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International POPs Elimination Network
Dioxin, PCBs and Waste Working Group
Keep the Promise at COP5

Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases

An IPEN Perspective

April 2011

Since COP4, notable progress has been made in revising and updating of the Dioxin Toolkit, as reported in UNEP/POPS/COP.5/11 and further detailed in UNEP/POPS/COP.5/INF/6. However, more must be achieved if the goals of the Stockholm Convention are to be met.

Source Identification Strategy

The revised Toolkit is to have a simple strategy for identifying dioxin sources not listed in the Toolkit, as has been requested in the past by Parties and NGOs. As described in the restricting plan detailed in UNEP/POPS/COP.5/INF/6, the revised Toolkit will include a source identification strategy in the first of its three major parts: "*Part I provides general guidance on identifying sources and calculating emissions of unintentional POPs, containing a simple but comprehensive procedure for identifying sources of PCDD/PCDF, including but not limited to the source categories listed in Annex C, Parts I and II …*"

Emission Factors

Many dioxin emission factors have been confirmed, revised and/or newly developed within the following source groups:

2 – Ferrous and non-ferrous metal production;
3 – Power and heat generation;
4 – Production of mineral products; and
6 – Open burning processes.

Of all the new emission factors, those in Source Group 6 – Open Burning Processes, specifically the new emission factors for forest fires, agricultural burning and open burning of domestic waste, are likely to have the greatest impact on national and regional estimates of total dioxin releases and the identification of their most important sources.

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Until now, many countries that rely on the Toolkit's emission factors have found that their most important dioxin sources are forest fires, agricultural burning and open burning of domestic waste.[1] This can be expected change with the new emission factors, most of which are smaller, as follows: [a]

- Forest fires: the new air emission factor is five times smaller, and the new emission factor for release to land is 26 times smaller;
- Agricultural burning
  - With no pesticide contamination and favorable conditions, the air emission factor is unchanged, but the new land emission factor is 200 times smaller;
  - With pesticide contamination and unfavorable conditions, both the air emission factor and the land emission factor are unchanged;
- Open burning of domestic waste: the new air emission factor is 7.5 times smaller, and the new land emission factor is 600 times smaller.

The overall impacts of the new, revised emission factors for forest fires, agricultural burning and open burning of domestic waste are 1) estimated dioxin releases from these sources will be smaller, 2) their rankings and those of all other sources are likely to change, and 3) total estimated dioxin releases will be reduced.

Prioritizing Source Groups for Further Development

1. Source Group 7 – Production and Use of Chemicals and Consumer Goods

Among the Toolkit's ten source groups, Source Group 7 - Production and Use of Chemicals and Consumer Goods – has perhaps the greatest need for more detailed, thorough development.

Many dioxin sources have been identified elsewhere but are not yet listed or otherwise specifically addressed in the Toolkit. If these as-yet unlisted sources are included in the Toolkit, it can be expected that most will be placed in Source Group 7.

Among the dioxin sources not yet listed or discussed in the Toolkit the following:

- In Japan, dioxins were reported as byproducts of these processes:[2]
  - Production of caprolactam, an intermediate material in nylon production,
  - Manufacture of monochlorobenzene, [2]
  - Acetylene production via the carbide process; and
  - Alumina fiber production. [2]
- In Sweden, dioxins were reported as byproducts of rubber production.[3]
- In China, production of triclosan, an anti-microbial used in soaps, toothpaste and other consumer products, has been identified as one of that country's largest dioxin sources,[4] and triclosan has been found to photodegrade in the environment to form dioxins.[5]

[a] The new emission factors for forest fires, agricultural burning and open burning of domestic waste correspond quite closely to those that were presented by IPEN at COP2.

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- In the Netherlands, a recent study of the industrial chlorine chain found dioxins in at least a dozen chemical products, including the following: [6]
    - Chloroprene rubber (neoprene),
    - Epichlorohydrin,
    - Hydrogen chloride (HCl), and
    - Trichloroethylene .
- Chinese scientists reported dioxins in these products: [7]
    - Chloranil, and
    - Phthalocyanine green and phthalocyanine copper, which are used in industry as well as in toys and ornaments.

