



Nordic Council
of Ministers

POLICY BRIEF

Improved knowledge base on air pollutant emissions after Nordic collaboration



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This publication is also available online in a web-accessible version at <https://pub.norden.org/temanord2022-538>.

Introduction

Emissions of particle matter, heavy metals and persistent organic pollutants (POPs) cause health issues to humans and other organisms. Air pollution is also linked to climate change and global warming. Reducing air pollution emissions is thus pivotal to the Nordic countries in many aspects. However, mitigation actions on greenhouse gas emissions may lead to increased air pollution emissions. Balanced political decisions to curb both greenhouse gas emissions and emissions of air pollution are thus essential to the Nordic countries. The foundation for making well-informed decisions on policies and measures are accurate and well-founded national emission inventories.

This policy brief summarizes a Nordic collaboration to improve the knowledge base of the Nordics national emission inventories on heavy metals and persistent organic pollutants.

Summary of project

The Nordic project has resulted in more transparent, consistent, comparable, complete and accurate Nordic emission inventories by:

- Increased knowledge about other Nordic countries' circumstances
- Improving emission inventories by harmonizing Nordic data sources, methods and assumptions
- Identifying gaps and correcting errors
- Development of emission factors for inclusion in the EMEP/EEA Guidebook 2019, providing guidance to other countries
- Verifying emission levels
- Facilitating further collaborations and networking

The need for Nordic collaboration

The Nordic countries are in many ways similar in terms of climate, economic development and legislations. Emission profiles are therefore expected to be similar and comparable between the countries in many cases. Furthermore, some industries are important emission sources in several of the Nordic countries, such as metal processing and pulp and paper production. Biomass is also an important energy source in the Nordic countries and the use has increased as a mean to reduce fossil fuel use to combat climate change.

There are also relevant differences between the countries that affect emissions. Norway has for example a large oil industry, Denmark a large agricultural sector and the fishing industry in Iceland is one of the country's most important emission sources.

The Nordic countries report annual emissions for 1990 onwards to the UNECE Air Convention (CLRTAP¹), following the reporting quality criteria: transparency, comparability, consistency, completeness and accuracy. All these aspects are therefore important to take into consideration as emission inventories are developed and improved. The basis for compiling emission inventories consists of the methodologies provided in EMEP/EEA Guidebook 2019².

Persistent Organic Pollutants, POPs, are a collective name for a group of toxic pollutants that degrade very slowly in nature and can therefore be transported far distances by wind and water and cause great damage to humans and wildlife. Due to their slow degradation, POPs may accumulate over food chains, resulting in high concentrations in animals at the top of the food chain.³

Heavy metals are also toxic, and in particular arsenic, cadmium, chromium, lead, and mercury can cause organ damage or are carcinogens.⁴

Heavy metals and POPs are emitted to the environment through air, soil or water. Emissions to air are often bound to particles, whereas some are more common in gas phase. In addition to their adverse effect on health, particle bound heavy metals and POPs emissions may also have a warming or cooling effect on the climate.

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1. Convention on Long-Range Transboundary Air Pollution
 2. EEA 2019. EMEP/EEA air pollutant emission inventory guidebook 2019
 3. US EPA. Persistent Organic Pollutants: A Global Issue, A Global Response. <https://www.epa.gov/international-cooperation/persistent-organic-pollutants-global-issue-global-response#pops>
 4. Tchounwou. P. B. et al. Heavy metals toxicity and the environment. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4144270/>

While knowledge and measuring schemes of emissions of NO_x, SO₂ and NMVOC have increased significantly in the Nordic countries since the 1960s, the emission inventories on heavy metals and POPs are still incomplete in many cases and associated with high uncertainties. As accurate emission inventories are crucial in developing relevant policies and measures to reduce emissions, improving these emission inventories is of high importance. Since data and information about these emissions are very scarce, there is a benefit in sharing available information between countries, and in particular between the Nordic countries that share many similar conditions.

Prioritizing what is most important

An annual Nordic project was initiated in 2016 with the aim to improve the Nordic (Denmark, Finland, Norway, Sweden and Iceland) emission inventories of heavy metals and POPs by making use of each other's knowledge, data and methods. In this way, significant improvements of the emission inventories were achieved using relatively small means.

The project has focused on some of the largest emission sources of heavy metals and POPs in the Nordic countries.

