascular disease. Inorganic mercury can cause kidney damage. Exposure to mercury can also lead to contact allergy or cause acute poisoning. The most serious effect is damage to the central nervous system, especially in fetuses and young children.

Mercury persists in the environment, accumulates in food chains, and is transported over long distances with ocean currents and in the atmosphere. Pollution spreads to areas far from emission sources, especially to the highly vulnerable Arctic environment.

In some Norwegian fjords, the concentration of methyl mercury in marine organisms is very high and it may be harmful to eat fish (e.g. cod) or shellfish from these areas. The Norwegian Food Safety Authority advises against the consumption of seafood from these fjords.

Nationwide advisories on the consumption of fresh-water fish have been introduced because of their mercury content. These apply to pike, perch larger than 25 cm, and large trout and char (weight above 1 kg). Pregnant women and breastfeeding mothers should avoid eating such fish, while children and women of childbearing age should not eat them more than once a month.

People who live or work near pollution sources are most at risk of exposure to high levels of mercury. The risk of serious damage to people and the environment is particularly high in many developing countries, where controls on mercury use and releases are lacking or inadequate.

A HIGH PRIORITY ISSUE

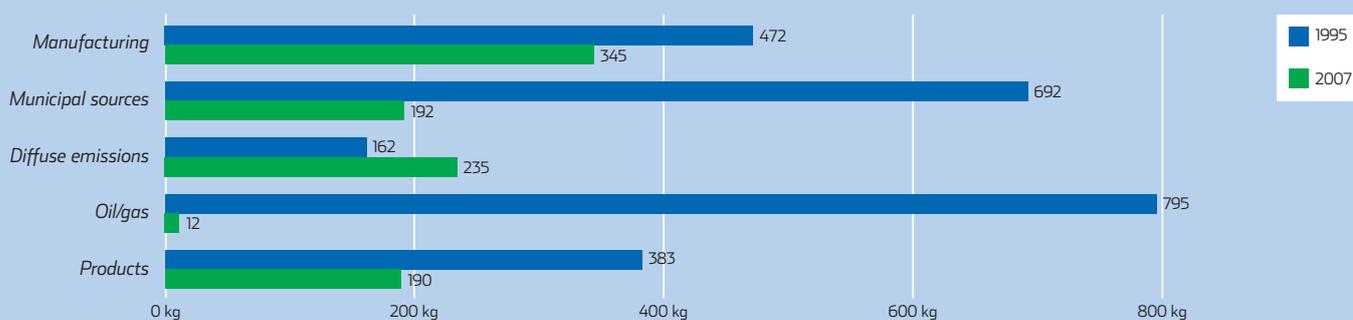
Mercury has high priority in Norway's efforts to minimise harm caused by hazardous substances. The national target is for releases and use of mercury and other substances that pose a serious threat to health or the environment to be continuously reduced with a view to eliminating them by 2020.

NORWEGIAN EMISSIONS

Total Norwegian releases to air, soil and water were estimated at almost 6 tonnes in 1985, 2.5 tonnes in 1995 and about 1 tonne in 2007. Emissions to air in 2007 totalled about 0.7 tonnes, considerably less than the atmospheric transport of mercury to Norway from other countries.

These substantial reductions are mainly explained by large cuts in releases from the oil and gas industry and the metallurgical industry, a steep reduction in discharges of dental amalgam, and considerable improvements in collection schemes for waste containing mercury.

Figure 1. Reductions in mercury emissions to air from 1995 to 2007. Kilograms



Municipal sources include waste incineration, household sewage, crematoria, etc.
Diffuse emissions from households, mobile sources, etc.
Products means articles and preparations

REDUCING MERCURY EMISSIONS FROM NORWEGIAN INDUSTRY

Norway has focused mainly on reducing mercury releases from manufacturing industries and the offshore oil and gas industry, which used to be the largest Norwegian sources. A discharge permit issued by the environmental authorities is required for any activity that may cause pollution, and Norway uses such permits as its main instrument for reducing industrial releases. Conditions in permits are set on the basis of best available techniques (BAT). The introduction of modern abatement technology means that mercury releases from Norwegian industry are well under control.

