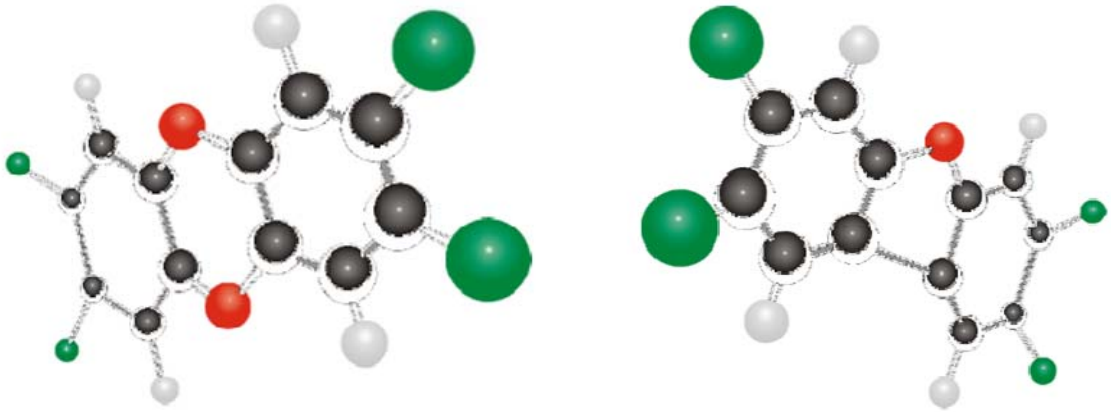
Toolkit



for Identification and Quantification of Releases of Dioxins, Furans and Other Unintentional POPs

under Article 5 of the Stockholm Convention

January 2013

This publication is intended to assist countries to establish release inventories of polychlorinated dibenzo-*p*-dioxins and dibenzofurans at a national or regional level. The information contained in this report comes from published scientific literature, government reports, Internet sources, and through personal communication. The designations employed and the presentations in this document do not imply any expression of opinion on behalf of UNEP or contributory organizations. UNEP or contributory organizations cannot be liable for misuse of the information contained in this publication.

PREFACE

One of the major goals of the Stockholm Convention on Persistent Organic Pollutants (POPs) is the continuing minimization and, where feasible, ultimate elimination of unintentionally produced POPs. Parties are required to identify, characterize, quantify and prioritize sources of releases of unintentionally produced POPs, and develop strategies with concrete measures, timelines and goals to minimize or eliminate these releases.

To support Parties in meeting these obligations, a methodology has been developed to ensure that source inventories and release estimates are complete, transparent, as well as consistent in format and content. It allows Parties to compare results, identify priorities, mark progress and follow changes over time at the national, regional and global levels.

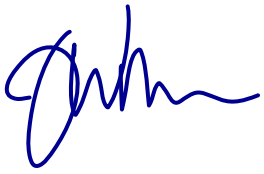
The Standardized Toolkit for Identification and Quantification of Dioxin and Furan Releases was first published in 2003 and revised in 2005. In 2006, the Conference of the Parties to the Stockholm Convention welcomed the second Toolkit edition and recognized its usefulness. At the same time, Parties acknowledged the need for its ongoing revision and updating, placing emphasis on key sources for which limited data were available and on providing support to developing countries in their efforts to verify their emission factors. Parties also requested overall improvement of the usefulness and user friendliness of the Toolkit.

The revision process was open and inclusive, involving experts nominated by Parties as well as by nongovernmental organizations and industry associations, and in cooperation with UNEP Chemicals.

The Toolkit is the most comprehensive available compilation of emission factors for all relevant PCDD/PCDF sources. It is useful particularly in countries where measurement data are limited, enabling the elaboration of source inventories and release estimates by using the default emission factors. It is also useful in countries where national measurement data are available, as a reference document for data comparison and validation purposes.

The Conference of the Parties at its fifth meeting in 2011 welcomed these revisions and updates, and Parties were encouraged to use the additional guidance.

This edition of the Toolkit contains all new information, as well as model inventories illustrating relevant processes. In addition, the entire Toolkit is now available in an interactive electronic version, with information structured according to the level of technical detail. With these improvements, we hope the Parties will find the new Toolkit edition more useful and user friendly than ever.



Jim Willis
Executive Secretary

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All experts nominated by parties and others, included in the Toolkit Expert Roster, were involved in the Toolkit review and updating process at least by electronic means. The following experts are gratefully acknowledged for their substantial contribution to the development of this document.

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Input into the Toolkit revision has also been received via projects implemented thanks to donor support and in-kind contributions such as the project on brick kilns led by the European Commission's Joint Research Centre, projects to determine emission factors for open burning of biomass and waste funded by Sweden, the World Chlorine Council and other donors, as well as through national projects such as those dedicated to household heating and cooking led by Germany, metallurgy sector led by France, Japan and China, and evaluation of simple stoves led by Mexico. Funding from the European Commission allowed the implementation of the Toolkit revision process, through organization of annual expert meetings.

