United Nations Institute for Training and Research

Mercury emissions from open burning of waste Geneva, 29 June 2018

Dear Sheila Logan and colleagues at the Minamata Convention Secretariat,

As part of the follow up from the first meeting of the Conference of the Parties to the Minamata Convention, UNITAR would hereby like to contribute with our observations regarding emissions from open burning of waste from our work with the Minamata Initial Assessments in many countries, as well as our work with waste in developing the UN Environment Mercury Inventory Toolkit.

As conveyed in the plenary at COP1, UNITAR has observed in its inventory assistance to many countries that open burning of waste is among the major mercury emissions sources, especially in countries with no non-ferrous mining activities or coal-fired power plants.

As the open burning issue will likely, among others, be investigated through the results from the national mercury inventories conducted with the methodology of the UN Environment Toolkit, we would like to bring the following to your attention:

The Toolkit works with two different approaches to quantifying mercury flows to waste treatment. One that is based on the estimated output of mercury from products and processes (is often under-estimated due to lack of data in developing countries), and the other one which works with input factors for mercury concentrations in relevant waste types, including municipal waste. In the general mode of using the Toolkit, it is the latter approach that is used for estimation of mercury emissions from open waste burning.

The input factor of the latter approach for municipal waste was at the time of the creation of the Toolkit based solely on data from developed countries, as no data from developing countries were available at that time (2004). The factor was set at 1-10 g/t waste, with a conservatively set intermediate value of 5g/t, considering that on-going substitution of mercury-added products in developed countries would be ahead of the substitution in developing countries, where the cheaper mercury-added products were still not regulated and the mercury-free alternatives were generally not in demand, and where there is no or little segregation of mercury-containing waste.

UNITAR is currently conducting an update for UN Environment of the Toolkit, expected to be finalised by the end of 2018. Preliminary collection of data in spring 2018 on mercury concentrations in municipal waste in developing countries for this work, supported by data from UN Environment's data on open waste burning (Honda et al., 2018), and from the Global Mercury Assessment work (Kindbom et al., 2018), indicate that the average mercury concentrations in the developing countries from which data on this subject have been published (mainly China, and a bit on Thailand and India) may be in the low end of the Toolkit default input factor range, that is, around or even below 1g/t waste.

Sheila Logan, Programme Officer,
Secretariat of the Minamata Convention on Mercury,
UN Environment Programme,
International Environment House 1, Geneva, Switzerland

While this work is still in progress, and additional data is needed from other parts of the developing world, it should be safe to say with some certainty that the mercury emission estimates from open waste burning based on the Toolkit may in some cases be overestimated. In some recent cases, where UNITAR has assisted countries' inventory efforts on The Toolkit's Inventory Level 2 (where estimation factors can be adjusted to local conditions), the input factors have been adjusted accordingly to 1 g/t waste).

Another massive uncertainty in this calculation is the amount of municipal waste burned nationally and globally. Nationally, authoritative data on this issue are not available, as open waste burning is mostly informal, and never registered in detail. Estimates have in some case been developed for waste management planning, for uPOP inventories (under the Stockholm Convention work), or for climate emissions inventories under the Kyoto Protocol.

To illustrate the order of magnitude of mercury emissions from open waste burning however, it may be useful to look at a global study on emission of trace gasses from open waste burning conducted by Wiedinmeyr et al. (2014). The study applies available national or regional experience estimates on amounts of municipal waste produced per capita in combination with municipal waste collection rates, and a set of assumptions developed by the IPCC (2006) for greenhouse gas emission inventories. Thereby they reach an estimate for global amounts of municipal waste burned informally plus waste burned in controlled landfills (where fires can happen spontaneously from ignition of landfill gas, or be initiated on purpose to reduce waste amounts). Wiedinmeyr et al. (2014) combines this waste amount with an emission factor of 0.208 (+/-0.13) g Hg/t waste from one study in China (Chen et al, 2013), and reach a resulting estimate for mercury emissions from open waste burning of 204 tonnes Hg/y.

It is worth noting the major uncertainties in the study by Wiedinmeyr et al. (2014):

- The estimates used for municipal waste generation are uncertain, and in many cases aged, indicating that they could potentially underestimate the waste amounts generated.
- The study applies an assumption (from the IPCC manual) that 100% of the waste in rural areas is burned informally and that 100% of the un-collected waste in urban areas is burned informally, and in addition to this comes any burning of collected waste in landfills/dumps. While the fraction of uncollected waste being burned is no doubt high in many developing countries, this may likely be an overestimation.
- The emission factor used (from China, Chen et al, 2013) is in fact an emission factor from modern technical waste incineration facilities with air pollution control filters, and the relevance of the factor for open waste burning can thus be questioned.

Our (very) preliminary estimate of average mercury concentration in municipal waste in developing countries, where open burning is most prevalent, is in the range of 0.6-1.9 g Hg/t waste (to be further worked on). Now, currently no studies have been identified on what fraction of mercury is emitted to the atmosphere per tonne of waste burned openly. Mercury's boiling temperature is 356.7 degrees Celsius, and emissions will even start happening below that temperature (as the vapour pressure increases with increased temperature even below the boiling point). If it is assumed, as seems reasonable, that 356.7 degrees Celsius can easily be reached in open waste burning, it seems likely that most of the mercury may be emitted when municipal waste is burned openly. This is also the assumption in the Toolkit, where – for simplicity, given the lack of precise data – 100% of the mercury present is considered as emitted from open waste burning.

As a very preliminary conclusion, based on the considerations above, in combination with knowledge of the estimated mercury demand over the years, the total emission could very well be larger than estimated by Wiedinmeyr at al. (and the draft GMA 2018), possibly in the range of some 200-600

tonnes Hg/y, including mercury from trace concentrations in other materials than mercury-added products (the estimate can be refined further based on existing data). Even in case the actual emissions from open waste burning are in the low end of this interval, the numbers underline that this is indeed a significant mercury emission source in the global perspective, that is worth investigating in more detail with a view to inform considerations on including reduction of open waste burning in the Minamata Convention.

We hope that you may find the provided information of relevance, and we remain available, should the Secretariat wish to involve UNITAR in the further investigations of this issue.

With the best wishes,

Jakob Maag
Senior Specialist

Chemicals and Waste Management Programme Unit
Division for Planet

United Nations Institute for Training and Research (UNITAR)
Palais des Nations, CH-1211 Geneva 10, Switzerland
Mobile: +45 2428 6449
Direct: +45 7575 7565
Back-up: +41 (0)22 917 8392 | Email: Jakob.MAAG@unitar.org / CWM@unitar.org
Website: www.unitar.org | www.learnatunitar.org | www.unitar.org/event

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