France

Description of available information

Until 1996 there were only a few informations available on PCDD/F emissions from installations in France. In 1992 CITEPA ‹1› published an emission inventory solely based on emission factors taken from literature; however, this report covered only a limited list of sources. Applying activity rates valid for 1990 a total emission of about 900 g I-TEQ/a was calculated. The main part of this emission was assigned to municipal waste incineration.

During the last years some efforts had been made to get more reliable data about dioxin emissions particularly from waste incineration and the metallurgical sector. An updated preliminary inventory was released by ADEME and the „cercle 2-3-7-8“ in 1996 ‹2› It comprises measurement results obtained at waste incineration plants and combustion facilities. Furthermore, using emission factors from literature emissions of facilities in the iron and steel industry and the non ferrous metal industry were estimated. All data presented relate to air emission only; the authors recommended to spend more effort in the evaluation of emissions associated with contaminated products.

As to the total emission, no considerable change is observed compared to the previous estimations. However, the contributions of the various source types shifted with the metallurgical sources being more important now than MSW incineration. This view is to be qualified by the fact, that nearly nothing is known about the real emissions from small waste incineration facilities (see 09 02 01). It should be noticed, that these plants probably will be closed down until the year 2000.

The authors of the new French inventory emphasise the urgent need of performing measurement programs at plants in the metal producing sectors.

CORINAIR SNAP	ITEM	Emission estimates g I-TEQ/a		
		typ	min	max
	SUM	**620.9**	**270.0**	**2700.0**
01	Combustion in Energy Production and Energy Transformation	0.0	0.0	0.0
02	Combustion in Commercial, Residential...	nd	nd	nd
03	Combustion in Industry	457.5	220.0	2200.0
04	Production Processes	nd	nd	nd
05	Extraction and Distribution of Fossil Fuels	nd	nd	nd
06	Solvent and Other Product USE	nd	nd	nd
07	Road Transport	nd	nd	nd
08	Other Mobile Sources and Machinery	nd	nd	nd
09	Waste Treatment and Disposal	163.4	50.0	500.0
10	Agriculture, Forestry, Land use change	nd	nd	nd
11	Nature	nd	nd	nd
12	Fires	nd	nd	nd

F: Annual PCDD/F AIR emissions (nd: no data available)

Detailed data sorted out by CORINAIR '94 codes

03 / 07 / 09
Combustion in industry / road transport and waste treatment

Except MSW incineration, the French inventory comprises only a few data on flew gas concentrations, emission factors and related annual emissions. Measurements had been performed taking 35 samples at 13 sites.

Regarding installations in the metal industry emission factors according to German data ‹3›, marked by * in the table] and VDI (reference not mentioned, marked by ** in the table) were used. The authors were aware of the problems associated with this procedure and recommended to be „cautious on the result obtained“.

Generally no information was given about the activity rates used for emission estimation. Therefore an aggregated form is chosen for this study to present these data. The table on the next page gives a complete overview including the data concerning waste incineration that are described in detail afterwards.

Snap code	Item	Subgroup	Measurements	Flew gas conc. [ng I-TEQ/m³]	emission factor (range) [µg I-TEQ/t]	annual emissions [g I-TEQ/a]	remark
03 01	industrial combustion	Coal	yes	0.060	?	9	maybe partly
		Oil	no	-	?		measured at
		wood	yes	0.015 (0.011-0.019)	?	1	power plants
		biogas	yes	0.07	?	?	
03 03 01	sinter plants		no	?	18 (10-100)	400 (220-2,200)	EF taken from German publ.
03 03 03	iron foundries		no	?	10*	20	
03 03 08	sec. zinc prod.		no	?	400-700*	7	
03 03 09	sec. copper prod.		no	?	650*	10	
03 03 10	sec. Aluminium smelter		no	?	50*	10	
03 03 11	Cement	dry type, with waste inc.	yes	0.053	?	0.5	
03 03 12	Lime furnaces		yes	0.06	?	?	
07	Road transport	leaded fuel	no	-	0.74 **		
		unleaded fuel			0.02-0.09** (ng I-TEQ/l)	1-5	
09 02 01	MSW incineration		yes	3.2 (0.7-14.8)	15.7 3.4-72.1	161.4 (50-500)	for details see below
09 02 02	Inc. of hazard. waste		yes	0.4	2.2	2	for details see below

09 02 07	Inc. of clinical waste			7-9	?	?	for details see below

F: Survey on the available information

09 02 01
Incineration of domestic and municipal wastes

Considered pathways or media

Air,

Plant data

In the French inventory a detailed survey on the number of plants with different capacities and flue gas cleaning systems is given which is reproduced here:

Capacity [t/h]	**> 15**	**= 10 to < 15**	**= 6 to < 10**	**=3 to < 6**	**< 3**	**total**
Number	31	22	22	52	181	308
Dust control + gas cleaning	23	11	7	9	17	67
dust control only	8	11	15	43	164	241
amount of waste [kt/a]	5,750	1,610	800	1,200	920	10,280

F: Incineration of domestic and municipal wastes; plant data

No further information was given about the meaning of the term „gas cleaning"; at least in the case the smallest facilities it is improbable that these are equipped with dioxin abatement techniques.

