CLIMATE AND POLLUTION AGENCY

Norwegian action plan for reducing mercury releases - 2010

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Summary

This document is an updated version of Norway's action plan for reducing mercury releases, which was first presented by the Ministry of the Environment in 2005.

Mercury is a highly toxic and dangerous pollutant, and still represents a threat to the environment and human health both in Norway and globally. Mercury is transported over long distances with ocean currents and in the atmosphere. Mercury pollution thus reaches areas far from the sources of emissions, including the highly vulnerable Arctic environment.

Norway's national target is for releases and use of mercury to be continuously reduce with the goal of eliminating them by 2020.

This plan gives an account of the progress Norway has made in reducing mercury releases and identifies areas where further action is needed. It particularly highlights steps to address the global problems associated with continued use and releases of mercury.

Norway has already achieved substantial reductions in national mercury releases. Total Norwegian releases to air, soil and water were estimated at almost 6 tonnes in 1985 and 2.5 tonnes in 1995. Between 1995 and 2008, they were reduced by a further 64% to about 0.9 tonnes.

It is important to maintain strict controls on mercury releases from manufacturing industries with a view to reducing them further.

In 2008, Norway introduced a general ban on the use of mercury in products. This was an important step, and its full effect will become apparent over time, depending on the lifetime of different products.

Take-back schemes have been established for waste electrical and electronic equipment and end-of-life vehicles. These are intended to ensure environmentally sound management of these types of waste, including depollution and removal of components containing mercury. Repeated information and awareness campaigns are needed to ensure that households and firms sort their waste at source and deliver it to approved collection systems.

Treatment and storage of mercury and waste containing mercury poses challenges. International research and development is in progress to find long-term, environmentally sound treatment and storage options, particularly for metallic mercury.

Earlier industrial activities have contaminated both sites and sediments. Remediation measures have been planned or implemented at the remaining contaminated sites where the highest levels of pollution have been documented. Remediation of contaminated sediments in the 17 most heavily polluted fjords in Norway has been started. This will also reduce the spread of mercury from contaminated sites and sediments.

To ensure satisfactory compliance with existing and new regulatory measures, the environmental authorities will maintain a risk-based inspection and enforcement system. For many branches and activities, this means that the authorities will in the next few years be focusing on products, processes, activities and waste where mercury is present.

Monitoring provides important information on pollution status and trends in the quantities of mercury in the environment, and is an essential basis for evaluating whether further action is necessary.

Norway must focus on reductions of inputs of long-range transboundary pollution to Norway and the Arctic and work towards reductions in the use and releases of mercury in developing countries. This will among other things require active participation in global UN efforts to reduce releases of mercury.

It is important that the legally binding instrument on mercury to be negotiated during the period 2010–13 contains strict provisions on the use and releases of mercury. Norway also makes use of its opportunities for influence in regional forums such as the Convention on Long-Range Transboundary Air Pollution and within the framework of the EU/EEA, and seeks agreement on action to reduce mercury emissions.

We must make use of the experience and expertise we have built up in limiting Norway's releases of mercury in our international efforts. This applies particularly to the development of industry emission standards in other countries and the introduction of alternative products that do not contain mercury through the negotiations on a global instrument on mercury.

Contents

This document is an updated version of Norway's action plan for reducing mercury releases, which was first presented by the Ministry of the Environment in 2005.

1. Effects of mercury on health and the environment

Mercury is one of the most toxic and dangerous pollutants, and is a threat to the environment and human health both in Norway and globally. Dietary intake of and contact with various mercury compounds can cause permanent brain damage, particularly in the fetus. Mercury exposure can also increase heart rate and blood pressure, and thus cause cardiovascular disease. Inorganic mercury can cause kidney damage. Exposure to mercury can also lead to contact allergy and cause acute poisoning.

The health and environmental problems associated with mercury are mainly a result of bacterial conversion of inorganic mercury to the extremely toxic organic compound *methyl mercury*. This process takes place in aquatic systems, and explains why methyl mercury is found particularly in fish, where it is stored largely in the muscle tissue. In Norway, there are nationwide advisories on the consumption of certain species of fish because they contain high concentrations of methyl mercury. In marine waters, mercury concentrations are lower, except in some fjords where there are known to be local sources of mercury. Mercury concentrations in Norwegian drinking water sources are low.

Mercury is transported over long distances with ocean currents and in the atmosphere. Pollution thus spreads to areas far from emission sources, especially to the highly vulnerable Arctic environment. Mercury is not degradable, and accumulates in food chains. Mercury is as serious a global problem as the most dangerous persistent organic pollutants (POPs) such as PCBs, dioxins and brominated flame retardants. Despite the fact that many countries have taken steps to reduce mercury pollution, more action is still needed to reduce global pollution levels.

The most important sources of mercury releases globally are the combustion of coal in coal-fired power plants and various industrial processes. Other important sources are gold mining, mercury mining, chlor-alkali production using mercury-cell technology, metal production, cement production, cremation, and waste treatment. In addition, mercury is released from products such as light sources, dental amalgam, thermometers and electrical switches. Globally, mercury is released mainly to air, but some is also released to water and soil.

