

090201**Incineration of domestic or municipal wastes***Abatement technologies:*

Depending on the age and on the capacity of the plant as well as on the legal conditions very different kinds of flue gas cleaning systems are applied. The most simple facilities comprise dry scrubber/fabric filter units or only dedusting by cyclones. New installations installed in countries with a legal emission limit for PCDD/F emissions must have complex multi-stage systems comprising adsorbent injection and/or catalytical devices for dioxin abatement. Various combinations of dry, semi-dry and wet scrubbers and electrostatic precipitators also are common.

Plant data/European situation

A brief survey on existing incineration plants for municipal waste in Europe is given in a study produced by TNO <<1> for the year 1993. Compared to the information given in the national inventories only slight differences occur except for the case of France; here, the TNO study did not completely regard very small facilities with capacities below 3 t/h. Overall, about 600 facilities with a combustion capacity of ca. 45,000 kt/a are in operation in the considered countries.

Currently some changes are underway as a consequence of emission limits that have been set by European or national directives in the recent past. In UK all of the old plants are to be closed since they do not meet the requirements regarding heavy metal emissions. For the same reason and in view of probable additional emission limits it is likely that the most small facilities in France will also be shut down until the end of the century. The plants in the Netherlands, Sweden, Austria and Germany have to comply with a dioxin emission limit of 0.1 ng I-TEQ/m³; hence these plants have been equipped with sophisticated flue gas cleaning devices during the recent past.

090201**Incineration of domestic or municipal wastes**

Activity data

Activity data (shown in 090201—Table 5) were taken from the national inventories and were completed with data of the TNO study on dioxin emissions from municipal waste incineration. The activity rates are sorted according to the abatement quality of the plants in the respective countries. The last column shows the total activity rate for every state.

Emission factors

The emission factors for the incineration of domestic or municipal wastes as reported by the national dioxin inventories are shown in 090201—Table 4. In almost each occurrence they had been gained by measurement programs; adoption of literature data accrued only in a few cases.

This large data base allowed to select three different default emission factors depending on the quality of the applied abatement technologie for the emission estimations.

non or low quality APCS	medium quality APCS	high quality APCS
typical	typical	typical
90.0	15.0	1.5

090201—Table 1 Selected emission factors for incineration of domestic or municipal wastes [$\mu\text{g I-TEQ/t}$]; APCS: Air Pollution Control System

It should be noted that the theoretical value corresponding to a flue gas concentration of 0.1 ng I-TEQ/m^3 would be 0.6 ng I-TEQ/m^3 . The value chosen for high quality APCS is somewhat higher having in mind that upgrading of the flue gas cleaning systems was not yet finished in all countries during the period considered in this report (1993-1995).

Emission estimation

On the basis of the default emission factors and the activity rates the standardised annual PCDD/F emissions were derived. The values obtained were compared to those reported in the national inventories and in the TNO study, resp. (090201—Table 6). To calculate the total for all 17 countries values were combined: in case an inventory value is given, this value, in other cases the result of the re-evaluation was taken for summation. For all 17 countries considered the following results are obtained (090201—Table 2). The combined total comprises genuine values of the national inventories if available and re-calculated values for those countries which did not provide any data in this section:

	TOTAL
national inventories	1185.1
re-evaluation	1020.6
combination	1437.1

090201—Table 2 Summary of re-evaluated typical PCDD/F air emissions [g I-TEQ/a] for incineration of domestic or municipal wastes

The re-calculated values obtained using the default emission factors generally were lower than in the national reports. In some cases e.g. in Austria, Luxembourg, The Netherlands, Sweden, Finland and Spain higher estimations were obtained. The inventory value reported for Spain is very questionable since no measurements were reported and the flue gas cleaning systems mainly may be termed of medium quality (cf. TNO-study). In the other cases the inventory data are considered to be quite reliable; thus the re-evaluation results in slight overestimation for these countries.

The high emission reported for Germany might be surprising since an emission limit value of 0.1 ng I-TEQ/m³ was set already in 1990. However, the period for upgrading the plants ended in December 1996, considerably later than the reference year of this report. As described briefly in Volume 2 data for 1994 show that a considerable fraction of operating plants did not comply to the emission limit. At the release of this

090201

Incineration of domestic or municipal wastes

study (mid of 1997) the emission value given in the last column of 090201—Table 6 presumably may describe the actual emission situation in Germany more accurately.