Dioxins are also formed as byproducts during the manufacture of numerous pesticides and are known to occur as contaminants in pesticides. In a recent study in Australia, dioxins were present at quantifiable levels in all pesticides that were analyzed – 23 pesticides in current use and 4 obsolete pesticides. Highest dioxin concentrations were found in the following pesticides, in order of decreasing concentrations: [8]

- 2,4,5-T (obsolete)
- Pentachloronitrobenzene (PCNB, also known as quintozene)
- 2,4-DB,
- Chlorothalonil,
- Lindane,
- Chlorthal,
- 2,4-D,
- Chlordane/heptachlor (obsolete), and
- Chlordane (obsolete)

In the same study, researchers estimated that current use in Australia of only one pesticide, pentachloronitrobenzene, was accompanied annually by release into the environment of a quantity of dioxins comparable in magnitude to that of the country's fifth largest dioxin source. [8]

Dioxins have also been reported as byproducts in the manufacture of other pesticides and as contaminants in other pesticides as well:

- In China, scientists have reported that dioxins are formed as byproducts during the manufacture of dicofol, [9]
- In Japan, dioxins were found as contaminants in the pesticides nitrofen and chloronitrofen, [10] and
- The U.S. Environmental Protection Agency lists more than 150 pesticides as having the potential to contain dioxins as contaminants when they are manufactured under conditions favoring dioxin formation. [11]

Whether the facilities that manufacture dioxin-contaminated pesticides are themselves dioxin sources depends, of course, on the design, operation and oversight of each facility. However, their status as potential dioxin sources depends strongly on the effectiveness of the methods use to manage the gaseous, liquid and solid residues from their processes. In any case, it has been well-established that past production and use of chlorine-based chemicals and pesticides has left a global legacy of dioxin-contaminated "hot spots" in industrialized countries. [12,13]

2. Source Group 10 – Hot Spots

The need for prioritizing the comprehensive, detailed development of Source Group 10 – Hot Spots – is established clearly in the following statement by Weber et al. (2008): [12]

> *"Even today, few historical PCDD/F emissions have been inventoried or estimated. But the cases that are known illustrate that the key historic Dioxin sources far exceed the releases from all contemporary sources. Since PCDD/Fs stored in soil/sediment and waste reservoirs persist over decades or even centuries, these legacies represent a large proportion of the global Dioxin contamination today. … However, as Dioxins persist in the environment, and contaminated soil/sediment can represent a secondary source to the food chain, these legacies will often remain of contemporary and future relevance. This has been recognised by the US EPA, who suggest that Dioxins from contaminated sites/hot spots will soon become the major source of contemporary pollution (US EPA 1994)."*

Much of the information gathered in a thorough development of Source Group 7 - Production and Use of Chemicals and Consumer Goods – will be equally useful in the revision of Source Group 10 – Hot Spots.

IPEN Recommendation

IPEN recommends that Parties request the Toolkit Expert Group to give high priority to thorough, detailed development of Source Group 7 - Production and Use of Chemicals and Consumer Goods and Source Group 10 – Hot Spots.

EndNotes:

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[2] Kawamoto, K., 2002. New sources of dioxins in industrial processes and their influences on water quality. Organohalogen Compounds 56: 229-232.
[3] Lexen, K., et al., 1993. Polychlorinated dibenzo-p-dioxin and dibenzofuran levels and patterns in samples from different Swedish industries analyzed within the Swedish Dioxin Survey. Chemosphere 27: 163-170.
[4] Zheng, G., et al., 2008. Polychlorinated dibenzo-p-dioxins and dibenzofurans pollution in China: Sources, environmental levels and potential human health impacts. Environment International 34: 1050-1061.
[5] Buth, J., et al., 2010. Dioxin photoproducts of triclosan and its chlorinated derivatives in sediment cores. Environ. Sci. Technol. 44:4545–4551.
[6] van Hattum, B., et al., 2004. Evaluation of current emissions of chlorinated microcontaminants from the Dutch chlorine chain. Final technical report of the Chlorine Chain Follow-up research programme on Chlorinated Organic Microcontaminants (OVOC). IVM, Vrije Universiteit, Amsterdam, 126 pp.
[7] Ni, Y., et al., 2005. Distribution patterns of PCDD/Fs in chlorinated chemicals. Chemosphere 60:779–84.
[8] Holt, E., et al., 2010. Polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/Fs) impurities in pesticides: A neglected source of contemporary relevance. Environ. Sci. Technol. 44*:* 5409–5415.
[9] Li, S., et al., 2009. Pops release in the dicofol production process. Dioxin 2009, Beijing, China, August 25-28, 2009. Organohalogen Compounds.
[10] Masunaga, S., et al., 2001. Dioxin and some dioxin-like PCB impurities in Japanese agrochemicals. Chemosphere 44: 873-885.
[11] U.S. Environmental Protection Agency, 2005. The Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the United States: The Year 2000 Update (External Review Draft) - Chapter 8: Chemical Manufacturing and Processing Sources. http://www.epa.gov/ncea/pdfs/dioxin/2k-update/.
[12] Weber R, et al., 2008. Dioxin – Contemporary and Future Challenges of Historical Legacies (Editorial, dedicated to Otto Hutzinger). Env. Sci. Pollut .Res. 15: 96–100.
[13] Weber, R., et al., 2008. Dioxin- and POP-contaminated sites—contemporary and future relevance and challenges. Environ. Sci. Pollut. Res. 15:363–393.

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