

Greenpeace Research Laboratories Analytical Results 2015-02

Metals concentrations for ambient airborne particulates (PM_{2.5}) collected over a 5 day period in Zonguldak, Turkey.

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1. Introduction

One sample of airborne particulates (PM_{2.5}) collected on a cellulose acetate filter was received at the Greenpeace Research Laboratories from Greenpeace Turkey on 28th March 2014. According to documentation supplied, the sample was collected between 21st March 2014 and 26th March 2014, from Zonguldak, Turkey. The sample was collected from ambient air over a 5 day period, see Table 1 for details.

The sample was analysed quantitatively for the presence of a range of metals within the PM_{2.5} particulate fraction bound to the filter.

Sample code	location	Start date	Start time	Sampling time (hrs)	Flow rate		Sampling volume (m ³)
					(l/min)	(m ³ /hour)	
TKPM14001	Zonguldak	21.03.14	10:22:56	120.2	1.52	0.0912	10.96

Table 1: details of sample received at the Greenpeace Research Laboratories

2. Materials and methods

The sample was collected using an active personal particulate monitor (MIE pDR-1500) fitted with a cellulose acetate filter (Pall GN-4 Metrical MCE membrane disc filter, 0.8 µm, 37 mm diameter), using a flow rate of 1.52 litres/minute (0.0912 m³/hour).

Following the collection period, the filter was removed from the monitor using clean plastic tweezers and transferred to a petri dish which was immediately sealed, and in which the filter was stored during transport to the analytical laboratory.

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The mass of each metal within the PM_{2.5} particulate fraction bound to the filter was determined by acid digestion of the filter followed by analysis with inductively coupled plasma – mass spectrometry (ICP-MS). This was performed according to European standard method EN 14902 by a laboratory accredited to ISO 17025 by the United Kingdom Accreditation Service (UKAS) to perform these measurements. The concentrations of metals per unit of filtered air (ng/m³) were calculated using the air filtering flow rate and total collection time. In addition, the average PM_{2.5} concentration during the sampling period was determined by the particulate monitor.

3. Results and Discussion

The results for the sample are reported in Table 2, together with certain regulatory limits/guideline values. In some cases, the concentration in the sample was below the limit of detection for the analytical method employed and these are shown in the results tables as '<xx', where xx is the method detection limit for the individual analyte.

Location	Zonguldak	EU limit value;	WHO Guidelines;
Date	21 - 26.03.14	Annual	Annual
Sampling period; days (hrs)	5 (120.2)	average for	(24 hour)
Sample code	TKPM14001	PM ₁₀ ^(a)	mean ^(b)
PM _{2.5} (µg/m ³)	89.65	25	10 (25)
Metal (ng/m ³)			
Arsenic	5.4	6	
Cadmium	0.60	5	5
Chromium	<82		
Cobalt	<0.26		
Copper	6.3		
Iron	207		
Lead	54	500	500
Manganese	8.1		150
Mercury	<0.07		1000
Nickel	<5.5	20	
Platinum	<0.05		
Selenium	5.4		
Vanadium	3.3		
Zinc	64		

Table 2. Average concentration of PM_{2.5} particulates (µg/m³) within air during over the sampling period, and average concentrations of metals (ng/m³) in the PM_{2.5} particulates collected during that period. (a) Annual Air Quality Standards for the EU, with metal concentrations for the PM₁₀ fraction (EU 1999, 2004, 2008); (b) WHO annual air quality guideline values (WHO 2000, 2005)

In the absence of national limits for Turkey for PM_{2.5} and particulate bound metals, the data are compared to ambient air quality standards for the EU (EU 1999, 2004, 2008) and guideline values set

by the World Health Organisation (WHO 2000, 2005). The EU limits and WHO guideline values given in Table 2 are annual average air concentrations, though concentrations for this sample cover a 5 day period. In addition, the ambient air quality standards for the EU set values for metals in the PM₁₀ fraction, and the values for this sample are the content in the PM_{2.5} fraction. Therefore, the limits and guideline values in Table 2 are not directly comparable with the concentrations for this sample, though they do provide a useful comparison.

Concentrations of metals in the sample (PM_{2.5} fraction) were below limits set under ambient air quality standards for the EU (PM₁₀ fraction) and below World Health Organisation (WHO) guideline values.

For more information please contact: Kevin Brigden or David Santillo

Disclaimer: Description of samples and sampling sites are purely according to information supplied with the samples by Greenpeace Mediterranean.

4. References

- EU (1999) Directive 1999/30/EC of the European Council of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31999L0030&from=EN>
- EU (2004) Directive 2004/107/EC of the European Parliament and of the Council of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32004L0107&from=EN>
- EU (2008) Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe. <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32008L0050&from=EN>
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