

REDUCING THE PCDD/F EMISSIONS FROM WASTE INCINERATORS FOR WOOD WASTE AND BIOMASS WASTE IN THE FLEMISH REGION (BELGIUM)

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Introduction

The Environmental Inspectorate Division (EID) is responsible for the enforcement of the environmental health legislation in the Flemish region (Belgium). The EID aims at constant improvement of the quality of the enforcement by focusing on efficient, professional, consistent and integrated action in The Flemish region¹. In the field of air pollution, PCDD/F emissions have received particular attention during the past decade, due to high public concern for their possible health effects and the high population density in The Flemish region. The EID has focused on reduction of PCDD/F emissions from municipal solid and industrial waste incineration plants², iron sintering plants³, non-ferrous metal plants⁴ and crematories⁵. The largest point sources of PCDD/F emissions have been monitored and tackled in the recent past. This led already to a very significant emission reduction. More recently, the focus is shifted towards incinerators for wood waste and biomass waste as they are gaining importance in the field of climate change abatement. This paper highlights the enforcement approach of the EID towards incinerators for wood waste and biomass waste and presents the results of an emission monitoring campaign at 45 installations.

Materials and Methods

Legislation

The environmental health legislation has been integrated in the Environmental License Decree (1985) which became operational through its implementing orders Vlarem I (1991) and Vlarem II (1995)¹. The main objective of the EID is to enforce the environmental health legislation for potentially most environmentally damaging establishments, the so called "class 1" establishments. Vlarem I defines all types of activities and establishments considered to generate nuisance and that are subjected to general and sector-related provisions, specified in Vlarem II.

As from the Order of the Flemish Government of 12 December 2003 the provisions related to waste incinerators have changed. The new provisions are in force since the 28th December 2005. The implementation of the Order is in accordance with the Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste. Since the implementation of the Order, the emission limit values (ELV) for wood waste and biomass waste incinerators and the self-monitoring program for stack emissions (SMP-stack) depend on the capacity of the incinerator and the quality of the incinerated wood as there are three categories of wood waste defined in Vlarem II. The table below (table 1) gives an overview of the different categories of installations depending on the capacity and the quality of the incinerated wood waste.

Table 1: Classification of the wood waste and biomass waste incinerators

	≤ 5MW	> 5 MW	Definitions
Incineration of biomass waste			
→ untreated wood waste	Class 2	Class 1	natural wood, bark included, that has only been subjected to mechanical treatment
→ non-contaminated treated wood waste	Class 2	Class 1	treated wood waste that meets the composition requirements mentioned in Vlarem II
Incineration of contaminated treated wood waste	Class 1	Class 1	wood that as a result of treatment can contain halogenated organic compounds, PAH's or heavy metals and wood waste where one or more of the composition requirements are exceeded

The definitions of non-contaminated treated and contaminated treated wood waste are linked with composition requirements. The classification of the wood waste uses the following guide values (table 2).

Table 2: Composition requirements of treated non-contaminated wood waste (in mg/kgDM)

	arsenic (As)	copper (Cu)	lead (Pb)	chromium (Cr)	fluorine (F)	chlorine (Cl)	pentachlorophenol	benzo-a-pyrene
A	2	20	90	30	30	600	3	0,5
B	4	40	180	60	60	1200	6	1

To classify the incinerated wood waste, it should be analysed on the initiative and at the expense of the operator, as part of the self monitoring program to define the quality of the wood waste (SMP-wood). The frequency of the wood analysis depends on the nominal thermal capacity of the incinerator. The wood waste is identified as non-contaminated treated wood waste if:

- out of the annual and six-monthly samples, none of the parameter concentrations mentioned in row B are exceeded.
- out of quarterly samples none of the parameter concentrations in row B are exceeded and per calendar year at least three of the four measurements meet the parameter concentration guide values in row A.

The table below (table 3) gives an overview of ELV, SMP-stack and SMP-wood for the different categories of installations.

