

Norway's submission of information on releases to the expert group under the Minamata Convention

Oslo, 15 April 2020

1 Summary

In Norway mercury releases to land and water are reported into a national pollutant release and transfer register, which is publicly available. Releases based on measurements are always preferred, but in the absence of them sector-specific calculation methods can be used.

Herein we present general information about the pollutant release and transfer register, as well as more specific information on reporting and calculating releases from wastewater to water and land. Particular attention is given to various estimation techniques and to the importance of accounting for the end-usage of the sludge residue, when estimating releases to land from wastewater treatment facilities. Finally, examples of industrial mercury releases obtained from the public pollutant release and transfer register are given.

A research article on mercury loads and fluxes in Swiss wastewater is also submitted due to its rigorous methodology and detailed description of mercury flows in modern wastewater treatment plants.

2 Pollutant release and transfer register

Statistics Norway and the Norwegian Environment Agency calculate the total annual national emissions to water and air.

Releases to air and water as well as transfers of waste from different sectors, both aggregated and at facility level are presented through the national pollutant release and transfer register. All data are made publicly available.

The data collected to the Norwegian register is consistent with the European Pollutant Release and Transfer Register (E-PRTR) and Norway submits data to the E-PRTR on an annual basis.

2.1 Guidance to the Pollutant release and transfer register

All industrial facilities having a permit under the Pollution Control Act are obliged to report yearly emission data to the national pollutant release and transfer register. This includes land-based industries, offshore petroleum industry, landfills and wastewater treatment plants. The facilities report through an official online webservice.

The obligation to report on an annual basis is included in the facility's permit.

Guidance is given on the Norwegian Pollution Agency's website and by means of direct guidance to the facilities.

3 Mercury releases from wastewater

3.1 Availability of data for mercury releases from wastewater treatment plants.

In Norway all wastewater treatment plants above 50 pe (person equivalents) are obliged to report on an annual basis to the Norwegian pollution authorities.

Wastewater treatment plants larger than 20 000 pe are obliged to perform direct measurements of heavy metals in influent and effluent to the wastewater treatment plant.

3.2 Releases of mercury to water from Norwegian wastewater treatment plants

Figure 1 shows mercury releases to water from wastewater treatment plants in Norway.

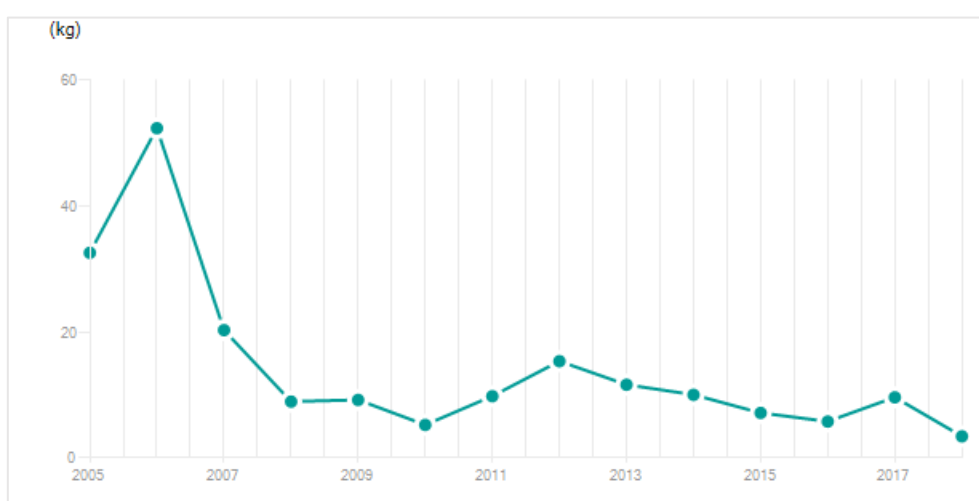


Figure 1. Discharges of Mercury (Hg) to water (in kg per year). Wastewater treatment plants, Norway. Source: Norwegian pollution release and transfer register.

3.3 Reports on methodology for estimating releases of mercury to water

Municipal wastewater report 2018, Statistics Norway

The report is issued by Statistics Norway. Statistics Norway is the national statistical institute of Norway and the main producer of official statistics.