For each of the selected sources, methods, activity data, emission factors and emissions per capita have been compared to identify areas of improvement. Significant differences in methods and assumptions have been identified and further investigated. Emission levels have then either been verified or suggestions have been given on improvements of the emission inventories by harmonizing the Nordic data sources, methods and assumptions. As the actual implementation of changes are in the hands of the respective countries' priorities and budgets, the Nordic project has not focused on follow-up on specific results.

Some of the more prominent results

Throughout the project, various discoveries were made on issues related to large sources of heavy metal and POPs emissions. Below, some examples are illustrating breakthroughs made in the project as well as remaining challenges.

The changes that have been made in the emission inventories are partly due to the Nordic project, either by direct results or indirectly by highlighting issues, improved collaboration and understanding of the Nordic emission inventories.

Emissions of heavy metals and POPs are relatively small in Iceland compared to other Nordics countries and thus exempted from the figures below. However, since 2016, Iceland has improved its completeness in reporting of heavy metal emissions.

Development of new emission factors

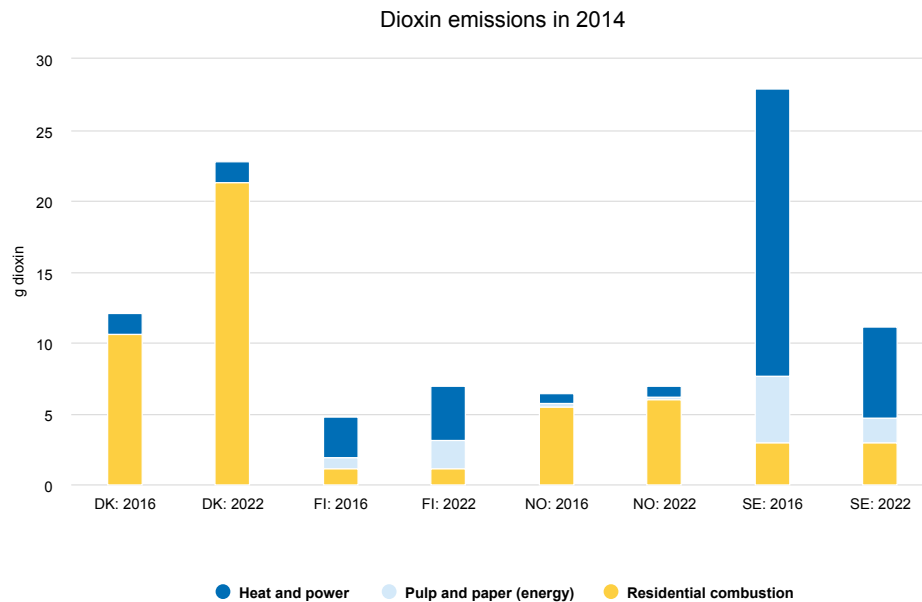
As part of the Nordic project, VTT Technical Research Centre of Finland has developed emission factors for vehicle exhaust and marine engine emissions suitable for Nordic conditions, which may serve as input to the Nordic emission inventories. As a basis for the developed emission factors, VTT has compiled and verified existing measurements of heavy metals and POPs in vehicle exhaust from different Euro standards as well as from marine engines^{5, 6}. The results have been presented at the annual UNECE CLRTAP task force meetings and have been included in the EMEP/EEA Guidebook 2019⁷.

Improved knowledge on dioxin emissions

There are some differences in emission levels of dioxin emissions between the Nordic countries (Denmark, Finland, Norway and Sweden) that stand out. The Finnish and the Swedish pulp and paper industries are among the largest in the world, being large sources of emissions in both countries. These emissions also relate to biomass combustion in the heat and power sector, which were much higher in Sweden than in other countries. Some revisions have been made since the 2016 reporting and this issue is being further investigated, for example by close communication with the industry as well as sharing of available data. Currently, work is ongoing to revise the dioxin emission factor for biomass combustion in the pulp and paper industry and the power and heat sector.

