

Air Emissions of Selected Substances from Particular Sectors Including Metallurgy in Poland

I. Kargulewicz

Institute of Environmental Protection – National Research Institute
Krucza 5/11d, 00-548 Warszawa, Poland
Corresponding author. E-mail address: iwona.kargulewicz@kobize.pl

Received 04.07.2016; accepted in revised form 22.09.2016

Abstract

This article presents data on the anthropogenic air emissions of selected substances (CO₂, SO₂, total suspended particles (TSP), dioxins and furans (PCDD/F), Pb and Cd) subject to reporting under the Climate Convention (UNFCCC) or the Convention on Long-range Transboundary Air Pollution (UNECE CLRTAP). It also presents the national emissions of these substances in 2014 by the major source categories and defines the share of metal production in these emissions. Analysis is based on national emission inventory reports. Most important source of air emission in case of CO₂ and SO₂ is *1.A.1 Energy industries* category. TSP and PCDD/F are emitted mainly from fuel combustion in small sources (i.a. households). Emission of heavy metals (Pb and Cd) is connected mostly with *1.A.2. Manufacturing industries and construction* category. Metallurgy is significant source of emission only for lead and cadmium from among all considered substances. The shares of particular sectors in the national emissions of given pollutants are important, in view of the possible reduction measures and the determination in which industries they could bring about tangible results.

Keywords: Environment protection, Emission, Emission inventory, GHG, Air pollutants

1. Introduction

Poland is a Party to the United Nations Framework Convention on Climate Change [1], hereinafter referred to as “the UNFCCC Convention” or “the Climate Convention”, and the United Nations Convention on Long-range Transboundary Air Pollution (LRTAP) [2], also referred to as “the Geneva Convention”. This imposes on it the obligation to submit annual reports with its national inventory of the emissions of greenhouse gases and other pollutants. Under the Climate Convention, reports with estimated emission levels of: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and so-called F-gases, i.e. hydrofluorocarbons (HFC), perfluorocarbons (PFC) and sulphur hexafluoride (SF₆), are submitted to the Convention Secretariat.

The LRTAP Convention provides for reporting on the following pollutants and their groups:

- sulphur oxide, nitrogen oxides, ammonia, carbon oxide,
- particulate matter (total suspended particles (TSP) and its fine fractions: PM10 and PM2.5),
- heavy metals (including those subject to mandatory reporting: cadmium, mercury and lead, and those that have so far been subject to voluntary reporting: arsenic, chromium, zinc, copper and nickel),
- non-methane voluntary organic compounds,
- persistent organic pollutants – POPs (dioxins and furans, polychlorinated biphenyls, hexachlorobenzene, as well as polycyclic aromatic hydrocarbons (benzo(a)pyrene and three others – PAHs)).

The inventories elaborated under both Conventions are prepared in accordance with relevant guidance [3-4]. In the case of greenhouse gases, this is the guidance of the Intergovernmental Panel on Climate Change - IPCC) given in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories [5]. The major emission source categories applied in national GHG inventories are unified for all the reporting countries and the estimated GHG emissions are listed in tables in the Common Reporting Format (CRF).

The emissions of the particular air pollutants covered by the Geneva Convention are estimated according to the SNAP (Selected Nomenclature for Air Pollution) classification, based on the structure of emission sources as contained in the EEA/EMEP Emission Inventory Guidebook [6]. In the reports submitted to the LRTAP Convention and the European Union, the results are given in accordance with the NFR (Nomenclature for Reporting) classification.

The major IPCC categories for which emissions are estimated in the national GHG inventory are as follows: 1. Energy (divided into: 1A. Fuel combustion and 1B. Fugitive emissions from fuels, with 1.A. including: 1.A.1. Energy industries, 1.A.2. Manufacturing industries and construction, 1.A.3. Transport and 1.A.4. Other sectors), 2. Industrial processes and product use, 3. Agriculture, 4. Land use, land-use change and forestry and 5. Waste. The NFR sectors are grouped analogously to the IPCC categories.

In determining the share of metal production in the emissions of particular substances, it should be taken into account that the emissions from this industry include part of the emissions from Category 2 (2.C Metal industry, including 2.C.1 Iron and steel production) and from Category 1.A.2 (1.A.2.a Iron and steel and 1.A.2.b Non-ferrous metals) [7].

2. The emissions of greenhouse gases

CO₂ had the largest share in the emissions of the gases reported on under the Climate Convention (in 2014, its emissions amounted to about 310.8 million tonnes, representing almost 82% of the national GHG emissions, estimated for 2014 at more than 380 million tonnes of CO₂ eq.¹). The shares of the other gases were as follows: CH₄ – less than 11%, N₂O – about 5% and F – gases slightly more than 2% [8]. Fig. 1 shows the sources of CO₂ emissions.

Fuel combustion has the overwhelmingly largest share of in CO₂ emissions (more than 91%). In 2014, the emissions from Category Industrial processes and product use represented less than 7% of the national emissions of this gas. Metal production had a slight share in the carbon dioxide emissions, i.e. about 3% (most of the emissions, i.e. more than 2%, were caused by fuel combustion in this industry, mainly in iron production, i.e. Category 1.A.2.a).