The report summarizes the most important findings regarding the status of the municipal wastewater sector in Norway, and covers topics like expenditures and investments, fees, compliance with treatment permits, discharges of nitrogen, phosphorus, **heavy metals**, a few organic pollutants, treatment efficiencies, number of wastewater treatment plants, capacity, number of people connected, heavy metal content in sewage sludge and disposal of sewage sludge.

In 2018 there were 2 717 wastewater facilities in Norway with a capacity of more than 50 population equivalents (pe) according to the municipalities reports to the Norwegian Environment Agency.

The report describes methods for estimating releases from municipal wastewater treatment plants, with and without direct measurements.

The method of calculation is mainly based upon a report on discharge of heavy metals and organic pollutants in wastewater from 2008 by Blytt and Storhaug (2008).

Two methods of calculations are described; 1) annual releases from wastewater treatment plants where measurement data exist and 2) annual releases from wastewater treatment plants where measurement data does not exist. Hence, calculation of discharge amounts from the wastewater treatment plants follows two approaches depending on the available data.

Approach no. 2 above is based on the three elements; number of population equivalents connected to each treatment plant, a specific emission factor based on data from plants which are doing sampling, and a treatment category based on the efficiency of the treatment plant and the percentage of the population connected to the municipal wastewater system. The specific emission factor and the adjustment factor are recalculated every year based on new measurements.

The following emission factor have been used in the Municipal wastewater report 2018 to estimate mercury releases to water from treatment plants with no data available: 803 - 4 748 µg / inhabitant / year.

Sources:

- *Kommunale avløp 2018. Ressursinnsats, utslipp, rensing og slamdisponering 2018. Gebyrer 2019. Statistics Norway, 2019.*
- *Blytt, L. og Storhaug, R. (2008): Tungmetaller og organiske miljøgifter i innløps- og utløpsvann fra kommunale rensesanlegg 2006. Aquateam rapport nr 07-029. Aquateam. Oslo.*

The report is available in full text in Norwegian. Content can be made available to the release expert group on request.

Discharge of wastewater from industries to municipal sewer systems. Guidance to municipalities. Norwegian Water, 2017.

Summary: Discharge of wastewater from industries into municipal sewer system can create problems for the sewer system, the wastewater treatment plant and for the sludge quality. The composition of the wastewater is often different from normal municipal wastewater and may also be more expensive to treat. The report describes:

- frequently experienced problems caused by discharge from industries
- types of industries that are most likely to produce problematic wastewater
- the legal framework that municipalities can apply to reduce problems related to discharge of wastewater to the municipal sewer system
- a method for calculation of additional discharge taxes

The report is mentioned here as it may give valuable information on how to address industrial discharges containing mercury to municipal wastewater systems.

The report is available in full text in Norwegian. Summary in English. Content can be made available to the release expert group on request.

Mercury in municipal sewers. Norwegian Environment Agency, 2004.

The report provides background information on sources of mercury in municipal wastewater and discharge amounts per source category. The report is written prior to the phase out of dental amalgam in Norway.

The report is available in full text in Norwegian. Content can be made available to the release expert group on request.

Methods for calculation of pollution discharges from municipal sewer system and wastewater treatment plants. Norwegian Water, 2017.

This report gives an overview of different methods for calculation of pollution discharges from the municipal sewerage system based on the size of the population served, total time with overflow over the weirs per year, number of overflow incidents and several other parameters.

The report provides methods which may be used for estimation of mercury releases from municipal sewer systems. It covers the following topics:

- Calculation methods for wastewater production
- Discharge from areas not connected to sewer systems
- Calculation of influent and effluent from treatment plants
- Calculation of operational overflows
- Calculation of emergency overflows
- Discharge from storm water systems
- Discharge from leakages in sewer systems

The report is available in full text in Norwegian. Content may be made available to the release expert group on request.

Guidance on interpretation and use of analytical results of environmental pollutants in urban wastewater, Aquateam AS on behalf of Norwegian Environment Agency, 2010.

This guidance is a tool to identify high levels of pollutants at a certain sewage wastewater treatment plants. The plant's "finger-print" is given as the ratio between different heavy metal concentrations in the inflow water to the plant. Knowledge of common concentrations makes it possible to react when higher values occur. A plant's "key number" is the ratio between heavy metals and phosphorus that enters the plant. The key number can give information about a trend at the plant and is useful to compare inflow water quality between different sewage plants.