Table 3: Overview of the ELV and the self monitoring program related to the wood waste quality and the nominal thermal capacity of the incinerator.

	capacity	dust	CO	TOC	HCl	HF	SO ₂	NO _x	Cd+Tl	Hg	metals	PCDD/F
Untreated wood waste:												
ELV	≤ 5MW	150	250				300	400				
SMP-stack		1/y	1/y				1/y	1/y				
ELV	5-50MW	30	200				300	400				0,1
SMP-stack		4/y	4/y				4/y	4/y				1/y
ELV	>50MW	10	100				50	200				0,1
SMP-stack		Cont.	Cont.				Cont.	Cont.				1/y + Cont.
Non-contaminated treated wood waste:												
ELV	≤ 5MW	150	250		50		300	400				0,4
SMP-stack		2/y	2/y		2/y		2/y	2/y				1/2y
SMP-wood		Annual analysis of treated wood waste, originating from the establishment its-self Six-monthly analysis of treated wood waste originating from third parties										
ELV	5-50MW	30	200	20	50	2	300	400	0,1	0,1	1,5	0,1
SMP-stack		Cont.	Cont.	2/y	2/y	2/y	2/y	2/y	2/y	2/y	2/y	1/y
SMP-wood		Six-monthly analysis of treated wood waste, originating from the establishment its-self Quarterly analysis of treated wood waste originating from third parties										
ELV	> 50MW	10	100	10	10	1	50	200	0,05	0,05	0,5	0,1
SMP-stack		Cont.	Cont.	2/y	2/y	2/y	Cont.	Cont.	2/y	2/y	2/y	1/y + Cont.
SMP-wood		Six-monthly analysis of treated wood waste, originating from the establishment its-self Quarterly analysis of treated wood waste originating from third parties										
Contaminated treated wood waste:												
ELV	≤ 6ton/h	10	50	10	10	1	50	400	0,05	0,05	0,5	0,1
ELV	> 6ton/h	10	50	10	10	1	50	200	0,05	0,05	0,5	0,1
SMP-stack		Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	Cont.	2/y	2/y	2/y	2/y + Cont.
<i>ELV in mg/Nm³ depending on the nominal thermal capacity of the incinerator</i> <i>ELV for PCDD/F in ng TEQ/Nm³</i> <i>SMP-stack in times a year or continuous (Cont.)</i>												

Set-up of the coordinated inspection campaign

To check up on the fulfilment of the new provisions, EID organised an inspection campaign on wood waste and biomass waste incinerators into the Environmental Inspection Plan (EIP) of 2006⁶ and 2007⁷. It contained three important points of interest:

- stack emission measurement performed by certified labs.
- sampling and chemical analysis of the wood waste as to determine the appropriate provisions.
- follow up of the obligatory SMP by the plant operators.

If necessary, the inspectors of the EID took measures to obtain the necessary cleanup in compliance with the environmental legislation.

As part of the inspection campaign the EID performed emission measurements on 45 wood waste or biomass waste incinerators. The EID measured 13 incinerators with untreated wood waste and 32 incinerators with treated wood waste. The incinerators are either functional as heating installation to produce process heat either as an incinerator where the heat of the fume is used for the drying process.

During the campaign the inspectors of the EID chose between extensive measurements including the measurement of PCDD/F emissions and limited measurements when there were no PCDD/F emissions expected. For instance, extensive measurements were more appropriate when there was suspicion or awareness of a contaminated wood waste feed. General parameters such as temperature and gas flow have been measured always. In the figure below (figure 1) the content of the two packages is presented.

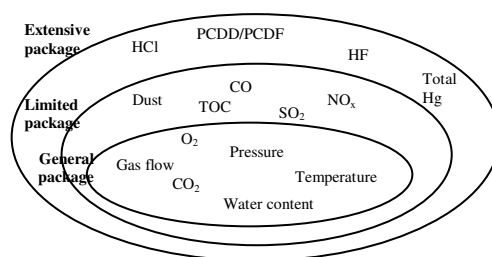


Figure 1: Measured parameters of the general, limited and extensive package

Results and discussion

The EID compared the measurement results with the corresponding ELV. It appeared that for one or more parameters the ELV was exceeded with more than 30% (the sum of all systematic and variable errors in sampling and analysis) for 25 of the 46 measurements (one installation was measured twice). The parameter CO is the most frequent exceeded. On 22 wood waste and biomass waste incinerators PCDD/F was measured. In 7 incinerators the EID noted that the ELV for PCDD/F (31,7%) was exceeded. Without taking the measurement errors (30%) into account, 38 of the 45 incinerators (84,4%) exceeded the ELV for one or more parameters. The following figure (figure 2) gives an overview of the results of the emission measurements.

