REDUCTION OF THE PCDD/PCDF EMISSION IN THE FLEMISH REGION (BELGIUM)

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Introduction

Flanders is the most northern of the three regions of Belgium. It has 5,7 million inhabitants on a surface of 13.512 km_, making it one of the most densely populated regions of Europe. Public awareness for the potential risks of PCDD/PCDF has spectacularly increased in the last decade, and was even strengthened by the major feed and food contamination of 1999.
The Environment Inspection Section (MI) of the Ministry of the Flemish Community is responsible for the enforcement of the environmental health legislation in Flanders. MI chooses to enforce in both a preventive and a repressive way, aiming at co-ordinated action in the whole of the Region. To reach a co-ordinated preventive enforcement in the field of air pollution, MI organises measurement campaigns, which are performed by external laboratories. These campaigns are complementary to the obligatory "self-control" measurements by the exploiters. The results of the emission measurements are compared with the legal prescriptions (emission limit values) and, if needed, MI imposes measures in order to obtain a sanitation of the emission. These measures can be situated in the field of administrative and/or criminal law. This enforcement approach led to a thorough reduction of the PCDD/PCDF emission in Flanders. In a first phase, the efforts were aimed at the municipal solid waste incinerators (MSWI). More recently, a similar approach is being applied to industrial process plants, leading to an important emission reduction within a couple of years.

Materials and methods

The Environment Inspection Section (MI) of the Ministry of the Flemish Community MI consists of an Inspectorate-General, responsible for the general management, a Chief Inspectorate, having a co-ordinating and supporting task, and Inspectorate services in each of the 5 Flemish provinces, performing the actual inspections in the field. In total, some 80 inspectors are working for MI.

Within Flanders, MI is responsible for the enforcement of the environmental health legislation. The major part of this legislation has been integrated in the Environmental Licence Decree (1985), which became operational through its implementing orders Vlarem I (1991) and Vlarem II (1995). Vlarem II contains the general and sector-related conditions for the types of objectionable establishments that are listed in Vlarem I. These conditions are based on the general principle of prevention and refer to BAT(NEEC). For various sectors, emission limit values (ELV) are given. When possible, these ELV are based on the European Directives.

Vlarem II on dioxin emissions to the air

Since its implementation in August 1995, Vlarem II contains a legal dioxin emission limit value for municipal and hazardous waste incinerators of 0,1 ng TEQ/Nm_. This ELV is taken from the EU directive 94/67 on hazardous waste incineration. On the EU-level, currently no dioxin ELV is operational for MSWI. Furthermore, Vlarem II mentions very explicitly that the incinerators are not allowed to continue operation when the ELV are not being met. Since 1/1/2000, also a continuous sampling of the flue gases, allowing biweekly analysis of the dioxin emission, is obligatory for MSWI. This way, a constant follow-up of the operation has become possible. Additionally, MI can perform emission measurements at all times by contracting an officially recognised lab. Since 1999, dioxin ELV and target values have also been included in Vlarem II for other sectors, including industrial process plants. This way, Flanders is really taking a leading role within Europe in the field of dioxin emission reduction from point sources. The following table gives an overview of the current Vlarem II prescriptions for PCDD/PCDF emissions to the air.

Sector	Emission limit value (ELV) (ng TEQ/Nm_) (TV: target value)	ELV valid for existing plants since/on:
Municipal waste (*) incineration > 6 ton/h	0,1	1/1/1997
Municipal waste (*) incineration < 6 ton/h	4 0,1	1/1/1997 1/1/2001
Hazardous waste incineration	0,1	1/1/1999
Crematories	0,1	1/1/2003
Manure incineration	0,1	1/1/2003
Metal smelters (ferrous/non-ferrous)	new: 0,5 (TV: 0,1) existing: 1 (TV: 0,4)	1/1/2003
Iron ore sintering plants	new: 0,5 (TV: 0,1) existing: 2,5 (TV: 0,4)	1/1/2002
Refineries	new: 0,5 (TV: 0,1) exisiting: 2,5 (TV: 0,4)	1/1/2002

(*) incl .industrial waste and wood waste

Stack emission measurement campaigns organised by MI

Since 1993, MI has organised several stack emission measurement campaigns, including the sampling and analysis of dioxins. Officially recognised labs performed the measurements. The first campaigns focused on waste incinerators. Later, mainly industrial process plants were chosen. The following table gives an overview of these campaigns [number of plants].