The report might be useful to develop methodology to identify high levels of mercury in wastewater.

3.4 Mercury releases from wastewater to land

A recent Swiss study, published in Water Research in March 2020, has estimated the mercury loads and fluxes in wastewater. The data is based on a nation-wide survey 64 WWTP that were sampled in January, June and July 2016. 28 of these plants were sampled again in more detail in June 2017. For the latter 28 plants total mercury concentration were determined for the influx, efflux and sludge residue. Based on these results average mercury loads (total mercury per year and total mercury per capita per year) were estimated for the entire country. The results are presented in Figure 2.

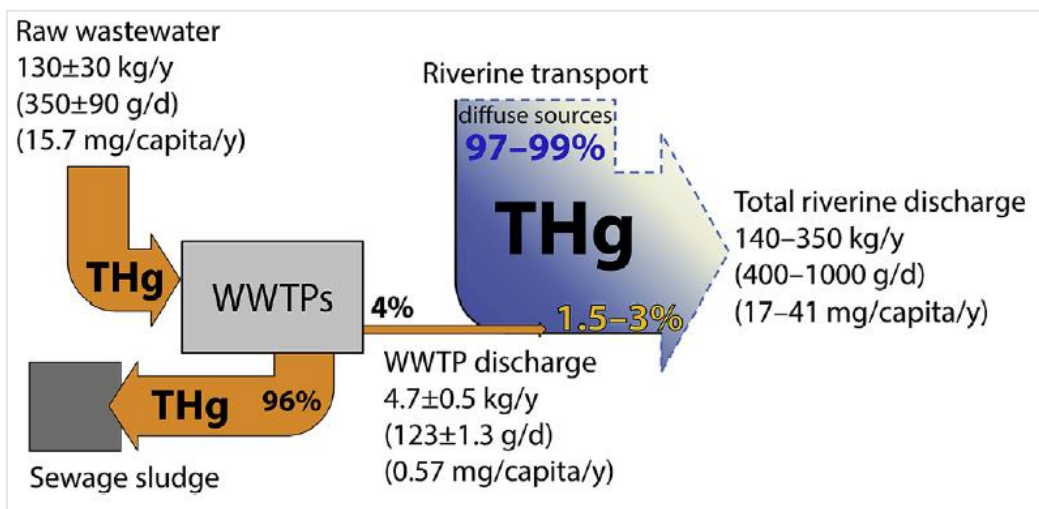


Figure 2. Estimated total Mercury loads of Swiss WWTPs and their contribution to the total mercury load in surface waters at the Swiss border.

The removal efficiency of 96% is noteworthy not only due to the low discharge loads to the effluent water, but due to the high mercury content retained in the sludge residue. According to the study, in Switzerland the total amount of Mercury in sewage sludge has decreased from an estimated 612 kg / year in 1984 (170 kilo tons of sludge, with a total mercury concentration of 3600 ng/g) to 176 +- 28 kg / year in 2017 (268 kilo tons of sludge, with a total mercury concentration of 656 +- 108 ng/g).¹ Similar mercury concentrations can be found in Norwegian sewage sludge according to *Statistics Norway*, as can be seen from Figure 3.

¹ Elke Suess, Michael Berg, Sylvain Bouchet, Lara Cayo, Stephan J. Hug, Ralf Kaegi, Andreas Voegelin, Lenny H.E. Winkel, Emmanuel Tessier, David Amouroux, Andreas M. Buser, Mercury loads and fluxes from wastewater: A nationwide survey in Switzerland, *Water Research*, Volume 175, 2020, 115708, <https://doi.org/10.1016/j.watres.2020.115708>.

