PCDD/F-Emissions of MSWI:
A status report on emission reduction means in Germany

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1. Introduction

At present, only 10 of the annually arising 40 Mio Mg of municipal wastes in Germany are incinerated. Due to new legal regulations (TASI, technical guideline for waste management), the situation will change considerably, because latest in 2005, waste disposal in landfills is only permitted if the waste keeps u.o. a very low TOC limit. This limit can in general only be kept by thermal pretreatment. As the capacity of the 50 German MSWI plants in operation amounts to actual 10 Mio Mg, about 40 new MSWIs are projected for Germany, nearly the half of them in the east-german lands, where the initial position of waste management is very unfavourable (only one incineration plant in operation before reunion).

In 1990, permitted PCDD/F concentration in clean gas of waste incineration plants was limited to 0.1 ng I-TE/Nm³ (N = 11 Vol.-% O_2) by the 17th ordinance (17. BImSchV) on the Federal Immission Protection Law. Table 1 gives a survey about the effective time limits to be kept.

Within the political debate before passing of the 17. BImSchV, several critics doubted the implementation of the 0.1 ng-limit within the given dates of effectiveness. This contribution will present, in how far and by which means the aims of the 17. BImSchV have been or will be realized.

Table 1: Effective time limits of the 17. BImSchV

Plants	0.1 ng I-TE/Nm³ is effective
New plants	since december 1, 1990
„Old plants"	
Plants in operation before 17. BImSchV	since december 1, 1994
Plants in operation before 17. BImSchV, which fulfilledthe demands of the German Clean Air Act (TA Luft) on december 1, 1990 or have to fulfill them no later than dember 1, 1994	since december 1, 1996
Plants in operation before 17. BImSchV, which cannot keep 850°C for at least 2 seconds because of special technical problems	after rebuilding the combustion unit or the waste-heat boiler

2. Technical means of PCDD/F emission reduction

In the past, old MSWI in Germany showed PCDD/F emission concentrations about 10 ng I-TE/Nm³, single plants even much higher levels. In fact, a reduction of flue (and clean) gas burden below the permitted level by optimizing the thermal process seems to be favourable. Classic grate incinerators already in operation can reduce emission concentrations far below 10 ng I-TE/Nm³ by e.g. improving plant design, operation conditions and waste input[1]. Modern grate incinerators can keep 5 ng I-TE/m³ , some of them even 3 ng I-TE/m³ without special dioxin filter/scrubber systems.

Within the last few years, thermal combination plants[2, 3, 4, 5] have been offered as an alternative to classic grate MSWI plants. Technical development of these plants is still in the beginning; no full-scale plant has proven long-time performance at the predicted high environmental standard. Therefore, some first users' risks cannot be excluded. Beneath other positive aspects, the new concepts show some advantages concerning dioxin emission. But here, too, a flue gas cleaning step with regard to dioxins has to be included, in order to keep the 0.1 ng I-TE/m³ level in clean gas in each case.

For flue gas cleaning, two general concepts for all types of incineration plants have been established:

- adsorptive removal,
- oxidative destruction.

Adsorptive removal always uses different carbon types as sorption medium, either as fixed-bed filter or by spray injection of granulated activated carbon into the flue gas stream. Table 2 gives a survey about the strategies of improving flue gas purification of german „old MSWI plants".

Catalytic oxidation shows a lot of strategic advantages. E.g. it can be integrated as last step of the catalytic removal of nitrogen by oxidative catalysts. Dioxin-containing residues which have to be treated as hazardous wastes are not produced herein. Therefore, reduction of dioxin emission should not be discussed without regard to nitrogen reduction means. Table 3 shows realized technologies at 38 „old" Germany MSWI plants for nitrogen emission reduction.

Table 2: Installed technology for dioxin emission reduction at 43 „old" Germany MSWI plants; 4 plants have not decided until now (status: 3/1995)

Dioxin emission reduction technique	installation rate in FRG
Conversion / spray injection	53 %
Catalytic oxidation	33 %
Fixed-bed filter/adsorber	14 %

Table 3: Already installed or actual installation of technologies for nitrogen emission reduction at 38 „old" Germany MSWI plants; 9 plants have not decided until now (status: 3/1995)

NOx emission reduction technique	installation rate in FRG
SCR technique	71 %
* < 200 mg/m³	→ 60 %
* < 100 mg/m³	→ 40 %
SNCR plus SCR technique	3 %
SNCR technique	14 %

3. Status quo of dioxin emission reduction in Germany

In the late 80s, dioxin emission of German MSWI plants reached 400 g TE (BGA), due to average clean gas concentrations of about 10 ng TE (BGA)/m³. Therefore, MSWI was one of the most important groups of thermal resp. industrial emission sources. At present, improved filter and scrubber techniques have been or are just installed at most „old" German MSWI plants. The latest effective time limit of the 17. BImSchV (december 1, 1996) has not been reached. It can be expected that most of the concerned plants will keep the permitted dioxin level in time.

Table 4 shows the status quo of keeping the permitted dioxin level at „old" plants in some of the 16 German lands. Data of further lands will be presented.

Table 4: Status quo of keeping the permitted dioxin level of the 17. BImSchV; Bavaria: (+ 1) = 1 pyrolysis plant

German Land	No. of plants	Plants with actual measurements < 0,1 ng I-TE/Nm³	
Bavaria[6)]	16 (+ 1)	12 (+ 1)	75 % (76 %)
Bremen	2	2	100 %
Hamburg	3	3	100 %
Lower Saxony	1	1	100 %
Northrhine-Westfalia	26	21*	81 %
* keeping projected in 1995[7)]			

At present, dioxin emission of the MSWI sector ranges at about 50 g I-TE/a, but is stronly declinig. Latest in 1997, total emission of this sector will lie at or below 4 g I-TE/a. In consequence, MSWI will become a dioxin source of minor concern, compared to other emission sources, as Table 5 shows, though some other important dioxin emission sources are reduced, too.

Table 5: Total balance of known PCDD/F emissions into the atmosphere[8,actualized)]

Source	Annual emission of PCDD/F historical ('85 - '90) g I-TE/a	actual ('93/'95) g I-TE/a
Chemical products, chlorine chemistry	??	??
Waste incineration		
* MSWI	400	50
* HWI	30	< 1
* Hospital waste incineration	5 - 6	-
Other incineration processes	30 - 90	25 - 65
Metal production and processing	570 - 1010	276 - 381
Paper production	< 1	< 1
Hazardous sites (esp. copper slag)	100	100
PVC-fires@	1 - 10	1 - 10
Sum	1166 - 1646	452 - 606

@ including fire residues

4. References

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