2. Goals and status in Norway

Mercury is on Norway's priority list of hazardous substances. The national target has been to reduce mercury releases substantially from the 1995 level by 2010. The target now is for releases and use of mercury to be continuously reduced with the goal of eliminating them by 2020.

The most important sources of mercury pollution in Norway are metal production and releases to air from road traffic, waste incineration plants and products. Norway has substantially reduced its own emissions, mainly through large cuts in releases from the oil and gas industry and the metallurgical industry, the recovery of dental amalgam from dental

surgeries in amalgam separators before discharge to municipal waste water, and considerable improvements in collection schemes for waste containing mercury.

The use of mercury in new products has been banned in Norway since 1 January 2008. The full effect of this will become apparent over time, as the quantity of products containing mercury in the waste stream declines.

Total Norwegian releases to air, soil and water were estimated at almost 6 tonnes in 1985, but have since been substantially reduced. In 1995, they totalled 2.5 tonnes, and were reduced by a further 64% between 1995 and 2008, to about 0.9 tonnes. Emissions to air in 2008 were about 0.7 tonnes, considerably less than the atmospheric transport of mercury to Norway from other countries.

Table 1: Mercury releases split by type of source in 1995 and 2008

Type of source	Releases 1995 (tonnes)	Releases 2008 (tonnes)	% of total releases 2008	% reduction 1995–2008
Industrial sources	0.5	0.3	32	40
Other sources (waste and waste water)	0.7	0.2	22	72
Diffuse sources	0.2	0.2	27	-47
Oil and gas industry	0.8	0.01	1	98
Products	0.4	0.2	19	57
SUM excl. contaminated soil	**2.5**	**0.9**	**Ca.100**	**64**
Contaminated soil		0.02		
Sum incl. contaminated soil		0.9		

Source: Prioriterte miljøgifter i 2008. Status og utslippsprognoser.(Priority substances 2008. Status and projected releases) TA 2738/2010. Climate and Pollution Agency.

For more details of Norwegian releases, see the table in the Appendix.

3. Efforts to reduce mercury releases in Norway

3.1 Manufacturing industries

Manufacturing industries accounted for about 32% of Norway's total mercury releases in 2008, and sources included the metallurgical industry and secondary steel manufacturing based on scrap containing traces of mercury. From 1995 to 2008, mercury emissions from manufacturing industries were reduced by about 40 %. The large cuts in emissions from this sector were largely made before 1995. Discharge permits issued under the Pollution Control Act are Norway's main instrument for reducing releases from manufacturing industries.

The chlor-alkali industry
Norwegian chlor-alkali manufacturers phased out mercury-based technology in 1987 (Hydro Herøya) and 1998 (Borregaard in Sarpsborg). Waste mercury from the industry has been stored in sealed concrete bunkers on-site, which are continuously monitored. All processing equipment was cleaned and metallic mercury was removed before storage as waste. Hydro

closed down its chlor-alkali production, while Borregaard switched to the membrane cell process, which does not use mercury.

VCM manufacture
The manufacture of VCM (vinyl chloride monomer) in Norway is based on oxychlorination of ethylene; the mercury catalyst process has never been used.

Cement manufacture
Two firms, Norcem Brevik and Norcem Kjøpsvik, manufacture cement in Norway. Their operations result in releases of mercury both from raw materials and from fuel.

Mercury releases from Norcem Brevik were relatively high at times after 1997. However, after the closure of one of the firm's kilns they have been considerably lower, between 10 and 15 kg per year from 2006 onwards. This is well within the limit values for concentrations and annual releases in the plant's discharge permit. Mercury releases from Norcem Kjøpsvik have been lower than those from Norcem Brevik.

Ferro-manganese production
In 1999, the Norwegian ferro-manganese plants in Sauda, Porsgrunn and Kvinesdal switched to a different ore, with a higher mercury content than the one they had previously used. This was partly because of a change of ownership and because the new owners wished to use ore from deposits that they own. When this appeared to be resulting in a rise in mercury releases, the Climate and Pollution Agency (formerly the Norwegian Pollution Control Authority) set strict limits for mercury releases for all Norwegian ferro-manganese producers. In 2003, ferro-manganese production was established in Mo i Rana, based on ore with a relatively low mercury content. When the mercury content of the ore used here rose, this firm also installed abatement technology.

The firms have installed abatement technology that removes more than 95% of the mercury from waste gases, either by using activated carbon or by using scrubbing systems. Releases of mercury from Norwegian ferro-manganese plants are now well below the limit values.

Steel manufacturing
Mercury releases from secondary steel manufacturing have been substantially reduced after the introduction of new requirements in 2008, which made it necessary to install abatement technology to remove mercury from waste gases. Activated carbon technology is now used, and can reduce mercury releases by up to 85%. The technology will also result in substantial reductions of releases of other heavy metals. Norway will propose the inclusion of the technology used by the Norwegian firm to remove mercury from waste gases in international agreements.

As regards manufacturing industries, the pollution control authorities will:

- continue to maintain strict controls on mercury releases and ensure that the industry develops plans to further reduce releases as much as possible;
- carry out targeted inspection and enforcement activities to ensure compliance with requirements;
- work towards strict requirements for abatement technology in similar industries in the EU and for the parties to the Convention on Long-Range Transboundary Air Pollution.