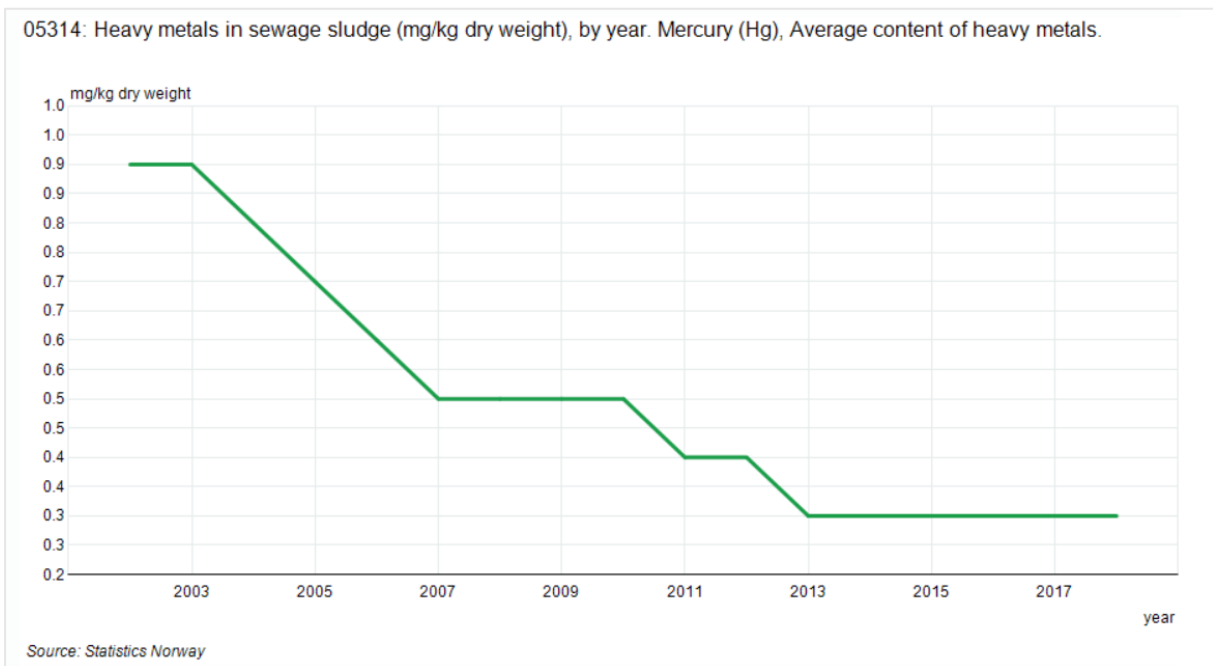


Figure 3. Average mercury concentrations in Norwegian sewage sludge between 2002 and 2018.

When calculating and reporting Mercury releases from wastewater, particular attention should therefore be given to the fate of the sludge residue and how much of it is used for agriculture and other landfill applications (as the mercury content of that fraction is a direct release of mercury to land). See Figure 4. for examples of disposal categories found in Norway.

