

Monitoring of ambient air PCDD/F levels in Portugal

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Abstract

As part of a monitoring program conducted by IDAD – Institute for Environment and Development and supported by regional municipal solid waste (MSW) management authorities, dioxin concentrations in ambient air were measured in three regions of Portugal: Porto, Lisbon and Madeira. These independent studies were performed with the intention of providing data as a basis for the evaluation of potential impacts of the operation of recently built MSW incinerators. Thus, 170 samples were collected in nine different sites from January 1999 till present. The measured levels revealed an extremely variable content of PCDDs/PCDFs depending both on the area and the season of the year. Samples taken in Porto and Lisbon reveal a similar homologue structure even if concentrations measured in the Porto region are significantly greater. Data from Madeira is characteristic of a remote site with some of the congeners concentrations below the detection limit.

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1. Introduction

Polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDDs/PCDFs) are ubiquitous in the environment. PCDDs and PCDFs are injected into the atmosphere by various combustion processes and dispersed throughout the environment by atmospheric transport. These compounds may be produced through the incineration of waste, released into the atmosphere, and transported at great distances before being transferred to other environmental matrices.

Between 1998 and 2000, state-of-the-art municipal solid waste (MSW) incinerators were constructed in Portugal, namely in the regions of Lisbon, Porto and Madeira. The construction of these MSW incinerators was accompanied by the development of comprehensive external environmental monitoring programs (Coutinho et al., 2001) with sampling of materials from different matrices such as ambient air, soil, locally produced vegetables, eggs and milk, as

well as, breast milk and human blood (Calheiros et al., 2002). The data collected in these monitoring programs is being used to understand the environmental and public health impact of these units. The present paper focuses on the description and interpretation of PCDD/PCDF ambient air data obtained in Portugal between January 1999 and December 2004. A total of about 170 samples, collected from nine different sites, were available for this study.

2. Materials and methods

2.1. Sampling sites

Samples were collected from nine different sampling points located in the regions of Porto, Lisbon and Madeira. A location map of the sampling sites is provided in Fig. 1. A simple description of the main characteristics of the sampling sites is presented in Table 1.

These sites were selected with the intention of providing data as a basis for evaluation of potential impacts of the operation of recent built MSW incinerators.

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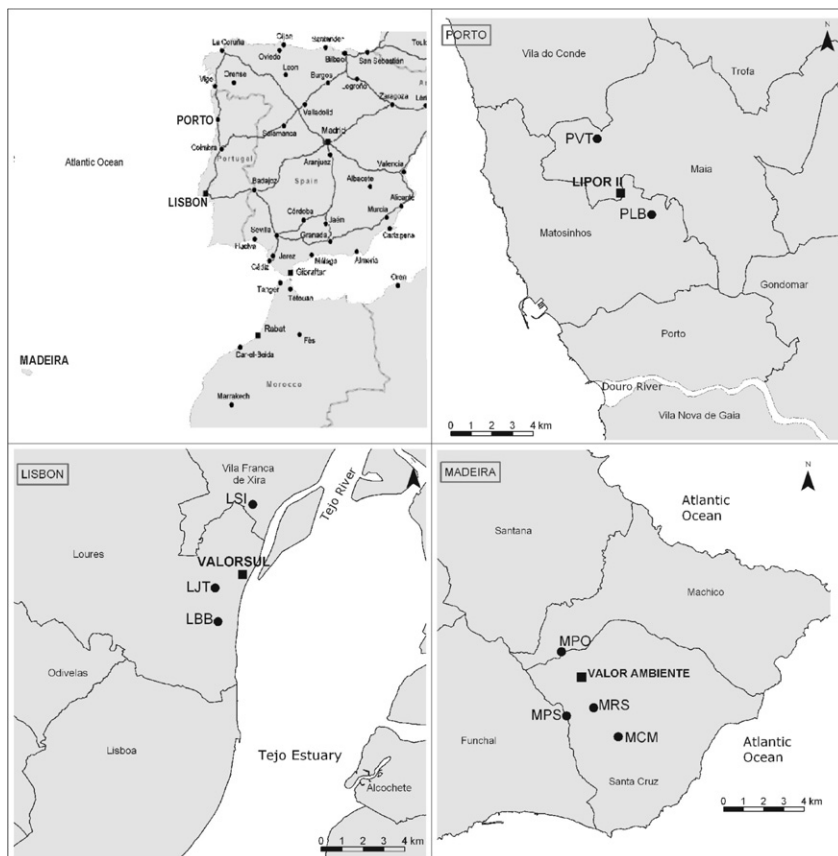


Fig. 1. Map of the three monitoring regions and detailed location of the sampling sites.

Table 1
Characteristics of the sampling sites

Location	Site ID	Land use	Altitude (m ASL)	Comments
<i>Porto</i>				
Leça do Balio	PLB	Suburban	57	
V.N. Telha	PVT	Suburban	88	
<i>Lisbon</i>				
S.J. Talha	LJT	Suburban	70	Winter only
Bobadela	LBB	Suburban	43	
P.S. Iria	LSI	Suburban	67	Summer only
<i>Madeira</i>				
Ribeiro Serrão	MRS	Rural	850	
Pico da Silva	MPS	Forest	1115	
Poiso	MPO	Forest	1390	Exposed to synoptic winds
Camacha	MCM	Rural	700	

2.1.1. Porto

In accordance with the MSW management plan adopted for Porto, Portugal, a MSW incinerator with the capacity of 400 000 tons per year (commonly referred as LIPOR II) was constructed. An ambient air-monitoring program for the MSW incinerator in the region of Porto was designed with the main objective of evaluating the effects of the operation of this facility on the surrounding area. Since 1998, sampling of ambient air for PCDD/F analysis

was performed at six different sites. Regular monitoring was restricted to two sites, Leça do Balio and V.N. Telha, with samples taken every three months through December 2004.

2.1.2. Lisbon

The MSW processing plant of Valorsul is a waste-to-energy facility located in Loures, a municipality just north of the city of Lisbon. This incinerator was designed to process a total of approximately 650 000 tons per year of MSW.

The Valorsul unit includes a flue gases removal system that is similar to LIPOR II in Porto and includes the following processes:

- injection of an aqueous ammonia solution at the boilers combustion chamber for the removal of nitrogen oxide;
- semi-dry removal of acid gases by injection of wet limestone;
- injection of activated carbon for the removal of PCDD/F and heavy metals;
- high efficiency fabric filters for removal of particulate matter.

The ambient air monitoring program has been running continuously since February 1999 with sampling three

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