# 15 Years Continuous Emission Monitoring of Dioxins Experiences and Trends

**The continuous monitoring of the emissions of dioxins and furans of incinerators is a topic which has been in discussion for several years. Until today no reliable online monitoring system has been available which can provide accurate information on the PCDD/PCDF emissions as a TEQ value, as demanded by EN-1948, US EPA method 23 or the EU directive for incineration of waste 2000/76/EC. Such systems won't be available for the next few years, so continuous sampling by a long-term sampling system is one alternative and a step nearer to continuous information of the dioxin/furan emissions from incinerators. Continuous sampling gives more information about the real dioxin emissions of a plant, with comparatively short sampling times of only 8 hours on 1 to 3 days per year, which represents only 0.1 to 0.3 % of the yearly operating hours of a plant.**

> *"Due to the increasing interests, it can be expected that this kind of emission monitoring will soon be introduced into many more regions worldwide."*

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More than 15 years ago the AMESA system for continuous sampling of dioxin/furan emissions was designed. It has received around 200 applications for installation.

Belgium was the first country worldwide which demanded the continuous sampling of dioxins and furans in all municipal waste incinerators (MWI) in 2000. Later this legal demand was extended to hazardous waste incinerators, cement kilns and other facilities. Sampling periods were defined as 2 weeks and the average limit value for the 2-weeks was 0.1 TEQ ng/Nm³. At this time Belgium was the only country in the world with a legal requirement for continuous dioxin emission monitoring and up to now more than 50 systems have been installed in various different facilities.

Specific to Wallonia, it was demonstrated over 10 years, that the total yearly dioxin emissions of 11 burners could be reduced by a factor of 10 to 20 even if the quantity of the total burned waste increased by a factor of 3 (Fig. 1).

Starting from 2004, several regional local authorities (ARPA) in Italy started to implement the continuous sampling of dioxins/furans in the operating license of the MWI´s and around 50 long-term sampling systems in Italy were installed.

In Germany several local authorities demanded the installation of such samplers in MWI´s, such as Biomass Combined Heating plants and Coal Fired Power Plants with co-incineration, this lead to around 20 installations in Germany.

In 2010 France followed the example of Belgium and demanded, by law, the continuous sampling of PCDD/PCDF emissions in all domestic and hazardous waste incineration plants until the 1st July 2014. This law covers around 200 stacks, which will increase the total number of worldwide installed continuous dioxin monitoring systems to around 450 to 500 systems.

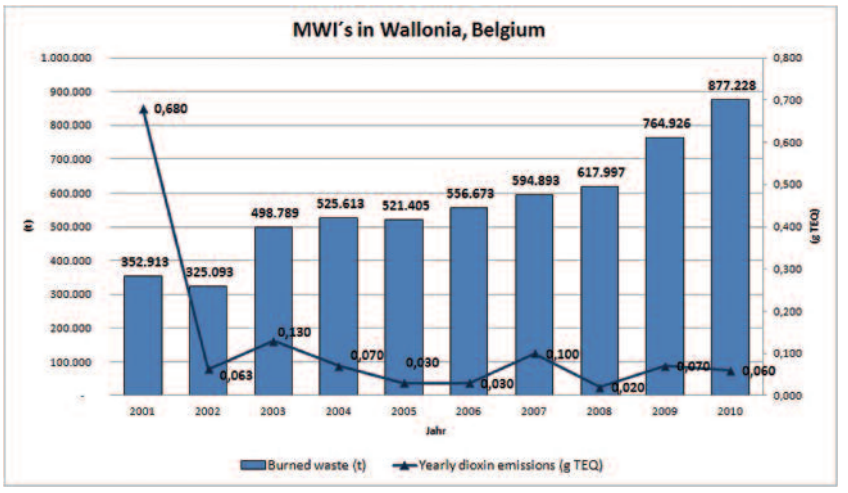


*Figure: 1 Reduction of the total burned PCDD/PCDF emissions in Wallonia region of Belgium.*

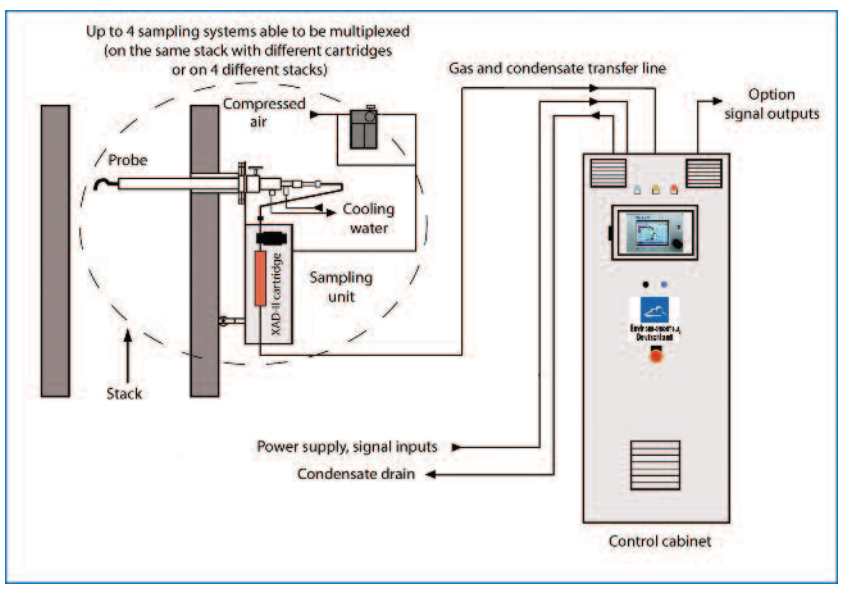


*Figure 2: Functional principle of the AMESA system*

This increasing interest on the continuous dioxin monitoring is in the meantime also supported by the work of the European TC264 WG1, which started to establish a standard, EN 1948-5, for continuous sampling of PCDD/PCDF and dioxin-like PCB. This will be the first international standard worldwide to describe this kind of emission monitoring.