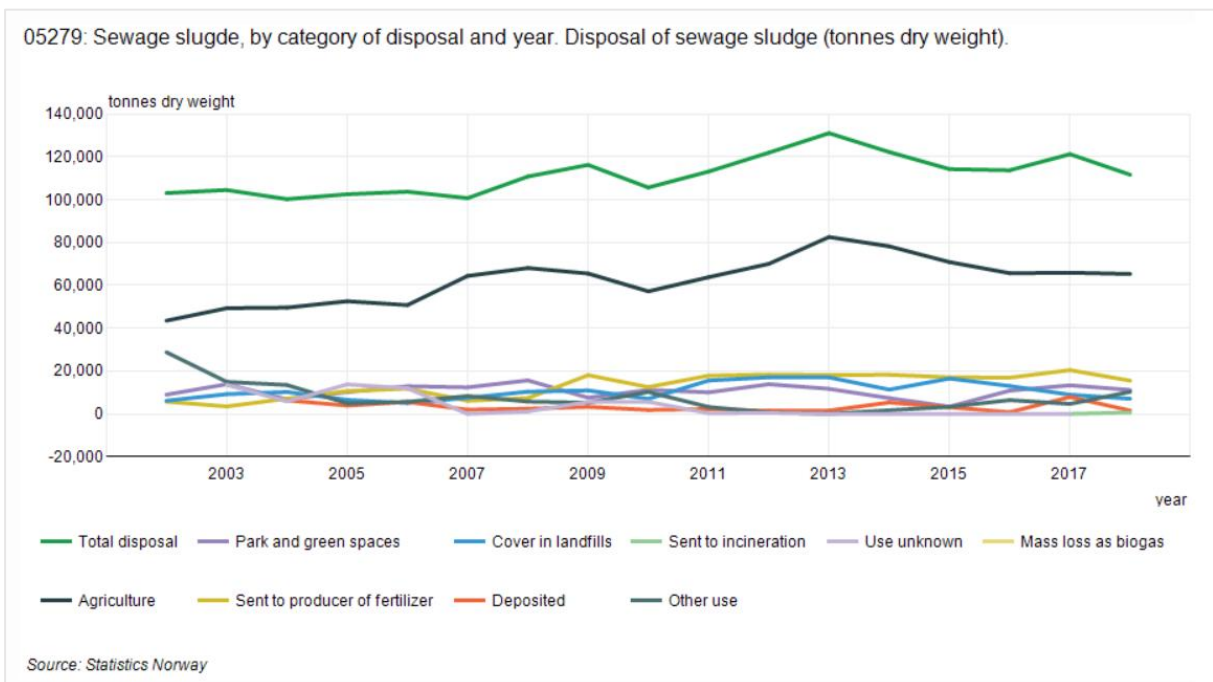


Figure 4. Disposal of sewage sludge in Norway between 2002 and 2018 by category.

4 Mercury releases from industrial activities

4.1 Availability of data for mercury releases from industrial activities

All industrial facilities that have a permit under the Pollution Control Act are obliged to report yearly emission and release data to the national pollutant release and transfer register. The facilities report through an official online webservice.

As part of the report the facility must inform whether the emission data are based on direct measurements, calculations or estimates based on, for example, raw materials.

Most of the Norwegian facilities conduct either online measures or sampling campaigns, although some base their emission data on estimates. Within the aluminium sector this approach has been common.

4.2 Releases to water from industrial activities

Table 4.1 shows releases of mercury to water from industrial activities divided per sector. Information is based on 2018 pollutant release and transfer register.

Table 4.1 Mercury releases from industrial activities in Norway in 2018, including waste treatment.

Release source	Mercury release to water (kg Hg)
Aluminium (primary production)	0,187
Inorganic chemical industry	0,711
Iron & Steel	0,718
Mineral and materials (dyes & pigments)	3,100
Mineral oils – extraction, refining and use	2,426
Natural gas – extraction, refining and use	0,187
Non-ferrous (Lead, zinc and tin)	0,280
Non-ferrous (other than lead, zinc and tin)	0,137
Pulp & paper	3,373
Waste treatment ²	0,037
Other industries	1,08
Total from industrial activities	12,2

Figure 5 shows development of mercury releases to water from industrial activities in Norway from 2002 to 2018. Data are based on the national pollutant release and transfer register and are publicly available.

² Waste treatment is not including releases from municipal wastewater treatment or landfills.

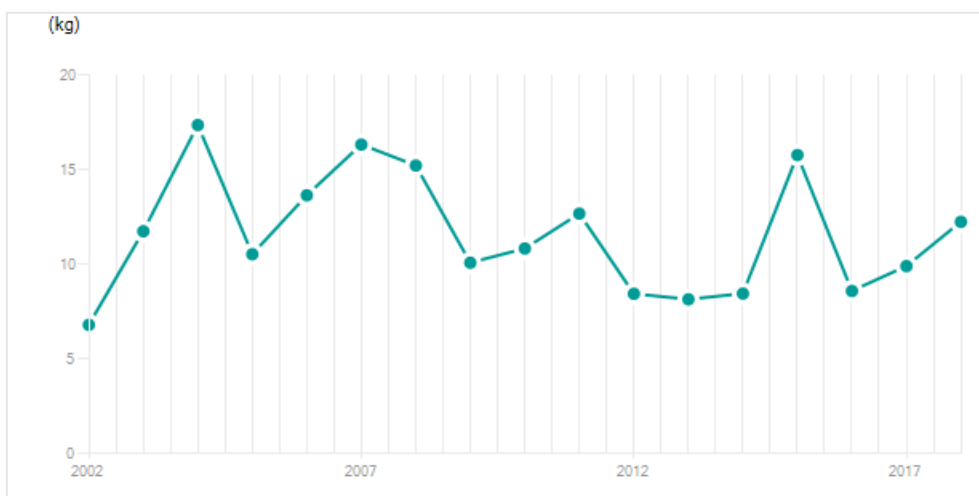


Figure 5. Releases of Mercury (Hg) to water (in kg per year). Land based industry.