•1993: municipal incinerators [19]
•1994: industrial waste incinerators [20]
•1995: industrial waste incinerators [7] medical waste incinerators, managed by hospitals [5] medium and large fuel combustion plants [8] industrial production plants [28]
•1996: industrial waste incinerators [21]
•1997: process installations [22], brick-works [12]
•1998: municipal incinerators [13]
•2000: industrial incinerators/process plants [14]

Based on these results of emission measurements, MI can decide to take measures if necessary. In the field of criminal law, the MI inspectors always make an official report of the legal infringements to the Public Prosecutor. As administrative measures, the inspectors can give exhortations and, in a next phase, can take coercive measures even leading to closing-down of the plant.

Results and discussion

Municipal solid waste incinerators

In 1993, MI performed the first dioxin emission measurements at the 19 existing MSWI. These measurements showed very high emissions at the majority of the plants. MI concluded from these data that the situation was intolerable, as there was danger for man and the environment. Therefore, MI ordered the immediate and thorough sanitation of the MSWI in order to minimise the dioxin emission. Following this first campaign, 6 MSWI were closed-down definitively as the sanitation appeared not to be feasible for economical and/or technical reasons or because no new licence was granted by the authorities. The other MSWI started an extensive sanitation programme. The 1998 MSWI emission measurement campaign showed that, due to this sanitation, the flue gas dioxin concentration was lower than 0,1 ng TEQ/Nm_ at nearly all MSWI. Meanwhile, the public awareness for dioxins had risen strongly and the Flemish Parliament had voted a motion in which it was stated that exploitation could not be tolerated if the emission concentration was higher than the ELV. Therefore, MI chose to maintain a strict enforcement policy. Whenever emission measurements showed that the ELV was not met and MI concluded that this was caused by structural problems, MI ordered to immediately stop the exploitation and to take the necessary measures.

The most commonly taken dioxin emission reduction measures at the MSWI during the last few years have been:

- injection of activated carbon or lignite;
- optimised fabric filter operation;
- catalytic filter sleeves;
- deNOx (catalytic), also as a final step for dioxin removal.

These measures resulted in a huge decrease of the average yearly emissions, from over 120 g TEQ/year in 1993 to less than 1 g TEQ/year at this moment. This shows that the investments

(running in the order of 3-30 million US$ per plant for the whole of the sanitation since 1993) really proved their value in terms of environmental benefit.

Industrial process plants

Since 1995, MI also performs emission measurement campaigns at industrial process plants, where a potential risk of significant dioxin emissions exists. These emission campaigns and further measurements resulting from them, revealed that at certain plants very high amounts of dioxin were emitted. The highest dioxin concentrations were found at iron sintering plants (typically 10-20 ng TEQ/Nm^3) and at (secondary) copper smelters (typically 10->100 ng TEQ/Nm^3). After the sanitation of the MSWI, these industrial sources clearly caused the majority of the dioxin emission in the Flemish Region.

A similar sanitation approach was followed as for the MSWI. Based on the results of the emission measurements, measures were taken by MI, depending on the seriousness of the situation. By using dispersion modelling, the impact of the emission on the neighbouring area was estimated. The deposition data from the models were compared to limit values, derived from the WHO ADI standards. Whenever a risk for nuisance or damage to man or the environment was found, MI took severe measures. The exploiters had to start sanitation programmes, that were closely followed-up by MI. This included a lot of research for process optimisation and emission reduction measures and investments in flue gas cleaning equipment.

It soon became clear that the heterogeneous material input, including a lot of recycling materials, and the temperature profiles in this type of ovens causes a high and strongly fluctuating dioxin emission. This means that end-of-pipe solutions are necessary to obtain a sufficient emission reduction. During the last couple of years, very significant efforts were made at some of the major Flemish industrial plants. By combining process-integrated and end-of-pipe measures and by frequent monitoring of the emissions during the research experiments, an emission reduction of at least 10 times was reached for the 2 major sources in Flanders (iron sintering plants and copper smelter). Further efforts will focus on an optimisation of this sanitation and on the extension to some smaller, but still important emission sources.

Conclusions

Between 1993 and 2000, a substantial improvement of the flue gas emission quality of the Flemish MSWI has been obtained, due to technological innovation of the plants. The stimulating force to reach this result was the strict enforcement of the Vlarem II environmental legislation by MI. This approach induced a shift of the Flemish MSWI from a 'retarded' to a 'high-tech' industrial sector. A similar approach is being followed for the major dioxin emitting industrial process plants, especially in the ferrous and non-ferrous sector. Due to the nature of these processes and the often heterogeneous input, tailor-made end-of-pipe solutions had to be applied. The emission of two major sources was reduced more than 10 times. This way, Flanders is taking a leading position within Europe in the field of dioxin emission reduction at industrial process plants.