The Norwegian chlor-alkali industry phased out mercury-based technology in the period 1987–97. Waste mercury from the industry is stored in a sealed concrete bunker

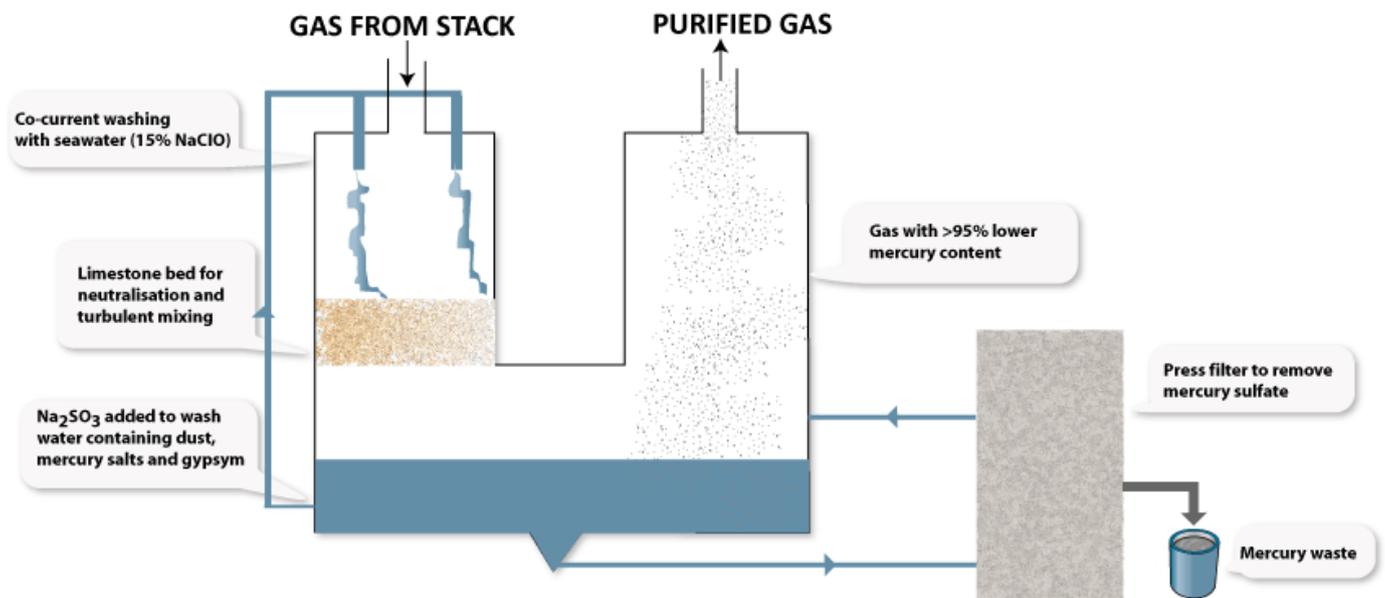
on-site, which meets standards for long-term environmentally sound management of such waste. The bunker consists of several chambers with membranes between them to prevent leaks.

Stricter requirements were introduced for secondary steel manufacturing in 2008, after the environmental authorities determined that mercury emissions from the industry were too high. Activated carbon scrubbers are now used to remove up to 85% of the mercury from the waste gas.



Strict control of Norwegian industry.

Figure 2. The abatement process in manganese production



Norwegian manganese smelters use ore with a high mercury content and have therefore had to install modern abatement technology. More than 95% of the mercury is now removed from the waste gases using activated carbon scrubbers followed by washing with seawater.

The oil and gas industry has never used mercury in production or other activities, but natural gas, produced water and the weighting materials used in drilling fluids all contain mercury naturally. Norway has a zero-discharge target for releases of environmentally hazardous substances from this industry. The oil and gas industry reduced mercury releases by 99% in the period 1995–2007.

All vinyl chloride (VCM) production in Norway is based on ethylene; the mercury catalyst process has never been used.

STRICT CONTROL OF NORWEGIAN INDUSTRY

Industrial enterprises are required to monitor releases of pollutants and submit annual reports to the Climate and Pollution Agency. The inspection and enforcement regime includes regular inspections of manufacturing industries and the oil and gas industry, and controls of products from various branches of industry. Norwegian companies have made good progress in introducing better abatement techniques, but must continue to evaluate ways of reducing mercury releases even further.