3.2 The oil and gas industry

The oil and gas industry has never used mercury as such, but mercury occurs naturally in the oil and gas extracted, in produced water and in the weighting materials used in drilling fluids.

The oil and gas industry reduced mercury releases by 98% in the period 1995–2008. In 2008, releases from the industry accounted for only 1% of Norway's total releases. The greatest reduction in releases was achieved in the period 1995–2001, through the injection of produced water back into wells and a reduction in the mercury content of some of the products used. In particular, the mercury content of drilling fluids was reduced (the weighting material used is often barite, which contain small quantities of the heavy metals lead, cadmium and mercury). Mercury releases from the oil and gas industry are now reported to be 12 kg per year.

The discharge permits issued to the oil companies under the Pollution Control Act require them to reduce releases of environmentally hazardous substances, including mercury, as far as possible. Norway has a zero-discharge target for releases of environmentally hazardous substances from this industry, to be achieved by 2005. An assessment of progress towards the target was made in 2008, and it was concluded that there is currently no need for further action to reduce mercury releases. Mercury releases are reported annually, and mercury is included in the monitoring programmes on the continental shelf.

Management of waste from platform decommissioning and any waste that may arise from the removal of mercury from the production stream is discussed in the chapter on waste management.

As regards the oil and gas industry, the pollution control authorities will:

- continue to monitor mercury releases and if necessary set strict limits on these releases;
- continue inspection and enforcement activities to ensure compliance with existing requirements;
- continue existing monitoring of the external environment.

3.3 Mercury in products

The quantity of mercury used in products in Norway was reduced from almost 1400 kg in 1995 to 170 kg in 2008. Releases from products have been reduced by more than 200 kg in the same period.

On 1 January 2008, Norway introduced a general ban, with few exceptions, on the production, import, export and placing on the market of mercury in new products, which is set out in the Product Regulations. The decision to do this was based on an overall evaluation of the risks to people and the environment posed by sources of mercury pollution in Norway. Although the use of mercury in new products is now banned in Norway, it will take time before all existing products containing mercury are replaced. It will therefore be some years before we see the full effect of the ban on mercury releases and mercury in waste. This makes it important to have good waste collection systems for product types that are still in use.

The most important product types that may contain mercury, and the action Norway has taken, are briefly discussed below.

Dental amalgam
Dental amalgam used to be the largest area of use for mercury in products. The Norwegian health authorities introduced guidelines to reduce the use of dental amalgam as early as 1991. New guidelines issued in 2003 required dentists to consider the use of alternative filling materials as their first choice. Consumption of dental amalgam was reduced by over 99% in the period 1990–2008. A total ban on the use of dental amalgam was introduced on 1 January 2011.

Measuring devices
Mercury has been in use for many years in thermometers, instruments for measuring blood pressure, thermostats, barometers and other measuring devices. Norway banned new mercury thermometers for private use as early as 1998, and for professional use from 2000. A nationwide campaign in 1998 to collect discarded mercury thermometers was very successful, and most of the thermometers in private households were collected. Other measuring devices containing mercury were banned in 2008. 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.

Batteries
There are easily available alternatives to most types of mercury batteries. Norway has banned mercury in all batteries except button cells, in accordance with EU/EEA legislation.

Electrical and electronic equipment
Since 2006, Norway's Product Regulations have banned the use of mercury in new electrical and electronic equipment, with certain exceptions, for example for fluorescent tubes and energy-saving light bulbs. The use of energy-saving light bulbs containing mercury will increase in the years ahead as traditional light bulbs that use more energy are phased out. There are rules on the maximum content of mercury in fluorescent tubes and energy-saving light bulbs, and these are being revised in the EU Restriction of Hazardous Substances (RoHS) Directive. The Norwegian legislation will be amended if any new requirements are introduced. Informing the public that light sources containing mercury are classified as hazardous waste and must not be thrown away with ordinary household waste is one important way of preventing such products from ending up in the environment. The proportion of mercury-containing light sources that is collected and delivered to approved facilities has been rising since 2006, and is now about 50%. Efforts to improve this are continuing.

Vehicle components containing mercury
Components containing mercury have previously been widely used in motor vehicles. Norway has prohibited the import of vehicles manufactured after 1 July 2003 that have components containing mercury. Scrapyards are required to remove components containing mercury from end-of-life vehicles before further dismantling.

Regulation of mercury in products in other countries
The general ban means that the use of mercury in products is more strictly regulated in Norway than in many other countries. However, on a global scale, the use of mercury in products makes a substantial contribution to mercury pollution, and the Norwegian authorities will work towards stricter restrictions internationally. Norway is also working towards stricter regulation of the use of mercury under REACH in the EU/EEA cooperation. Stricter

regulation of mercury use in products will reduce the need for mercury and the quantities used, and reduce the mercury content of waste. In this way, the global health and environmental impact of mercury can be reduced.