Conclusions/recommendations

Despite the emissions appear to be nearly halved compared to the TNO estimation the incineration of domestic or municipal wastes was still one of the most significant dioxin source for the total emission of PCDD/F in Europe in the years 1993-95. Particularly important were the Belgian, German, French, Italian and British contributions to the total dioxin emissions from waste incinerating plants in Europe. To date (1997) the situation has been improved; however, since data from some countries are missing at all no actual emission estimate can be given.

As all calculations in this chapter are based on a large data base considerable uncertainties may not occur. However, almost nothing is known about the emissions from the huge number of small plants operated in France. At least spot- check measurements should be performed to assess possible local impacts of these facilities. The same applies to the plants operated in Italy and Spain since the corresponding emission values are purely based on estimations.

Generally, abatement measures should be enacted to achieve an additional reduction of dioxins especially at those plants with rather high dioxin emission levels.

European Dioxin Inventory - Results

090201

Incineration of domestic or municipal wastes

	Flue gas conc. [ng I-TEQ/m ³]		Emission factors [µg/t]				Remark
	Typ	min	max	typ	min	max	
none or low quality APCS							
B				120			
D		0.10	63.0	15.1	0.6	378.0	according to the Federal measurement program on MSW incineration
Dk				20			
Uk	36	4	306	206	184	231	
				90			default factors from TNO study
				90			Chosen value
medium quality APCS							
B	4	3	7	22/50 µg/t			refers to dry and dry/wet scrubber technology, resp.
CH				50			based on results from CH [28], Germany [124] and literature data
D	0.052	0.00	2.9	16.5			estimation based on measurements of Bavarian and NRW plants
F	3	1	15	16	3	72	geom. mean of EF range used as typical value; would be 38 µg I-TEQ/t if arithm. mean was used as done in the French inventory
S				1.58	0.5	5	emission probably calculated only as the sum of emissions from all measured plants; may be underestimated compared to TNO-report
Sf							
Uk	0.15		1	1		7	
				15			TNO
				15			Chosen value

090201—Table 3 PCDD/F air emission factors for incineration of domestic or municipal wastes from national dioxin inventories

090201

Incineration of domestic or municipal wastes

High Quality APCS							
A				0.1			
B				2.5			
CH				3			valid for installations with DeNOx facility
L							
NL	0.21	0.01	4	1.1	0.06	20	
				0.6			TNO
				1.5			Chosen value

090201—Table 4 PCDD/F air emission factors for incineration of domestic or municipal wastes from national dioxin inventories

Activity data	Inventories, completed with TNO data			total [kt/a]
	low	medium	high	
Abatement quality				
A			458	458
B	953	902	32	1,887
CH		2,405		2,405
D		9,250		9,250
Dk		1,248		1,248
E		798		798
F		10,280		10,280
Gr				0
I	2,800			2,800
Irl				0
L			137	137
N	440			440
NL			2760	2,760
P				0
S		1,700		1,700
Sf	50			50
Uk	2,500	420		2,920
TOTAL	6,743	27,003	3,389	37,133

090201—Table 5 Activity rates related to incineration of domestic and municipal wastes [kt/a]

090201

Incineration of domestic or municipal wastes

	emission [g I-TEQ/a]				
	Inventories.	re-evaluation	combination	TNO study 1993	Compliance to 0.1 ng I-TEQ/m ³
A	0.1	0.7	0.1	0	0.3
B	187.0	99,3	187	148	1.1
CH	123.1	39.7	123.1	133	1.4
D	157.2	138.8	157.2	417	5.6
Dk	25.0	18.7	25.0	103	0.7
E	0.6	12.0	0.6	57	0.5
F	161.4	154.2	161.4	741	6.2
Gr	-	0.0	0.0		0.0
I	-	252.0	252.0	131	1.7
Irl	-	0.0	0.0		0.0
L	0.1	0.2	0.1	7	0.1
N	2.6	39.6	2.6	24	0.3
NL	6.2	4.1	6.2	91	1.7
P	-	0.0	0.0		0.0
S	3.0	25.5	3.0	86	1.0
Sf	3.0	4.5	3.0	5	0.0
Uk	515.7	231.3	515.7	283	1.8
TOTAL	1,185.1	1,020.6	1437.1	2226	22.3

090201—Table 6 Comparison of PCDD/F air emission estimates [g I-TEQ/a] for incineration of domestic and municipal wastes (reference period: 1993-1995)

-
- 1 Ir. L. P. M. Rijpkema: The Impact of a Change in EC Legislation on the Combustion of Municipal Solid Waste. Report No. 93-312, TNO, Apeldoorn, NL, 1993, 95 p.