The inspection and enforcement regime is risk-based, meaning that resources are primarily concentrated on firms where there is the highest risk of serious consequences in the event of non-compliance with the legislation.

When stricter regulation is introduced, the rules may be broken more often, whether deliberately or because they are misinterpreted. A good inspection and enforcement system is therefore particularly important in branches of industry and firms where new regulatory measures or stricter measures have recently been introduced.

REDUCING MERCURY EMISSIONS FROM PRODUCTS

Mercury has a number of useful properties that have led to its use in many types of products, and also to releases to the environment during manufacture, during the use of products, and from waste products.

GENERAL BAN IN NORWAY

In 2008, Norway introduced a general ban on the use of mercury in new products, with only a few time-limited exceptions. These rules are set out in the Product Regulations (see the Climate and Pollution Agency's website, www.klif.no.) Mercury and mercury compounds are mainly dealt with in section 2-6. The ban applies to the production, import, export and placing on the market of products containing mercury. The decision to introduce the ban was based on an overall evaluation of risks to people and the environment, and assessments of the availability of alternative products that do not contain mercury. The ban also applies to any new areas of use for mercury that may arise in the future.

Some examples of how Norway has regulated important product groups:

MEASURING EQUIPMENT

Mercury has been in use for many years in thermometers, instruments for measuring blood pressure, barometers and other measuring equipment. All these uses are now prohibited. Norway banned new mercury thermometers for private use as early as 1998, and for professional use from 2000. A nationwide campaign to collect discarded mercury thermometers was very successful, and most of the thermometers in private households were collected. Norwegian hospitals phased out the use of blood pressure instruments containing mercury voluntarily before 2008. According to the health authorities, this has not had negative effects, and they cannot see any need to use mercury-containing instruments even for calibration.



Handheld X-ray fluorescence (XRF) analyser for rapid measurements of about 30 elements. XRF can be used to measure the content of heavy metals in alloys, plastics, wood, stone, soil and painted surfaces, and is increasingly being used in controls of ordinary consumer products such as toys and electronic goods.

ELECTRICAL AND ELECTRONIC EQUIPMENT

Norway, like the EU, prohibited the use of mercury in new electrical and electronic equipment from 2006. There are exceptions for fluorescent tubes and energy-saving light bulbs, which must comply with rules on maximum mercury content. Used tubes and bulbs are classified as hazardous waste and must not be treated as ordinary household waste. The proportion of waste mercury-containing light sources that is collected and delivered to collection sites is rising, and is now about 50%. Information campaigns and other efforts are being implemented to improve this further.

VEHICLE COMPONENTS CONTAINING MERCURY

Components containing mercury have previously been widely used in motor vehicles. Norway prohibited the import of vehicles containing such components in 2003, and scrapyards are required to remove components containing mercury from end-of-life vehicles before further dismantling.

BATTERIES

There are easily available alternatives to most types of batteries that contain mercury. Norway has banned mercury in all batteries except button cells.

DENTAL AMALGAM

Dental amalgam used to be the largest area of use for mercury in products in Norway. The Norwegian health authorities have been urging dentists to use alternative products since 1991. Consumption of dental amalgam was reduced by about 95% in the period 1990–2007, and has been eliminated with the general ban on mercury in products from 2008, although mercury will continue to be released from old fillings.

Since 1994, Norway has required all dental clinics to have amalgam separators installed. This is important in preventing the release of mercury to municipal waste water. Older separators must be type-approved, while a minimum efficiency of 95% is required for those installed after 2006. In all, releases of mercury from dental amalgam to air and water have been reduced by about 54% in the period 1995–2007.



Collection of discarded electrical and electronic equipment.

MERCURY IS HAZARDOUS WASTE

The best way of reducing mercury releases from waste is to ensure that waste containing mercury is sorted at source and is appropriately treated as hazardous waste. Norway has introduced a mandatory take-back scheme for waste electrical and electronic equipment, which is important in ensuring that waste containing mercury is collected through approved schemes and treated separately. The 2008 ban on mercury in products will gradually reduce the amount of mercury in waste.