¹ CO₂ equivalent means a unit to which greenhouse gas emission levels are reduced with respect to the warming effect caused by carbon dioxide; global warming potentials (GWPs) defined for all greenhouse gases are used to recalculate GHG emissions to CO₂ eq.

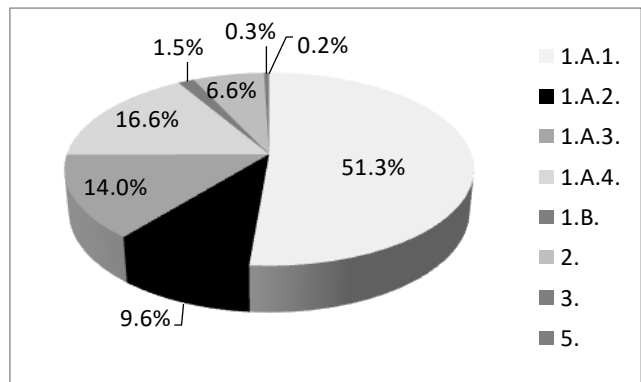


Fig. 1. Share of particular categories in CO₂ emission in Poland in 2014

3. The emissions of other selected air pollutants

Figs. 2-6 show the national emission levels of selected air pollutants: SO₂, total suspended particles (TSP), PCDD/F, Pb and Cd) in 2014 by major source categories [9].

In 2014, the national SO₂ emissions amounted to about 800,000 tonnes. Almost all the emissions of this gas were generated by fuel combustion (mostly coal) in stationary sources. The share of metal production in SO₂ emissions was 3.6%, resulting mostly from fuel consumption in iron production (Category 1.A.2.a).

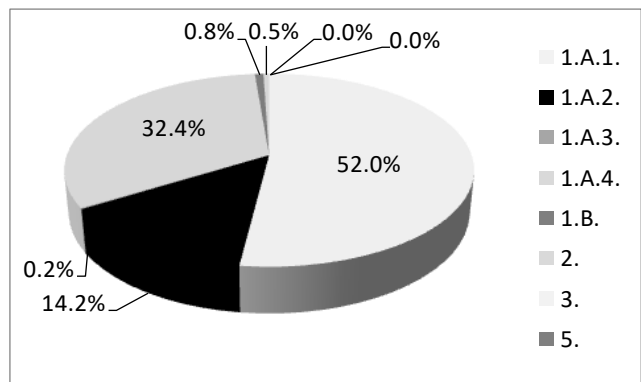


Fig. 2. Share of particular categories in SO₂ emission in Poland in 2014

In 2014, the emissions of total suspended particles amounted to 383,000 tonnes. In this case, too, fuel combustion processes (Fig. 2) were the main source, but, in contrast to SO₂, with quite a significant share of combustion in mobile sources (Category 1.A.3 Transport). It is estimated that more than 76% of the national TSP emissions in 2014 came from fuel combustion. The share of metal production in the national emissions was slightly more than 3% and represented mostly emissions from iron production.

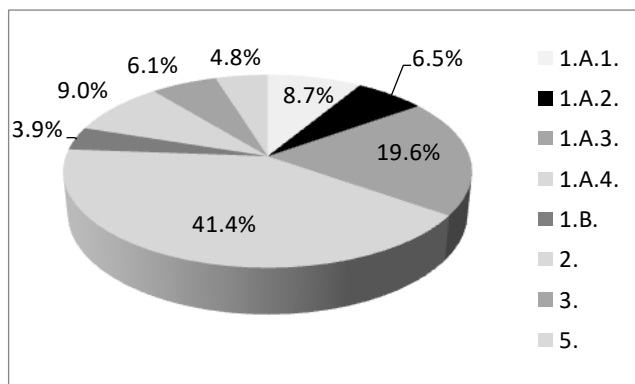


Fig. 3. Share of particular categories in TSP emission in Poland in 2014

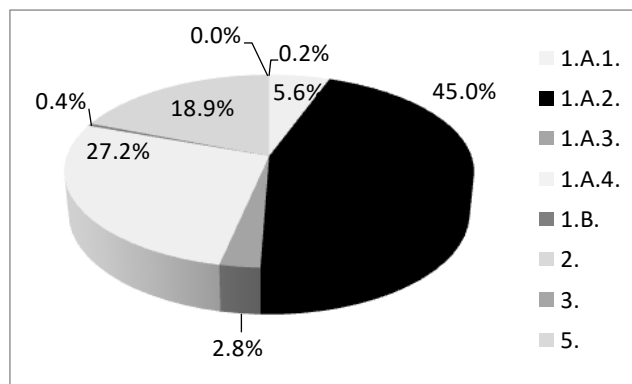


Fig. 5. Share of particular categories in Pb emission in Poland in 2014

Fuel combustion processes (Fig. 4) were the main source of dioxin and furan emissions estimated for 2014 at a level of 240.6 g I-TEQ². As a total, these processes generated more than 80% of the national PCDD/F emissions, including about 57% from fuel combustion at households alone. The share of metal production in the dioxin and furan emissions exceeded 18%, with almost equal contributions from iron production and non-ferrous metals production.

