GLOBAL POPS TREATY AND QUALITY CRITERIA FOR INTERNATIONAL POPS MANAGEMENT

NEEDS AND WAYS TO ESTABLISH COMPLETE AND COMPARABLE DIOXIN INVENTORIES

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INTRODUCTION

Worldwide there are only a few national inventories reporting releases of polychlorinated dibenzo-*p*-dioxins and polychlorinated dibenzofurans (PCDD/PCDF). A review by UNEP Chemicals in 1999 [1] identified only 15 national inventories, nearly all from developed Northern countries. Since that date, one more inventory has been completed and published for New Zealand [2].

The global convention on persistent organic pollutants (POPs) presently under negotiation, is expected to require minimization of releases of PCDD/PCDF [3]. Therefore, dioxin sources must be quantified and the methodology used to assess sources must be consistent in order to follow or monitor dioxin releases over time and between countries.

Existing PCDD/PCDF inventories are not satisfactory for these purposes as they were not compiled in a comparable form. Not all inventories consider all known sources, some examine only industrial sources and some are limited to a small subset of sources, there is no consistent means of handling and presenting data and some are out of date. This has led to the situation in which some inventories do not address potentially important sources of PCDD/PCDF, perhaps because there was insufficient information on a national basis, leading to the misleading conclusion that these sources are not significant and hindering the development of effective controls. Further, only a few inventories addressed releases other than to air.

Starting in 1999 and running through the year 2000, UNEP Chemicals will operate a capacity building program and hold training workshops to assist countries in the preparation for the POPs Convention [3]. In order to assist countries to identify sources of dioxins and furans and to estimate the amount of their releases into the environment, UNEP Chemicals has initiated this project for the development of a "Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases" in a consistent and resource effective manner.

MATERIALS AND METHODS

The "Toolkit" was assembled using the accumulated experience of inventory compilation for countries, regions and in depth assessments of source categories. The framework was developed by a core team in consultation with end users from countries wanting assistance in compilation of inventories.

RESULTS

This project was designed to produce a simple and standardized methodology and accompanying database (the "Toolkit") to enable the reasonably straightforward assembly of national and regional PCDD/PCDF inventories, which are consistent with each other.

The key criteria are that the compilation of the inventories should be consistent, resource efficient (*i.e.* not too time consuming to assemble) and accurate enough to reliably identify the major sources and the key data deficiencies. No emission testing is necessary to apply the toolkit and to compile an inventory.

The process is also designed to be adaptable and responsive to new and improved data where these are currently lacking. For this reason the main emphasis is on the collection of information that enables relevant processes and industries to be well described. The emission factor database may be revised and improved as new emission data emerges and the new figures may be applied to improve the overall inventory. As with any dynamic process, the inventory has to be updated and revised as new data become available or processes change.

The key elements of this "Toolkit" are:

- The entire process of compiling an inventory should be straightforward, resource efficient and sufficiently accurate to assess the magnitude of the major releases and to identify the important data gaps.
- An effective methodology for identifying the relevant industrial and non-industrial processes releasing PCDD and PCDF in a country and screening these to identify the most important
- Clear guidance on the gathering of information about the relevant processes, which will enable classification of the processes into classes with similar emissions.
- A detailed database of emission factors which provide suitable default data to be applied which is representative of the class into which processes are grouped. This database could be updated in future as new emission data becomes available.
- Guidance on the assembly of an inventory and presentation of the findings using both the default emission factors and any country specific data so that the resulting inventories may be compared to each other. The presentation of the data will allow for data gaps and will indicate ranges of emissions where accurate classification cannot be achieved to assist in prioritizing further actions.
- Information on release of PCDD/PCDF is related to the following general five compartments and/or media into which PCDD/PCDF are released or transferred: air, water, land, waste (residues), and products. For a comprehensive approach, all PCDD/PCDF must be considered (although it does not follow that releases to all compartments have an equal impact).

The basic principle is to gather "activity statistics" – describing the amount of a process for example in tons of steel produced per year, and the "emission factor" which gives release of PCDD/PCDF to each medium per unit of activity (*e.g.* µg I-TEQ/ton) – combining the two gives annual emissions.