As regards products, the pollution control authorities will:

work towards stricter regulation of mercury in products in the EU/EEA and globally;
ensure that discarded products containing mercury are collected through approved waste collection schemes;
carry out inspection and enforcement activities to ensure compliance with requirements.

3.4 Releases of dental amalgam

Dental amalgam is an alloy consisting of mercury (approximately 50%) and other metals including silver, tin and copper. Existing amalgam fillings can result in discharges of mercury to municipal waste water and emissions to air from crematoria. Dental amalgam is the largest source of mercury pollution from products in Norway, and accounted for 14% of Norway's total mercury releases in 2003. Releases from amalgam were reduced by about 55% in the period 1995–2008.

The use of amalgam is now prohibited. The importance of amalgam as a source of mercury releases has been considerably reduced, and will continue to decline. Nevertheless, we must expect that some mercury will continue to be released from existing amalgam fillings for up to 30 years.

Amalgam separators and municipal waste water
Requirements to recover mercury from waste water have been introduced. Since 1994, Norway has required all dental clinics to have amalgam separators installed. Older separators must be type-approved, while a minimum efficiency of 95% is required for those installed after 2006.

These measures have reduced the mercury content of waste water and sewage sludge. About 40 kg of mercury was discharged with waste water in 2008. The presence of mercury in waste water also results in mercury residues in sewage sludge. The total quantity of mercury in sewage sludge dropped from 185 kg in 1995 to 50 kg in 2008.

Crematoria
Mercury emissions from crematoria have been regulated since 2007. The largest crematoria are required to have abatement technology to control emissions. No specific requirements apply to the smallest crematoria, but their mercury emissions are small. Mercury emissions from crematoria are expected to decline with the decline in the number of amalgam fillings.

3.5 Waste containing mercury

Waste from products that contain mercury
Mercury is released by incineration and landfilling of waste containing mercury. From 1995 to 2008, releases from incineration plants, crematoria and combustion of landfill gas have dropped by 33%.

The best way of reducing mercury releases from waste is to ensure that waste containing mercury is sorted at source and is treated as hazardous waste. The ban on mercury in new products will gradually reduce the amount of mercury in waste.

The principle of producer responsibility for waste electrical and electronic equipment and end-of-life vehicles plays an important part in ensuring that waste containing mercury is collected separately. Mercury switches (in telephones, freezers, cars, and so on) are collected through the established schemes. However, repeated information and awareness campaigns are needed to ensure that households and firms sort waste at source and deliver it to collection systems.

In 2003, requirements for incineration plants for non-hazardous waste were tightened up, and they must now meet the same mercury emission limits as hazardous waste incineration plants, in line with EU/EEA legislation. The requirements are in accordance with the best available techniques (BAT) for waste incineration. The three-year transitional period has expired, and all operational incineration plants must now meet the new requirements. As a result of Norway's recent prohibition against landfilling of biodegradable waste, more waste is being incinerated. Several modern incineration plants are therefore being constructed or expanded.

Waste containing mercury from manufacturing industries and the oil and gas industry
Mercury is a natural part of the Earth's crust, but in very low concentrations. When oil and gas, or other minerals, are extracted, they are contaminated by small quantities of mercury, which must be removed during production processes. This generates waste containing mercury and mercury releases. The quantities involved depend on the activity level in a particular industry, and cannot be reduced unless abatement technology is available that can be used without unreasonable inconvenience. It is important that firms are required to meet strict emission standards and requirements that ensure sound waste management, so that mercury releases are reduced.

Filters and other waste from mercury recovery during natural gas production and at refineries must be collected and delivered to approved hazardous waste facilities.

Scale and sludge that may contain small quantities of mercury can build up on equipment and pipelines used in the oil and gas industry. Such equipment must therefore be properly handled as mercury-contaminated waste when it is decommissioned.

As regards waste from manufacturing industries and the oil and gas industry, the pollution control authorities will:

- continue to assess the need for stricter limits on releases of pollutants and monitoring of industrial activities;
- set requirements for sound management of materials that are taken out of use and that are contaminated with mercury.

Treatment, storage and final disposal of waste containing mercury
It can be difficult to find satisfactory ways of disposing of waste containing mercury. Waste that contains low concentrations of mercury can normally be disposed of in hazardous waste landfills. On the other hand, there is as yet no good solution for the final stabilisation and disposal of metallic mercury. This will be a growing problem as products containing mercury are phased out.

Requirements in the legislation and in discharge permits will be used to ensure that mercury in discarded products is removed from circulation. Recovery of mercury for re-use has been banned in Norway. Under the Basel Convention, the export of waste containing mercury to countries outside the OECD is prohibited. Since 2009, Norway has also ceased to issue permits to export mercury waste for recovery in other countries. Export will still be permitted for secure final disposal on condition that adequate guarantees are provided that the mercury will be taken out of circulation.

Landfills largely release mercury to the environment in water, with leachate. Landfills that are in use must have systems for collection of leachate and monitoring of pollutants, including mercury, in the leachate. At about half of Norway's landfills, some form of treatment of the leachate has also been established.

It is possible that some mercury may also be transported out of landfills together with other volatile substances, either during recovery of landfill gas or as fugitive emissions through the surface of the landfill.