5 Other sectors

As the guidance on the methodology for preparing inventories of releases should also provide information on significant point sources of releases covered by other provisions of the convention, we have presented some available data.

Both offshore petroleum industry and landfills are obliged to report their emissions to water and air in accordance to their discharge permit, and report to the national pollution and transfer register.

5.1 Offshore petroleum industry

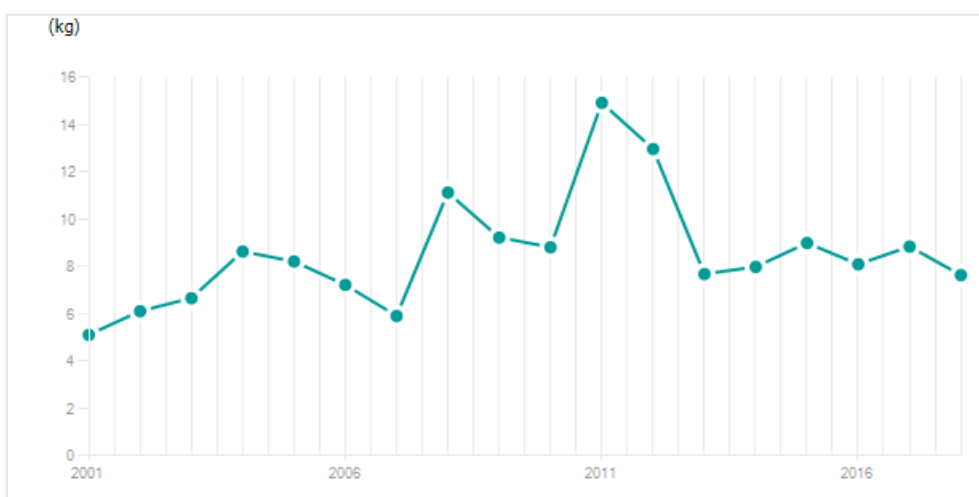


Figure 6. Releases of Mercury (Hg) to water (in kg per year). Offshore petroleum industry.

5.2 Landfills

Figure 7 shows releases of mercury to water from landfills. Releases to water from landfills in Norway are regarded as point sources of release.

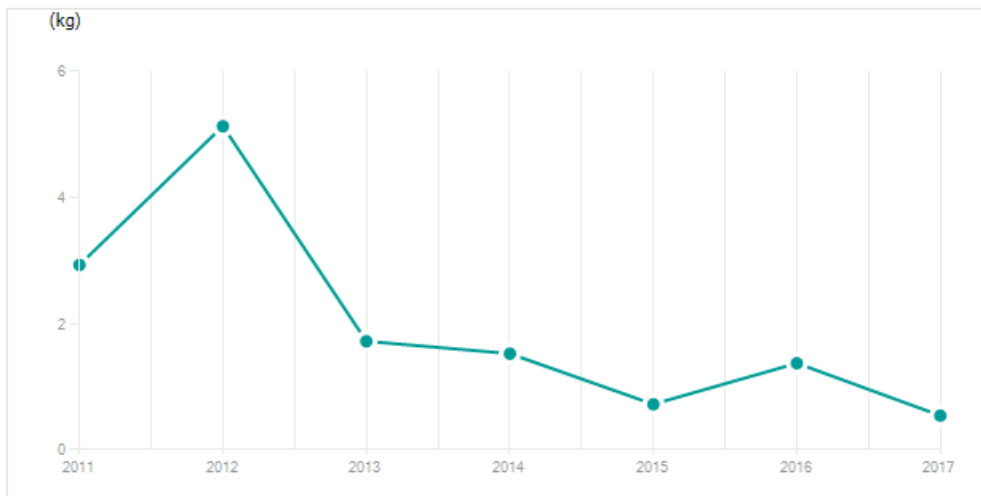


Figure 7. Releases of Mercury to water (Hg) (in kg per year). Landfills.