Mercury is released by incineration and landfilling of waste containing mercury. Releases from landfills and incineration plants accounted for 27% of total mercury releases in Norway in 2003, dropping to 20% in 2007. From 1995 to 2007, the quantity of mercury released from these sources dropped by 72%.

In 2003, Norway tightened up its requirements for incineration plants for non-hazardous waste, which must

now meet the same mercury emission limits as hazardous waste incineration plants. These are in accordance with BAT for hazardous waste incineration. Landfills release mercury to the environment with leachate. Landfills that are in use must have systems for collection of leachate and monitoring of pollutants in leachate, including mercury. Closed landfills are classed as contaminated sites, see the next section.

Norway ceased to issue permits for exports of products containing mercury from 2008, and permits to export mercury waste for recovery from 2009. This will ensure that mercury waste generated in Norway is not re-used in processes and products in other countries.

Border controls have revealed illegal exports of discarded products on a number of occasions. These are often consignments of electrical and electronic equipment that are classified as hazardous waste.



Customs officers removing illegal goods from a lorry.

REDUCING MERCURY RELEASES FROM CONTAMINATED SITES AND SEDIMENTS

Many earlier industrial sites are contaminated with a variety of pollutants. In general, mercury is not the main problem, but it can be a significant problem. Measures have been planned or implemented to reduce pollution from about 95 sites in Norway. It is not yet clear how many of these are polluted by mercury. One solution that has been used is to channel leachate into large underground rock caverns and cast in concrete in large containers. Monitoring programmes have been established for leachate from contaminated sites, including closed landfills.

The sediments and biota in some coastal waters and fjords in Norway are contaminated with mercury as a

result of local pollution from industry, particularly smelting works, or inputs from rivers or other sources. In some areas, steps have been taken to reduce pollution from contaminated sediments. In one area, part of the seabed has been covered with a geotextile material capped with sand. In another, the authorities are now considering whether the most seriously contaminated sediments should be removed before capping with clean sand and gravel.



Dredging contaminated sediments.

MONITORING AND MEASURING ENVIRONMENTAL MERCURY

Mercury loads in marine organisms along the coast of Norway are monitored annually and trends in mercury levels in the biota are analysed. This provides a basis for evaluating whether to introduce advice to the public on fish and seafood consumption. Mercury inputs from rivers and direct inputs from industry to Norwegian coastal waters are also monitored. These programmes provide important information on mercury in the environment, and particularly about the mercury cycle (transport and physical state) and sources of mercury pollution.

Norway has two stations for monitoring long-range transport of mercury in air to Norway, one (Birkenes) in the south of the country and one in the Arctic archipelago of Svalbard. Measurements show stable mercury levels in air in the period 1990–2008, with no decline despite substantial national action to reduce mercury pollution.

The measurements also show that in spring, following the polar sunrise, atmospheric mercury in Svalbard is converted into more reactive forms that are deposited on land

and on the surface of the sea. These forms are much more readily bioavailable to plants and animals than elemental mercury. Thus, the bioavailability of mercury increases at the time of year when plant and animal growth starts.

In addition, Norway has a nationwide monitoring programme for pollutants in lake sediments, which includes mercury measurements at roughly 10-year intervals. Nationwide surveys of mercury and other heavy metals in mosses are carried out about every five years. Regular measurements of mercury concentrations in freshwater fish show that concentrations have risen by 20–60% in the past 20 years.

Studies in the Arctic (Svalbard) show that mercury concentrations are higher in animals near the top of food chains, such as glaucous gulls and fulmars, than in those further down food chains, such as zooplankton and polar cod. Mercury levels are alarmingly high in some animals in the Arctic.



Mussels are used as an indicator when giving advice on consumption.

NORWEGIAN POLICY AND POLICY INSTRUMENTS

Direct regulation (including discharge permits and regulations) is much the most widely used category of policy instrument in Norway's efforts to reduce and prevent mercury pollution, supplemented as appropriate by information/awareness raising activities, voluntary measures and economic instruments. Norway has a comprehensive national action plan for mercury, first published in 2005 and recently updated.