When a landfill is closed, it must be capped with a material that limits further infiltration of precipitation and fugitive emissions of landfill gas. It may also be appropriate to require collection and treatment of leachate, depending on when the landfill was closed and assessment of its pollution potential. Leachate monitoring programmes have been established at several closed landfills, as required by the current legislation.

As regards the management of waste containing mercury, the pollution control authorities will:

- play a part in international research and development to find safe long-term treatment and storage solutions for final disposal of waste containing mercury, with a particular focus on metallic mercury;
- carry out inspection and enforcement activities targeting the waste management branch, including firms that deal with waste containing mercury;
- make use of inspection and information campaigns to prevent landfilling of waste containing mercury, and thus continue to reduce mercury releases from landfills.

3.6 Contaminated sites

Mercury is one of the pollutants at a number of contaminated sites in Norway. In general, mercury is not the main problem, but contaminated sites are nevertheless a source of mercury pollution. Measures have been planned or implemented to reduce the dispersal of pollutants from the remaining sites where contamination is most serious. This should also reduce the spread of mercury from such sites.

There are certain sites where mercury pollution is a problem. The largest of these is the site of an earlier chlor-alkali plant at Herøya near Porsgrunn. It is estimated that the site is contaminated with 10–20 tonnes of mercury. Monitoring programmes have been established both here and at the Borregaard site in Sarpsborg to check whether mercury is leaching from landfills and contaminated soil to recipients. At both sites, waste containing mercury has been stored in sealed concrete bunkers. In Odda, at the site of a zinc smelter (now closed), leachate containing mercury used to drain into the fjord, but is now being channelled into large

underground rock caverns and cast in concrete in large containers. This will prevent leachate from draining into the fjord.

At most of the large mines in Norway, steps have been taken to prevent leaching of metals.

As regards contaminated sites, the pollution control authorities will:

follow up measures at the most heavily polluted industrial sites.

3.7 Sediments

Sediments will generally contain some level of mercury contamination from wet or dry deposition of long-range pollution.

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 that release pollutants to the marine environment.

Well-known examples of pollution from earlier industrial activities are the fjord near Odda (zinc production), Porsgrunn and Sarpsborg (Hydro's and Borregaard's chlor-alkali plants), and Sandefjord (probably polluted by spills from the Jotun paint plant).

At the Odda site, part of the seabed has been covered with a geotextile material capped with sand. At the Porsgrunn site, the authorities are considering whether the worst contaminated sediments should be removed before capping with clean sand and gravel. No remedial action has been taken in the fjord at the Sarpsborg site, but inputs of mercury have been greatly reduced with the closure of the chlor-alkali plant. Earlier spills from Jotun's plant in Sandefjord contained some mercury. Remedial action to deal with contaminated sediments in the fjord close to the plant means that the mercury is no longer bioavailable.

In other fjords and ports, sediments may be contaminated by mercury inputs from rivers or local sources. The Government's action plan for contaminated sediments gives priority to remediation measures in the 17 most heavily polluted fjords in Norway. Pollution is being mapped and programmes of measures are being drawn up for these areas, and in some of them, such as Oslo and Kristiansand, extensive measures have already been implemented to reduce the dispersal of pollution from contaminated sediments.

Studies are also being carried out in ports to investigate and assess the need for measures to limit pollution as part of the work of sediment remediation.

In certain areas, shipyards have also caused some mercury pollution. The commonest forms of mercury are metallic mercury and the organic compound methyl mercury, which is formed by bacterial conversion of inorganic mercury. Methyl mercury is the mercury compound that is most toxic to humans and animals. Shipyards are therefore also a priority in the action plan for contaminated sediments. According to the action plan, investigations and assessments of the need for action are to be completed for the priority shipyards (about 100) by the end of 2010.

High concentrations of metallic mercury in sediments have been found in an area around the wreck of the German submarine U-864, which lies at a depth of about 150 m near Fedje in

Hordaland county. The submarine was on its way to Japan with about 65 tonnes of metallic mercury on board when it was sunk by the Allies in 1945. The Norwegian Coastal Administration is responsible for monitoring wrecks and any risk of acute pollution associated with them. The Climate and Pollution Agency is in close contact with the Coastal Administration on how to deal with mercury from the wreck.

As regards sediments, the pollution control authorities will:

ensure progress in the implementation of the Government's action plan for contaminated sediments, which among other things is intended to prevent the spread of mercury along food chains;

maintain close contact with the Norwegian Coastal Administration on how to deal with mercury from the wreck of U-864.

3.8 Diffuse emissions to air

Diffuse sources (road traffic exhaust and shipping and fuelwood use) accounted for about 27% of Norway's mercury emissions to air in 2008. Mercury emissions from these sources rose by about 47% in the period 1995–2008. According to Statistics Norway, rising emissions from diesel vehicles are the main explanation for this. Mercury emissions to air from these sources are in gaseous form, but may also be adsorbed on to particulate matter.

Fuelwood use

Emission limits for particulates from new wood-burning stoves were included in the technical regulations under the Planning and Building Act in 1998. Since then, particulate emissions from fuelwood use have gradually been reduced by more than 30%, but mercury emissions have nevertheless risen, according to Statistics Norway.