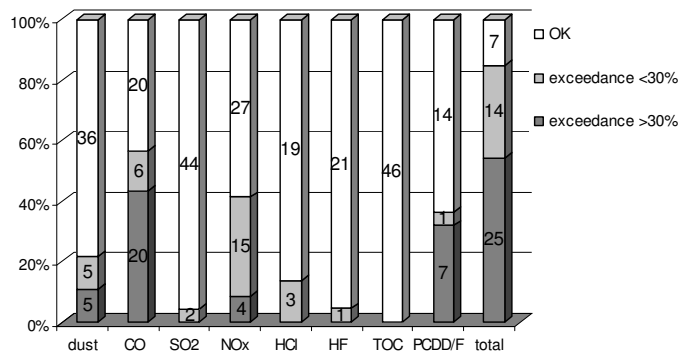


Figure 2: Overview of the results of the emission measurements

As the implementation of the Order of 12 December 2003 states that the ELV and the SMP depend on the quality of the incinerated wood waste, the EID sampled and analysed the incinerated wood, simultaneously with the emission measurements performed. It appeared that in 15 out of 46 samples (32,6%) one or more parameters of the compounding elements in row B (table 2) were exceeded. The most common exceeded parameters were chlorine, fluorine, lead, copper and arsenic. The contamination might originate from treatment with wood preservatives or application of a coating.

It is obvious that the incineration of contaminated wood waste might cause an elevated PCDD/F emission. However, it should be stated that the EID found out that burning non-contaminated treated wood waste or even untreated wood waste, in some cases, led to elevated PCDD/F emissions also. As to prevent PCDD/F emissions as much as possible, it is forbidden to incinerate wood waste that doesn't meet the composition requirements for treated non-contaminated wood waste installations for non-contaminated wood waste. After all, these installations lack the necessary end of pipe emission reduction techniques and measurement devices for the continuous measurements. The cost to install emission reduction techniques and measurement devices, adjusted with maintenance costs, is substantially and economically not profitable for small capacity incinerators. To be sure the type of wood waste fits the type of installation, the incinerated wood waste must be checked rigorously and selected with consideration and constant vigilance.

In most of the cases where the ELV are exceeded, this can be attributed to three important factors:

- bad or irregular incineration process
- insufficient end-of-pipe emission reduction technique or complete lack of it
- bad quality of the incinerated wood waste or incinerators which are not adapted to the wood waste

When the EID concluded that the ELV for one or more parameters were exceeded, the inspectors of the EID sent an official report of the infringements to the Public Prosecutor and exhorted the operator to take measures as to comply with the ELV. Also when the SMP wasn't fulfilled, an official report to the Public Prosecutor was made. In these cases the operator was exhorted to perform the necessary measurements. When the EID found out that contaminated wood waste was incinerated in installations for non-contaminated treated or untreated wood waste, the operator was exhorted to choose the input more selectively or to install end-of-pipe emission reduction techniques and measurement devices. Following this inspection campaign, the EID made 18 official reports and 29 exhortations.

Conclusion

During the campaign of 2006-2007 only 10 out of 45 investigated installations were found to be fully in line with the existing provisions of the environmental health legislation. The EID concluded that besides emission measurements, a rigorous supervise of the quality of the incinerated wood waste was of major importance as the incineration of contaminated wood waste in badly equipped installations causes elevated PCDD/F emissions. As a result of these alarming results and given the proliferation of biomass waste incinerators in The Flemish region, the EID decided to continue the inspection campaign in 2008⁸ and to expand it with wood waste incinerators of 'class 2' establishments. To steer the campaign in the right direction and to achieve a consistent enforcement an internal instruction was written.

Acknowledgements

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