## Materials and methods

The operating principles and functionality of the AMESA system (Fig. 2) is similar to the cooled probe method of EN-1948-1 with the exception that the condensate flask is installed after the XAD-II cartridge and therefore the condensate does not need to be collected and analysed. This is in accordance to US EPA method 23A. Additionally the plane filter for the dust collection is replaced by quartz wool included in the top of the XAD-II cartridge. The cartridge containing the adsorbed dioxins and furans is evaluated together with a data medium in an accredited laboratory. By means of this process, dioxins and furans are separated from the gas phase and the condensate in one adsorption step. With this method it is possible to collect the dioxin and furans for up to 6 weeks on one XAD-II cartridge. Therefore the complete yearly dioxin emission of a plant can easily be determined.

The complete operation of the system is handled by an easy and menu driven operation with the controller and a jog-dial (Fig. 3)

In an installation in Flanders the positive impact of a new flue-gas cleaning can be demonstrated for the first time on a long term basis. In this MWI the dioxin emission values were reduced by a factor of 5 – 10 after the installation of a catalytic DeNOx system in October 2004 (Fig. 4).

The results of a survey by the Flemish plant operators which was published by Vito in 2009 were also very interesting. All 13 plant operators who answered the questionnaire have installed in total 21 AMESA systems. On the question, "do you think that the use of a continuous dioxin sampling system is useful?", 76 % answered yes. This reflects the positive impression of the operators after using these systems for several years. Contrary to some former doubts, the operators see the possibility to have an adequate check for the efficiency of flue gas cleaning, to have an early warning system for disturbances, to have an alarm function with prevention of calamities and to have a proof of innocence after high dioxin depositions measured by the environment agency.

In conclusion it can be said, that the continuous emission monitoring of the dioxin/furan emissions in different incineration plants has been gathering a uniform standard in the European region. There have also been several systems in the Asian region in countries such as Japan, South Korea, P.R. of China and Taiwan installed.

Due to the increasing interests, it can be expected that this kind of emission monitoring will soon be introduced into many more regions worldwide.

In the meantime the system was modified for the continuous sampling of mercury emissions to fulfill the requirements of the new US EPA rules for Portland Cement Kilns and Coal Fired Power Plants.

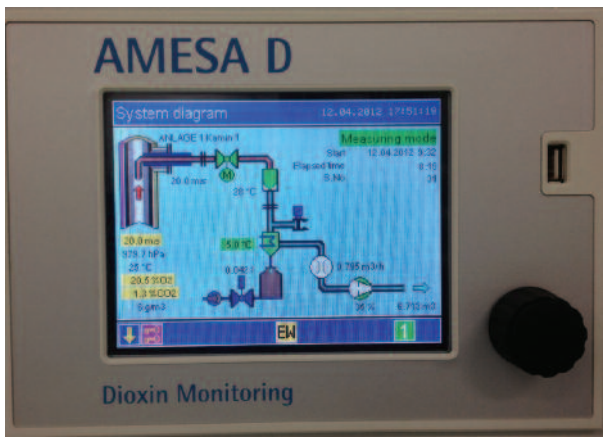


*Figure 3: Display and controller of AMESA D*

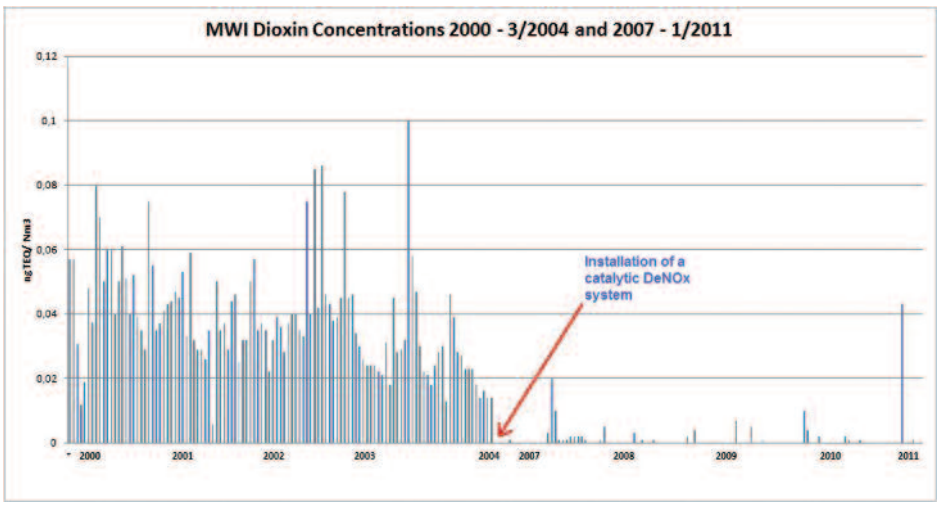


*Figure 4: Reduction of PCDD/PCDF emissions after the installation of a catalytic DeNOx-system.*