Vehicles

Stricter limits on particulate matter in exhaust from vehicles were introduced in the Motor Vehicle Regulations from 2005 (for type approval) and 2006 (for licensing of new vehicles).

Further differentiation of fuel taxes was introduced from 1 January 2005, and this has increased sales of sulphur-free fuel (diesel). Since 1 January 2009, all fuel for road transport and construction machinery has had to be sulphur-free. This will reduce emissions of particulate matter and thus also of the accompanying mercury. The differentiation of the road tax for heavy vehicles according to their emissions, which since 2005 has also applied to buses, also provides an incentive to replace the oldest vehicles so that emissions of particulate matter are reduced. It is uncertain how much this has influenced total mercury emissions from vehicles.

The proportion of diesel vehicles in Norway is rising, which has resulted in a rise in diesel consumption and emissions of mercury. However, this has not so far been shown to result in urban air pollution levels that will have any health effects.

Under the Pollution Regulations, regular measurements of the atmospheric concentrations of PAHs and heavy metals, including mercury, are required. The data are collected in a central database for air quality data maintained by the Norwegian Institute for Air Research, and are reported to the EU. This will improve our knowledge of mercury dispersal to air. The

measurements also include dry and wet deposition of mercury. In the course of 2010, the European Commission will submit a recommendation on measures that should be introduced to reduce atmospheric mercury concentrations, based on new knowledge about health effects and measurements.

3.9 Monitoring and studies

It is important to learn more about the effects of mercury in the environment, particularly about the mercury cycle (transport and physical state), and about the sources of mercury releases. The Climate and Pollution Agency is responsible for several long-term monitoring programmes.

Monitoring of mercury loads in marine organisms is combined with analyses of time trends in the biota, inputs from rivers and industry, and continuous monitoring of mercury in air at two measuring stations, at Birkenes in the south of the country and in the Arctic archipelago of Svalbard.

Other programmes include sampling for mercury at regular intervals. For example, a nationwide monitoring programme for lake sediments also includes measurements of mercury levels at roughly 10-year intervals, and levels of mercury and other heavy metals are measured in mosses about every five years.

A study of Lake Mjøsa indicates that long-range atmospheric transport of mercury is an important source of mercury inputs to the lake, and probably more important than local sources. A comparison has also been made of long-range mercury inputs to Lake Mjøsa and to other comparable lakes in Scandinavia.

The most recent studies of mercury in freshwater fish (perch and trout) show that mercury concentrations have risen by about 60% in perch and about 20% in trout in the past 20 years. There may be several reasons for this, but small-scale climate change is one possible reason for increased leaching of mercury from soil.

Studies in 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.

Studies in Sweden, Finland and Norway show that forestry operations increase mercury runoff, resulting in elevated concentrations of mercury in freshwater fish. According to the Swedish studies, mercury runoff increases by a factor of 10–50 after heavy machinery has disturbed damp ground, so that mercury enters lakes and rivers.

As regards monitoring, the pollution control authorities will:

- monitor trends in mercury concentrations in the environment;
- try to identify the reasons for/mechanisms behind mercury runoff in river basins;
- investigate mercury uptake in organisms and causes of elevated mercury concentrations in fish and food chains.

3.10 Inspection and enforcement

The Climate and Pollution Agency and the county governors are responsible for ensuring that manufacturers, importers, exporters and distributors comply with the requirements of the Pollution Control Act, the Product Control Act and the Greenhouse Gas Emission Trading Act.

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

The introduction of stricter regulation may result in more frequent breaches of the rules . 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.

Inspections regularly reveal that firms have inadequate information on their own emissions or their routines for reporting to the authorities. In recent years, there have also been some cases where accidents have resulted in relatively large releases of mercury.

Importers of chemicals and products are also inspected. There are very large numbers of importers, so it is a major task to ensure that they focus on the content of prohibited substances in their products. This is also important as a means of ensuring that dangerous substances are dealt with properly as waste.

As regards inspection and enforcement, the pollution control authorities will:

- focus on mercury in their inspection and enforcement activities;
- organise more inspection campaigns targeting products, hazardous waste and landfills, and that focus on mercury;
- ensure an active response to indications of non-compliance with the legislation on mercury.

4. Action in the EU and EEA countries to reduce mercury releases

The EU adopted a comprehensive mercury strategy in 2005, with the aim of reducing mercury levels in the environment and human exposure. It identified 20 actions to reduce emissions, supply and demand and to address surpluses and reservoirs. The strategy was reviewed in 2010.

Mercury production in the EU stopped in 2003. In 2009, the EU adopted legislation on the storage and export of surplus mercury, including that from the chlor-alkali industry, and a ban on the export of mercury from 2011. This is intended to prevent mercury from re-entering the global market. The management of waste containing mercury is regulated by a directive dating from 1999, and new provisions on the final disposal of metallic mercury are being drawn up. Several product groups that may contain mercury are regulated in the EU – batteries and accumulators, electrical and electronic equipment, end-of-life vehicles and

certain measuring devices. Norway shares the EU chemicals legislation, and within the EU/EEA is working towards further reductions in mercury releases and use.