Measurements

Measurements were performed at 13 different sites, covering furnaces of various ages, types sizes and air cleaning equipment. The number of samplings achieved at furnaces with less than 3 t/h is considered as insufficient.

The following concentrations were measured:

Parameter	**concentrations [ng I-TEQ/m³]**
Minimal	0.7
Maximal	14.8
geom. mean	3.2
arithmetic mean	7.8

F: Incineration of domestic and municipal wastes; measurement results

National activity rates

As shown above, the amount of waste incinerated is reported to be as follows:

Year	1996
[kt/a]	10,280

F: Incineration of domestic and municipal wastes; activity rates

Emission factors

The French inventory reckons the typical emission factor to be 38 µg I-TEQ/t; by comparison with the mean concentration found this translates into a specific flue gas volume of 4,872 m³/t. With this value the following emission factor limits are obtained:

Parameter	Emission factor [µg I-TEQ/t]
Minimal	3.4
Maximal	72.1
geom. mean	15.7
arithmetic mean	38

F: Incineration of domestic and municipal wastes; emission factors

Estimation of uncertainty:

The authors of the French inventory consider the uncertainty of their estimates to be low despite almost nothing is known about the emissions from the small incineration facilities. They argue, that only 10 % of the total waste is treated by these plants. However, even the emission factors measured at larger facilities cover a range of more than one decade. Taking into account that emissions from small installations might be much higher than the measured maximum an index of „2“ is proposed here regarding the emission factors. With the activity rates being accurately known the following figures result:

Activity rates	0
emission factors	2
total uncertainty	2

F: Incineration of domestic and municipal wastes; indices of uncertainty

Emission estimation

In the French inventory the annual emissions were calculated using the arithmetic mean of the emission factors. This value is reproduced in the first line of the table following hereafter. In accordance with the general approach of the present study, another estimate based on the geometric mean and the indices of uncertainty is added for comparison.:

	g I-TEQ/a
Annual emission	
(based on arithm. mean)	390.6
based on geom. mean	161.4
Margin of uncertainty (rounded values)	50 - 500

F: Incineration of domestic and municipal wastes; annual PCDD/F emissions

09 02 02 and 09 02 07
Incineration of industrial and hospital wastes

General Remark:

Concerning the other types of waste incineration the data base of the French inventory is quite poor; hence the topics mentioned in the headline are covered here together.

Considered pathways or media

AIR,

Plant data

No information is given.

Measurements

According to the data shown in the summary table of the French inventory measurements should have been performed; however, nothing is said about the number of investigations. The following concentrations were found:

Type of waste	**concentrations [ng I-TEQ/m³]**
Hazardous	0.4
Clinical	7 - 9

F: Incineration of industrial and hospital wastes; measurement results

National activity rates

No data provided.

Emission factors

Regarding the incineration of hazardous waste only an emission factor was evaluated; no reason is given for the lack of data concerning the clinical waste incineration.

Type of waste	**Emission factor [µg I-TEQ/t]**
Hazardous	2.2
Clinical	?

F: Incineration of industrial and hospital wastes; emission factors

Estimation of uncertainty:

On the basis of the data content in the French inventory it is impossible to make any estimations of the uncertainty range.

Emission estimation

An emission estimate is reported for the incineration of hazardous waste only.

	Hazardous waste	**clinical waste**
Annual emission	2	?

F: Incineration of industrial and hospital wastes;
annual PCDD/F emissions [g I-TEQ/a]

Comment

The authors of the French survey stress the importance of additional measurements at installations for hospital waste incineration.

References

1 R. Bouscaren (1992): Inventaire des emisions de dioxines et furannes en France. CITEPA (Ed.) 43

2 Milhaut A., Pernin H. (1996): Prliminary Dioxin Emission Inventory in France. ADEME and Cecle 2-3-7-8 (Ed.)

3 Lahl, U., Zetschmar-Lahl, B.: (1995): PCDD/F-Bilanz und bewertung vor dem Hintergrund des EPA-Reassassment. EMPA Dübendorfer Dioxintag.