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5. Aakko-Saksa, P. 2019. Nordic programme on developing air pollutant emission inventories, especially POP and heavy metal emission inventories "NMR": Marine
 6. Aakko-Saksa, P. 2017. Nordic programme on developing air pollutant emission inventories, especially POP and heavy metal emission inventories "NMR"
 7. EEA 2019. EMEP/EEA air pollutant emission inventory guidebook 2019

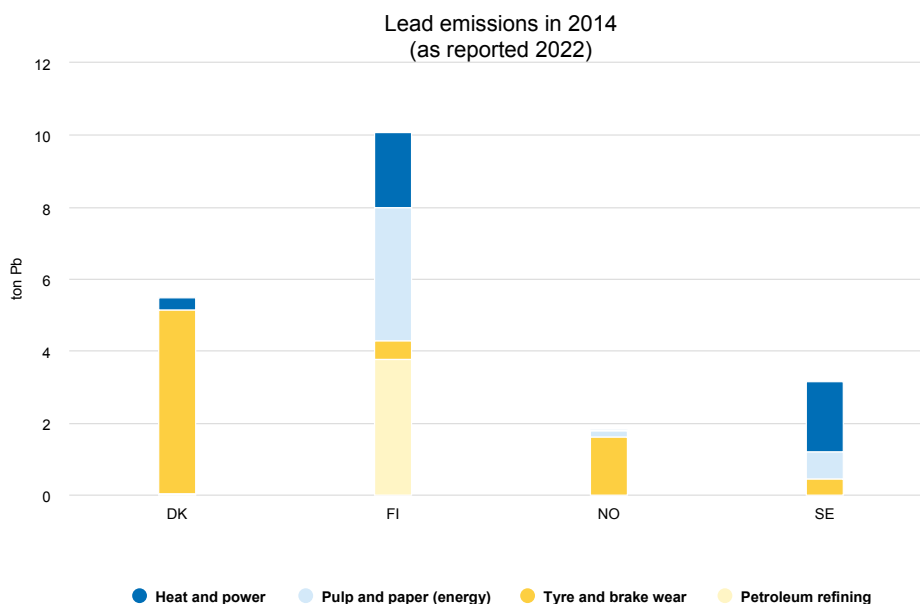
Furthermore, emissions from residential combustion are much higher in Denmark than from other countries and have recently been revised. This indicates that there is potential to improve the other Nordic countries' emissions inventories also in relation to residential combustion.



Emissions emitted in 2014 were first reported to CLRTAP in 2016. The 2014 emissions reported in 2022 have been revised for all countries.

Still work to be done on lead emissions

Lead (Pb) emissions as reported in 2022 show that there still are significant differences between the Nordic countries. Emissions from vehicle tyre and brake wear, an emission source that is expected to be fairly similar in all Nordic countries due to similar legislations and climate, differ substantially. In the project, analysis of emission levels and calculation methods led to explaining some of the difference that were discovered despite these similar conditions. The project result led to further investigation into some of the countries methods and development of calculation methods are planned.



Emissions from the pulp and paper industry again shows differences between Sweden and Finland, leading to ongoing investigations into underlying explanations and data. Also, petroleum refining is an emission source that is surprisingly high in Finland compared to other countries, again resulting in further communication with the industry and investigation into underlying data.

Improved completeness in HCB emissions

Comparison of emissions from aluminium production in the Nordic countries revealed that HCB emissions from secondary aluminium production is reported from all countries except for Sweden. Since the default emission factor from EMEP/EEA Guidebook is unrealistically high, Sweden plans to include HCB emissions based on the references used by the other Nordic countries, thus achieving a more complete emission inventory for HCB.

Soft benefits of collaboration

The project has resulted in many indirect benefits to each country's emission inventory, as it has facilitated communication and collaboration between the countries. For example, discussions and comparisons of each country's methods for modelling and calculating emissions have led to a deeper understanding of emission inventory in respective country and thus facilitating further collaboration and inspiration to improvements. In addition, the collaboration between the countries provided a network during the annual reviews of emission inventories conducted under the CLRTAP and the EU National Emission Ceilings Directive.

Future needs

The project has identified a number of important areas for further development:

- Focus areas which are identified as important in Nordic emission scenarios, e.g. common manufacturing industry, small-scale combustion of biomass, and vehicle tyre and brake wear.
- Measurement data, especially from industry. Close cooperation with the industry is essential.
- Closer follow-up on emission reduction seen in emission inventories in relation to enforced policies and measures.

About this publication

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Nordic co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland and Åland.

Nordic co-operation has firm traditions in politics, economics and culture and plays an important role in European and international forums. The Nordic community strives for a strong Nordic Region in a strong Europe.

Nordic co-operation promotes regional interests and values in a global world. The values shared by the Nordic countries help make the region one of the most innovative and competitive in the world.

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