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Abbreviations and Acronyms

2,4,5-T	2,4,5-Trichlorophenoxyacetic acid
°C	Degrees Celsius
a	Year (annum), 365 days
ADt	Air-dried ton (of pulp)
APC(S)	Air pollution control (system)
BAT	Best available techniques
BEP	Best environmental practices
BF	Blast furnace
BOF	Basic oxygen furnace
BOS	Basic oxygen steel
C	Chlorination bleaching stage using molecular chlorine dispersed dissolved in water (pulp and paper production)
CCMS	Committee on Challenges of Modern Society
CHP	Combined heat and power
CF	Cupola furnace
CLRTAP	Convention on Long-range Transboundary Air Pollution
CNP	2,4,6-Trichlorophenyl-4'-nitrophenyl ether
COCHILCO	Comisión Chilena del Cobre (Chilean Copper Commission)
CORINAIR	Core inventory of air emissions
CTMP	Chemo-thermo-mechanical pulp
CUF	Capacity Utilization Factor
D	Chlorine dioxide bleaching stage using a water solution of chlorine dioxide (ClO_2) (Section on pulp and paper production)
DCB	Dichlorobenzene
dl-PCB	dioxin-like Polychlorinated Biphenyls
DL	Detection limit
d.m.	Dry matter
E	Extraction bleaching stage using sodium hydroxide (NaOH)
EAF	Electric arc furnace
ECF	Elemental chlorine free (bleaching)

ECVM	European Council of Vinyl Manufacturers
EDC	1,2-Dichloroethane
EMEP	Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe
EPA	Environmental Protection Agency
ESP	Electrostatic precipitator
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Global Environment Facility
h	Hour(s)
H_2SO_4	Sulfuric acid
ha	Hectare(s)
HCB	Hexachlorobenzene
HW	Hazardous waste
I-TEF	International Toxicity Equivalency Factor
I-TEQ	International Toxic Equivalent
IF	Induction furnace
IPCS	International Programme on Chemicals Safety (of the World Health Organisation)
IPPC	Integrated Pollution Prevention and Control (of the European Union)
ISO	International Organization for Standardization
K	(Degree) Kelvin
kPa	Kilo Pascal (= one thousand Pascal)
L	Liter
LPG	Liquefied petroleum gas
LOI	Loss of ignition (a measure for residual carbon content)
LoC	Level of Confidence
LOQ	Limit of quantification
LPG	Liquefied petroleum gas
LS	Liquid steel

m	Meter
m^3	Cubic meter (typically under operating conditions without normalization to, *e.g.*, temperature, pressure, humidity)
Mg	Magnesium but see also: megagram (under units)
MSW	Municipal solid waste
NA	Not applicable (not a relevant release vector)
NaOH	Sodium hydroxide
Na_2S	Sodium sulfide
NATO	North Atlantic Treaty Organization
NCASI	National Council (of the Paper Industry) for Air and Steam Improvement, Inc.
N-TEQ	Toxic equivalent using the Nordic scheme (commonly used in the Scandinavian countries)
ND	Not determined/no data (in other words: so far, no measurements available)
NFR	Nomenclature For Reporting
NIP	National Implementation Plan (under the Stockholm Convention on Persistent Organic Pollutants)
Nm^3	Normalized (standard) cubic meter; the volume a gas occupies at atmospheric pressure (1,013 mbar) and 273.15 K (0°C)
o	ortho
O	Oxygen bleaching stage (pulp and paper production)
OECD	Organisation for Economic Co-operation and Development
OSPAR	Commission for the Protection of the Marine Environment of the North-East Atlantic
p	para
PARCOM	Paris-Oslo Commission
PCB	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzo-*p*-dioxins
PXDD	Polyhalogenated dibenzo-*p*-dioxins
PCDF	Polychlorinated dibenzofurans
PXDF	Polyhalogenated dibenzofurans
PeCBz	Pentachlorobenzene

PCP	Pentachlorophenol
PCP-Na	Sodium pentachlorophenol
POPs	Persistent organic pollutants
PRTR	Pollutant Release and Transfer Register
PTS	Persistent toxic substances
PVC	Polyvinyl chloride
RDF	Refuse derived fuel
rpm	Revolutions per minute
SCR	Selective catalytic reduction/reaction
SI	International system of units
SNAP	Selected Nomenclature for Air Pollution
t	Ton (metric)
TCB	Trichlorobenzene
TCF	Totally chlorine free (bleaching)
TEF	Toxicity Equivalency Factor
TEQ	Toxic Equivalent Note: For the purpose of the Toolkit, there is no difference if concentrations or emission factors are reported in I-TEQ or N-TEQ or WHO-TEQ (for PCDD/PCDF only)
TMP	Thermo-mechanical pulp
TRI	Toxics Release Inventory
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
URL	Uniform Resource Locator (the global address of documents and other resources on the World Wide Web)
UV	Ultra-violet
VCM	Vinyl chloride monomer
VSK	Vertical shaft kilns

WEC	World Energy Council
WHO	World Health Organization

Units

SI Units

g	gram	10^0 g		
kg	kilogram	10^3 g		
t	ton	10^6 g (1,000 kg)	also Mg	Megagram
kt	kilo-ton	1,000 t		
mg	milligram	10^{-3} g		
µg	microgram	10^{-6} g		
ng	nanogram	10^{-9} g		
pg	picogram	10^{-12} g		
fg	femtogram	10^{-15} g		

kJ	Kilojoule	10^3 Joule
MJ	Megajoule	10^6 Joule
GJ	Gigajoule	10^9 Joule
TJ	Terajoule	10^{12} Joule

MW	Megawatt
MWh	Megawatt hour

Pa	Pascal	
kPa	kilopascal	10^3 Pascal

Non-SI Units

Gallon	1 gal	=	0.1337 ft^3	=	0.0038 m^3
pound	1 lb.	=	0.4536 kg		
inch	1 in	=	2.54 cm	=	0.0254 m

Definitions

Unintentional POPs Throughout the document, the term “unintentional POPs” will be used to address the persistent organic pollutants that are listed in Annex C Part I of the Stockholm Convention.