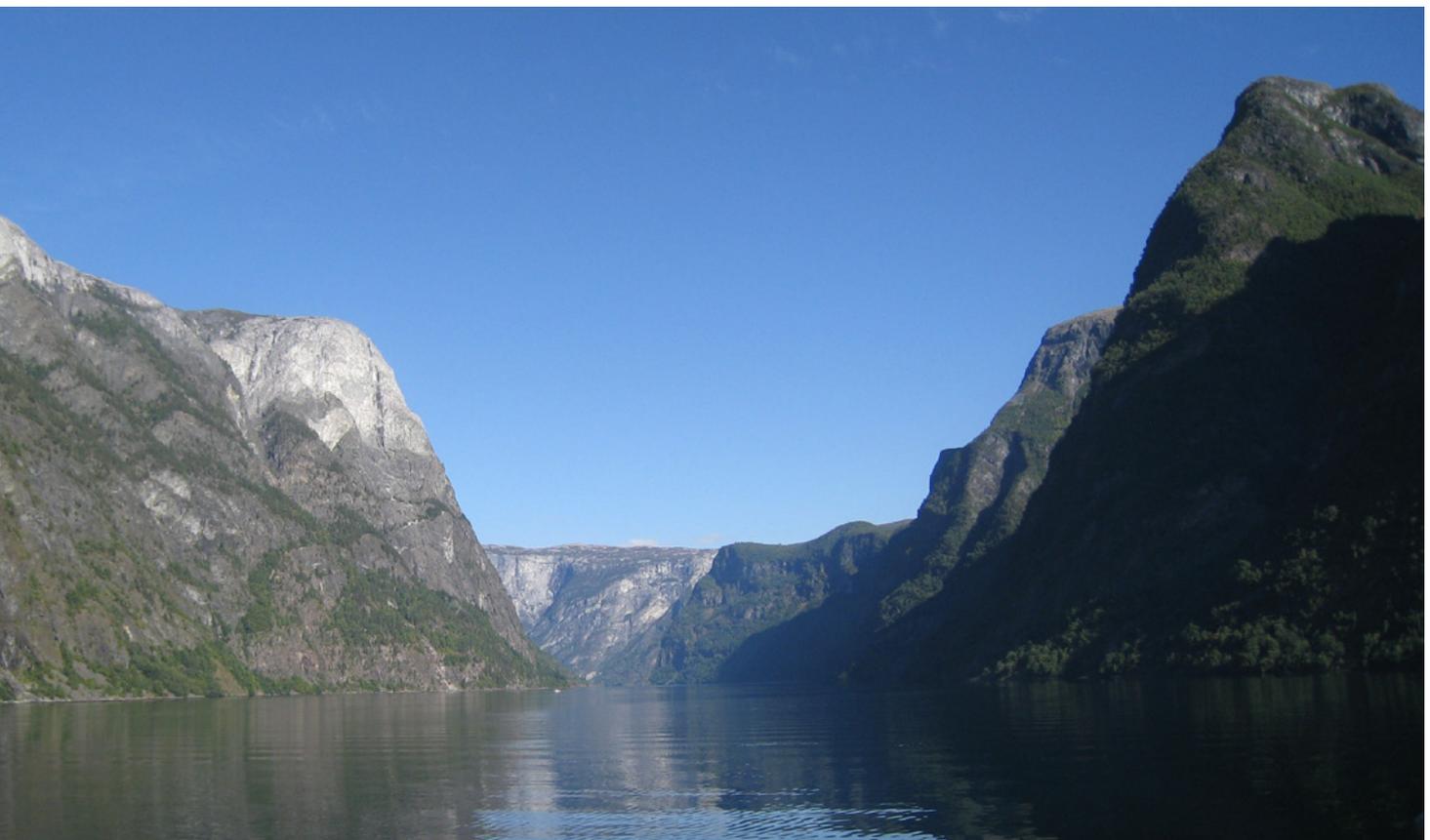
Two Norwegian acts provide the legal basis for regulations and discharge permits.