Within the framework of EU/EEA cooperation, the pollution control authorities will:

make a contribution in areas where Norway has expertise and experience, for example abatement technology for industry and collection and treatment of hazardous waste;
play a part in efforts to phase out the use of mercury in products;
seek the implementation of Norway's proposals to restrict the use of five mercury compounds as catalysts in the production of PU elastomers;

5. International efforts to reduce mercury releases

UNEP's mercury programme was established in 2003 on the basis of the conclusions from a global risk assessment. This report clearly demonstrated the impacts of mercury on health and the environment, and the fact that long-range transport of mercury is a global problem.

5.1 Global legally binding instrument on mercury

International negotiations on a legally binding instrument on mercury were started up in 2010. The decision to elaborate such an instrument was made at a meeting of UNEP's Governing Council in February 2009. The goal is to complete the negotiations by the 2013 meeting.

The negotiations will include important elements such as the supply of mercury, trade, use in products and processes, atmospheric emissions from coal-fired power plants and manufacturing industries, sound solutions for storage, and remediation of contaminated sites.

In 2010, Norway has been supporting projects under UNEP's Chemicals Branch with the aim of improving the management of waste containing mercury in developing countries, reducing the use of mercury in VCM production, and reducing mercury releases from small-scale artisanal gold mining in developing countries. Further support will be considered for projects that that can provide important information for the negotiations.

At global level, the pollution control authorities will:

play an active part in the negotiation process so that the global instrument on mercury includes strict restrictions on use and releases.

5.2 Regional agreement on heavy metals

Norway is a party to the Heavy Metals Protocol under the Convention on Long-range Transboundary Air Pollution, which entered into force in 2003. Under the protocol, the parties are required to reduce their total annual emissions of mercury to the atmosphere below the 1990 level. The parties are also required to apply the best available techniques (BAT), and to ensure that certain sources of emissions comply with the emission limit values (ELV) set out in the protocol. The protocol is an important instrument for reducing overall European emissions and will therefore be important in reducing long-range inputs to Norway and the Arctic. Negotiations on revision of the protocol and its annexes will take place in the period 2011–12.

At regional level, the pollution control authorities will:

work towards the inclusion of restrictions on the use of mercury in products (this applies to products where mercury is added deliberately, such as batteries, measuring equipment, vehicles, electrical and electronic equipment and fluorescent tubes) and requirements to install amalgam separators in the Heavy Metals Protocol;
take part in the work of updating BAT requirements in the Protocol for branches where Norway has special expertise;
support efforts to encourage more countries to ratify the protocol.

5.3 Other agreements

Basel Convention
Waste containing mercury comes within the scope of the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal. The central objective of the Basel Convention is to ensure environmentally sound management of hazardous waste. To achieve this, technical guidelines have been drawn up for priority types of hazardous waste, including waste containing persistent organic pollutants. The convention prohibits the export of hazardous waste, including waste containing mercury, from developed to developing countries, but this prohibition has not yet entered into force. However, the EU and EFTA states have banned such exports. Work is in progress under the convention on guidelines for environmentally sound management of mercury waste.

Rotterdam Convention
This is a global legally binding agreement on trade in certain hazardous chemicals. The convention was established to prevent chemicals that have been banned in developed countries from being dumped in developing countries. Parties must give prior consent to the import of dangerous substances listed in the convention.

The Arctic Council and the Barents Council
Norway takes part in several of the working groups under the Arctic Council, including the Arctic Contaminants Action Program (ACAP). Its goal is to reduce emissions of pollutants into the environment in order to reduce the identified pollution risks. Some of its projects are circumpolar, but most are being carried out in Russia, including projects on mercury. ACAP is providing important input to the global work on regulation of mercury.

The Barents Euro-Arctic Council has focused on 42 particularly heavily polluted areas, or "hot spots", that have been identified in the Barents region. Norway takes part in several of the Council's working groups, and the Subgroup on Cleaner Production and Environmentally Sound Consumption is particularly relevant in the context of mercury.

Bilateral environmental cooperation
Norway has entered into bilateral agreements on environmental cooperation with several countries, the most important of which are Russia, China, India and South Africa. One area of cooperation included in these is chemicals and hazardous waste, but so far specific projects have only been initiated in Russia and China.

China

A Sino-Norwegian competence-building project on environmental management was initiated in Beijing in 2010, with the aim of strengthening the environmental expertise of the Chinese environmental authorities and experts. It is based on experience gained during several earlier, successful projects within the framework of the Norwegian-Chinese agreement on environmental cooperation. These include a project on inspection and enforcement in Zunyi in Guizhou province involving the Climate and Pollution Agency (2005–09), and the SiNoMER project, which is focusing mainly on mercury.