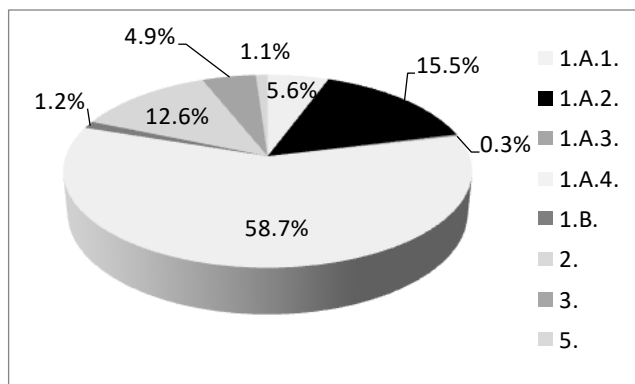


Fig. 4. Share of particular categories in PCDD/F emission in Poland in 2014

Metal production had a much a larger share in the national lead and cadmium emissions than in the case of the pollutants presented previously: more than 57% of the lead emissions estimated for 2014 at 517.7 tonnes and about 40% of the national cadmium emissions estimated at a level of 13.9 tonnes. Figs. 5 and 6 show the emissions of these metals by particular reporting categories.

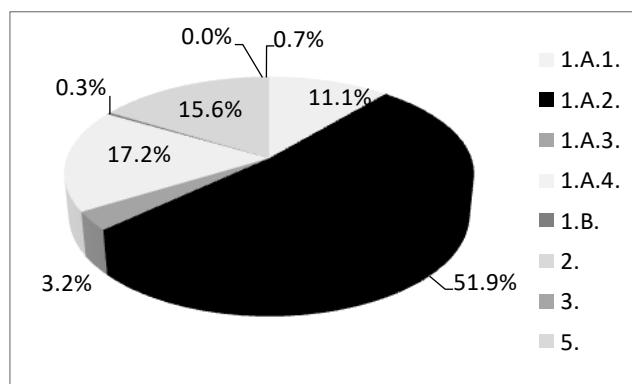


Fig. 6. Share of particular categories in Cd emission in Poland in 2014

4. Conclusions

In concluding on the results presented in this article, it can be said that metal production has a slight share in the emissions of such substances as CO₂, SO₂ and TSP, amounting barely to a few percent. The metal production sector has a larger impact on the national dioxin and furan emissions, where its share is already estimated at a dozen or so percent. In turn, in the case of the emissions of heavy metals (Pb and Cd), metal production is the main emission source. The shares of particular sectors in the national emissions of given pollutants are important, in view of the possible reduction measures and the determination in which industries they could bring about tangible results.

References

- [1] Dz.U. 1996 nr 53 poz. 238. United Nations Framework Convention on Climate Change, adopted in New York on May 9, 1992. (Official Journal of the Laws of 1996, No. 53, Item 238. United Nations Framework Convention on Climate Change, UN FCCC. New York, 9th May 1992.). (in Polish).

² I-TEQ- International Toxicity Equivalency Factor

- [2] Dz.U. 1985 nr 60 poz. 311. Convention on transboundary air pollution over long distances signed in Geneva on 13 November 1979. (Official Journal of the Laws of 28 December 1985, No. 60, Item 311. Convention on Long-range Transboundary Air Pollution, CLRTAP. Geneva, 13th of November 1979.). (in Polish).
- [3] Decision 24/CP.19. 2013. Revision of the UNFCCC reporting guidelines on annual inventories for Parties included in Annex I to the Convention. FCCC/CP/2013/10/Add.3.
- [4] ECE/EB.AIR/125. 2014. Guidelines for Reporting Emissions and Projections Data under the Convention on Long-range Transboundary Air Pollution. Economic and Social Council.
- [5] IPCC. (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). Published: IGES, Japan.
<http://www.ipcc-nggip.iges.or.jp/public/2006gl>
- [6] EMEP/EEA. (2013). *EMEP/EEA air pollutant emission inventory guidebook 2013*. European Environment Agency, Copenhagen. DOI:10.2800/92722.
<http://www.eea.europa.eu/publications/emep-eea-guidebook-2013>
- [7] Kargulewicz, I. (2016). Emission of CO₂, CH₄, N₂O and fluorinated gases from selected sector of industry. *Przemysł Chemiczny*. 95 (3). 441-444. DOI: 10.15199/62.2016.3.21
- [8] KOBiZE. (2016). *National Inventory Report 2016*. National Centre for Emissions Management in Institute of Environmental Protection – National Research Institute, Warsaw. Report is available on the website:
https://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/9492.php
- [9] KOBiZE. (2016). *Poland's Informative Report 2016*. National Centre for Emissions Management in Institute of Environmental Protection – National Research Institute, Warsaw. Report is available on the website:
http://www.ceip.at/ms/ceip_home1/ceip_home/status_reporting/2016_submissions