The Product Control Act (1976) is intended to prevent products and consumer services from causing damage to health and to ensure that products and services are safe. It is also intended to prevent products from causing environmental disturbance, for example ecosystem dis-

turbances, pollution, waste or noise. It applies to the production (including testing) import, marketing, use and other handling of products.

The Pollution Control Act (1983) is an enabling act, which authorises the pollution control authorities to adopt regulations and issue individual discharge permits. Its purpose is to prevent and reduce pollution, reduce the quantity of waste and promote better waste management.

Under the EEA Agreement, Norway largely shares EU legislation on chemicals.



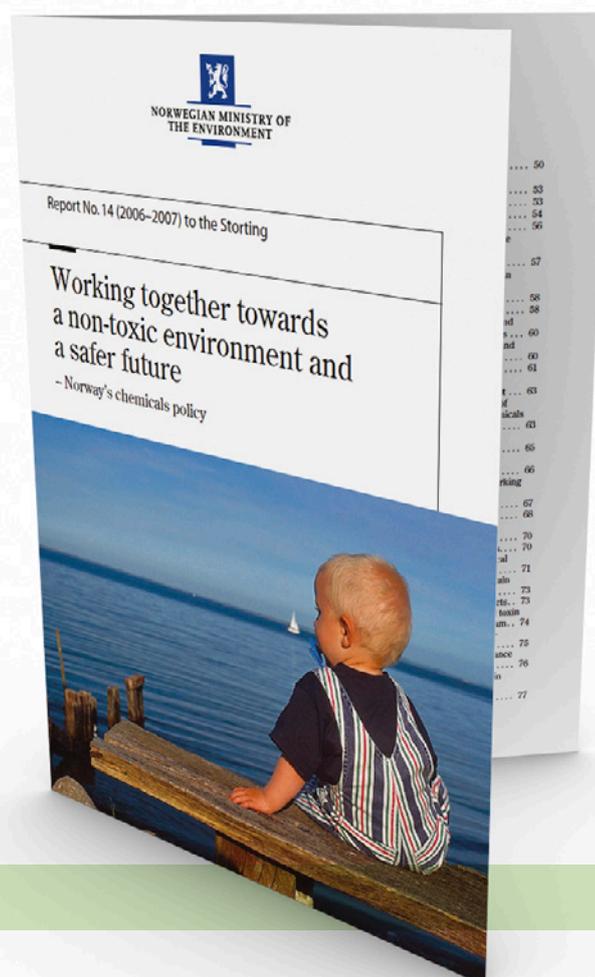
Nærøysfjorden in Norway is on the UNESCO World Heritage List.

WORKING TOGETHER TOWARDS A NON-TOXIC ENVIRONMENT AND A SAFER FUTURE

The white paper Working together towards a non-toxic environment and a safer future (Report No. 14 to the Storting (2006–2007)) sets out Norway's chemicals policy and the main principles for work with hazardous substances.

THE MOST IMPORTANT OF THESE ARE:

- the precautionary principle – if a threat related to hazardous substances is identified during efforts to achieve the goals of chemicals policy, steps must be taken to address this even in the absence of full scientific certainty;
- prevention is better than remediation – the Government intends to prevent releases of hazardous substances rather than remediating damage, to avoid costly clean-up operations in future;
- the substitution principle – users of hazardous substances are expected to replace these with alternatives that entail less risk, and as a general rule to discontinue use of the most dangerous substances if less hazardous alternatives are available;
- the polluter-pays principle – the costs of pollution, including clean-up costs, must be borne by those who are responsible for the pollution;
- right to information – the general public has a statutory right of access to environmental information held by public authorities and to participate in decision-making.



Towards a safer future.

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The Climate and Pollution Agency reports to the Ministry of the Environment and has 325 employees based mainly in Oslo. We implement government policy on pollution. We act as advisors, guardians and stewards for the environment. Our most important fields of work include climate change, chemicals, marine and freshwater environment, waste management, air quality and noise. Our vision is a future without pollution

WE ARE WORKING TO

- reduce greenhouse gas emissions
- reduce the spread of hazardous substances harmful to health and the environment
- achieve integrated and ecosystem-based management of the marine and freshwater environment
- increase waste recovery and reduce emissions from waste
- reduce the harmful effects of air pollution and noise