The framework is applied and the inventory produced by taking the five steps shown in Figure 1. The screening matrix (see Table 1) indicates the 10 major source categories and includes industrial and non-industrial sources as well as reservoirs and contaminated sites. For each main category a listing of subcategories indicates the detailed process activities. Within each process type key parameters or process characteristics are provided which enable the emissions (to all media where data are available) to be assigned. For example within the category "metal processing", sub-category "aluminum production from scrap" three classes of processes are be distinguished based on the technology applied and the controls in place – the emissions from these three categories are very different. The intention is that the end user can use relatively easily accessible plant and process information to adequately and simply select an emissionfactor which will describe the emissions from that broad technology.

The process of gathering the detailed information on the processes carried out within the country will be tailored to the situation and may range from accessing central statistical data to a plant by plant questionnaire. Example questionnaires are provided which enable the crucial characteristics of processes to be assembled to help a user make process categorization and select appropriate emission factors from the database.

Once activity statistics are available ranges of potential releases can be made by applying the highest and lowest emission factors to the overall activity such information can help to prioritize areas for more detailed data gathering.

Guidance is provided on the presentation of the results with the intention that inventories are clear, consistent and comparable. The results are also designed to be amenable to updating and improvement as additional information becomes available either on the processes in a country or in the form of better emissions factors.

Where measured data are available or national estimates have been made the toolkit is designed to allow for their inclusion alongside the estimates made by application of the default emission factors. This should help to rapidly show where there are data gaps or uncertainties and differences between processes in one country and emission factors generated from the international literature.

The final country inventories would clearly show that all potential sources have been addressed (even if it is to conclude that the activity does not exist or is insignificant) to remove one element of doubt in comparing inventories. For each source within a country there would be an estimate of releases to all media where data are sufficient and an indication of likely magnitude if full data are unavailable. Additional information should be included such as plans for upgrading of processes or imminent closure of plants – all of which should help in the interpretation of the results and the prioritization of future actions.

1. Apply Screening Matrix to identify Main Source Categories in the Country

2. Check subcategories to identify existing sources and get initial estimate of activity

3. Gather detailed information on processes – eg by applying Standard Questionnaire to obtain information on sources - to choose the characteristic parameters for emission factors

4. Quantify identified sources with default/ measured emission factors

5. Apply nation-wide to establish full inventory following guidance on presentation of findings

Figure 1: The recommended five step approach to establish standardized PCDD/PCDF source inventories

Table 1: Screening Matrix – Main Source Categories

No.	Categories and Subcategories	Air	Water	Soil	Product	Residue
1	Waste Incineration	X				X
2	Ferrous and Non-Ferrous Metal Production	X				X
3	Power Generation and Heating	X		X		X
4	Production of Mineral Products	X				X
5	Transport	X				
6	Uncontrolled Combustion Processes	X	X	X		X
7	Production of Chemicals and Consumer Goods	X	X		X	X
8	Miscellaneous	X	X	X	X	X
9	Disposal	X	X	X		X
10	Identification of Potential Hot-Spots	Probably registration only to be followed by site-specific evaluation				

DISCUSSION

At the outset it is very important to recognize that our experience with assembling inventories of PCDD/PCDF is based almost exclusively on the "developed industrialized" countries. An assessment of the important sources of PCDD/PCDF in other countries cannot assume that the same sources will be found or that the same rank order of sources can be expected. Consequently for effective actions to be developed a comprehensive and inclusive approach to inventory compilation is required.

The majority of emissions data that is available has been measured on well controlled, identifiable point sources. It is much harder to provide estimates of emissions from processes, which have lower levels of pollution control, less operational controls or are generally small and dispersed. Consequently emission factor estimates for these types of processes are more uncertain.

Inventories of PCDD and PCDF will always be subject to uncertainty since emissions can be highly variable. It is crucial that existing as well as additional data gathered within and between large and diverse geographical regions is comparable to allow a rigorous assessment.

UNEP clearly recognizes that the process of assembling inventories can be complex with many stakeholders involved. It is therefore intended that the Toolkit is used in conjunction with a series of training workshops and other information to be produced by UNEP that will assist in the assessment and addressing of the challenges posed by PCDD/PCDF.

The default emission factors are designed to be representative of a class of process and therefore are meant to reflect the average emissions of all the processes in each class. It is not possible to use the emission factor to indicate the actual emissions from a particular process or facility since there is considerable variation from one plant or process to another over time and within nominally similar processes.

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