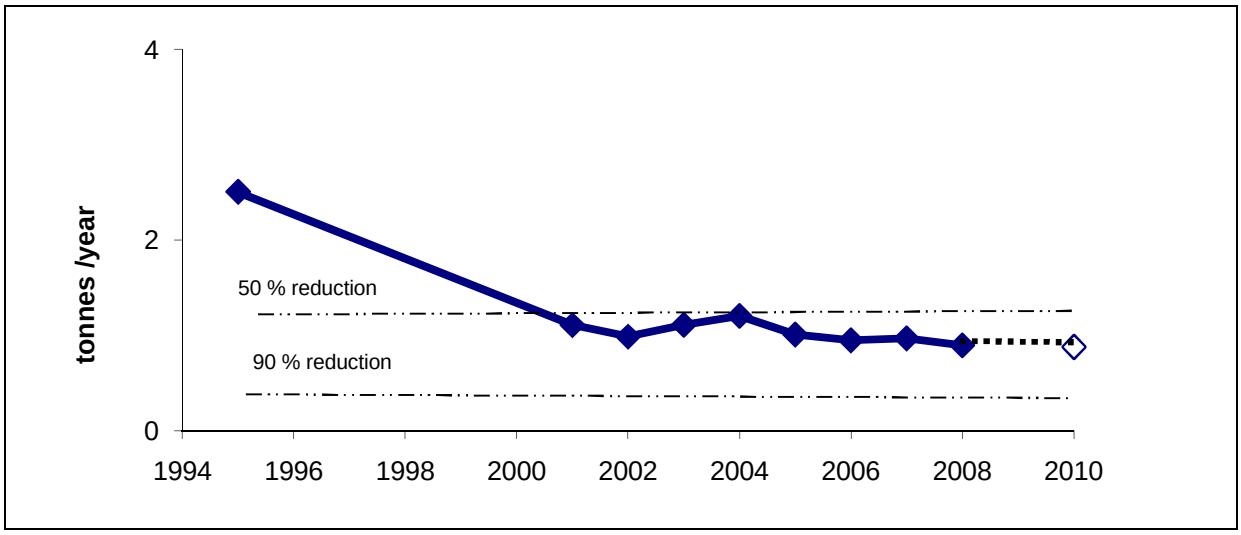
SiNoMER involves cooperation between the Norwegian Institute for Water Research and Chinese authorities and research institutions in Guizhou province. The project started in 2006, and will continue until 2012. The main aim is to reduce mercury releases from coal-fired power plants, zinc production and mining, and to reduce industrial mercury use.

Russia

The Climate and Pollution Agency is carrying out a cooperation project with Arkhangelsk county called “waste handling – regional cooperation”. The first part has been completed, and involved the establishment of a system for the collection, transport and storage of mercury waste, especially from fluorescent tubes and light fittings. The second part is still in progress, and is intended to put in place sound final disposal systems for this waste.

6. Appendix : Mercury emissions in Norway

Figure: Norwegian releases of mercury (excluding those from contaminated sites, sediments and shipwrecks) in the period 1995–2008, and projected releases in the period 2008–10.



Source: Prioriterte miljøgifter i 2008. Status og utslippsprognoser. (Priority Substances 2008. Status and projections of releases) TA 2738/2010. Climate and Pollution Agency.

Mercury (Hg)

Table: Consumption, quantities in contaminated soil and releases in 1995 and 2008

Sources	Consumption 1995 (kg)	Consumption 2008 (kg)	Contaminated soil 2008 (kg)	Emissions 1995 (kg)	Emissions 2008 (kg)
Industrial sources:				**472**	**284**
Petroleum refining				0	3
Wood processing				41	33
Manufacture of mineral products				37	36
Chemical industry				15	13
Metal manufacturing				291	136
Mining, disused mines					
Other industry				86	62
Industrial waste and sewage				0	0
Correction for emissions not reported in 1995				2	
Other sources:				***692***	***197***
Waste incineration, combustion of landfill gas, crematoria				120	81
Municipal waste water				345	40
Municipal sewage sludge				185	50
Leachate from landfills					
Other sectors				42	26
Diffuse sources:				***162***	***238***
Households (homes +other combustion)				24	23
Road traffic, road dust and tyre wear				56	100
Snowmobiles				0	0
Motorised equipment				12	25
Shipping (vessels of all sizes)				57	77
Railways				2	1
Aviation				11	12
Oil and gas industry				***795***	***13***
Natural gas				3	4
Gas terminals				0	1
Flaring				0,5	0
Use of diesel				6	8
Oil and gas extraction				786	0
Products:	***1378***	***169***		***383***	***167***
Dental amalgam	840	0		275	124*
Batteries	215	0		0	0
Thermometers	90	0		55	0
Light sources	130	130		30	40
Laboratory chemicals	40	37		0	0
Measuring devices	55	20		20	0
Mineral fertiliser	3	2		3	2
Mercury switches and relays	5	0		0	0
SUM (excl. contaminated soil)	***1378***	***168***	***20000***	***2504***	***898***
Contaminated soil:			**20000**		**20**
SUM (incl. contaminated soil)					***918***

* Releases to soil only. Releases to air and water are included under waste incineration and municipal waste water respectively. Releases from dental amalgam include releases from disposal of fillings, extracted teeth and burial and cremation of persons with amalgam fillings.

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Climate and Pollution Agency

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 advisers, guardians and stewards for the environment. Our most important fields of work include climate change, chemicals, the 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 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

TA-2731/2010