EXAMPLE OF OPENING PAGE LAYOUT

Identification of emission sources by trace metal concentration

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Abstract

Aerosols emitted by antropogenic activity are in relationship to their emission source and exhibit distinguishable characteristics (size, metal concentration and density) that can often univocally identify the source. Nevertheless, different processes can characterize industrial plants that produce the same product. Due to this, dusts emitted by the same source can have different chemical composition and physical properties. This paper reports the analysis carried out on dusts emitted by two cement plants that produce Portland cement, according to a substantially similar technological cycle, realized using the same raw materials. The most important difference between the two cement plants is that one uses a long kiln while the other utilizes a short one equipped with cyclon preheater and precalciner. This causes differences to be noticed in the composition of the dusts emitted by the two plants.

1 Introduction

Many industrial processes are concerned with the production of dust aerosols, *e.g.* industrial plants burning oil, residential heating, refuse incineration plants, cement industry, smelting industry. These types of emission sources are also, with traffic, mainly responsible for airborne trace metals in relationship with the size of the dust emitted. This relationship between particle size of atmospherically deposited dust and metal pollution has been previously studied. Fergusson and Ryan [1] found that the concentrations of most elements increase with a decrease in the size of the dust particles. The results of other studies, [2, 3, 6], showed a higher affinity of heavy metals with the smaller particle sizes.

2 Main level heading

Small particles may be formed either by high-temperature vaporization followed by condensation upon cooling, or from elements that are dispersed on a molecular level within a combustible material. Elements that have predominantly small particle distributions are: Na, Cs, Cl, Br, Cu, Zn, Ag, Cd, In, Sn, W and Pb (75%<2μm).

2.1 Second level heading

There are considerable differences between the behaviour of the smallest and largest particles within our range of interest, roughly from molecular sizes up to 10^3 microns, as shown in table 2. The smaller particles closely follow the motion of the surrounding gas and may remain airborne almost indefinitely, whilst the larger particles have an appreciable acceleration under gravity and are relatively easy to precipitate. Nevertheless, large grains of dust are transported for many miles under favorable atmospheric conditions.

2.1.1 Third level heading

The following elements can be chosen as tracers for a specific source type: Cu for industrial heavy oil combustion, Pb for traffic, Cd and Zn for refuse incineration plants and Cd and Cu for the cement industry. Size-resolved elemental concentrations will make it easier to distinguish between sources Bratanow *et al* [2]. Therefore similar industrial plants could emit different types of dusts and then different types of metal pollutant. In this paper we consider a particular location, situated near two cement plants, that is characterized by dust pollution that does not exceed the law limits and we determine which substances are really present in the dusts.

2.1.1.1 Fourth level heading
Furthermore we determine if these substances come from the operation that takes place in one or both cement plants, or if they derive from other sources, and we evaluate the amount of dusts produced by these plants.

In this case study, we also analyse the differences between the processes used in both the cement plants.

In order to define the atmospheric dispersion and the ground fallout of the dusts emitted by the cement plants, we have to consider that the size distribution of the particle is not different because of the analogous dedusting system used by the two plants. Due to the small size of these particles, we realized that dust emitted by the two cement plants follows the Gaussian dispersion models.

The site is close to Roccavione, whilst the two cement plants are located near Borgo S.Dalmazzo and Robilante, in the Piemonte region (Italy), fig. 3. The site is located at a distance of 600m from the plant of Robilante, along the Vermenagna Valley, and at a distance of 2600m from the plant of Borgo.

EXAMPLE OF TABLE LAYOUT AND TABLE CAPTION

Table 1: The maximum of the tracer concentrations.

	value ($\mu g/m^3$)	Receptor (num)	time (hour)
measurements	32.2	18	0800
set 1, $u_{min} = 0.5$	7.8	20	0800
set 1, $u_{min} = 1.0$	10.9	21	0800
set 1, $u_{min} = 1.5$	14.8	22	0800
set 2, $u_{min} = 0.5$	18.4	6	0800
set 2, $u_{min} = 1.0$	17.0	9	0700
set 2, $u_{min} = 1.5$	18.8	18	0600

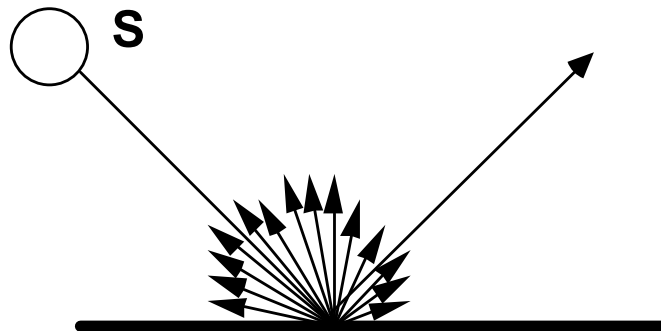**EXAMPLE OF FIGURE AND FIGURE CAPTION LAYOUT**

Figure 1: Example of sound diffusion from a wall.

OR IF THE CAPTION IS MORE THAN ONE LINE

Figure 1: Example of sound diffusion from a wall, from a sound source S for a given frequency with a wavelength larger than the wall's surface. The waveform will not bounce off the wall like a beam of light but instead will spread away from the wall in all directions.

$$\frac{dm}{dt} = \sum_{i=1}^{N_i} \dot{m}_i - \dot{m}_e \tag{1}$$

As a result, eqn (1) can now be written as follows:

$$\frac{\partial T}{\partial t} + \frac{\partial}{\partial x_k}(v_m T) - a_T \frac{\partial^2 T}{\partial x_k^2} = \frac{1}{\bar{c}_p m} \sum_{i=1}^{N_i} \dot{m}_i \left[\sum_{s=1}^{N_s} (h_{is} - h_s)\xi_{is} \right],$$
$$- \sum_{s=1}^{N_s} \frac{\dot{\omega}_s h_s M_s}{\rho \bar{c}_p} - \frac{\dot{Q}_{loss}}{\bar{c}_p m} - \frac{1}{\rho \bar{c}_p} \frac{\partial p}{\partial t} \tag{2}$$

$$\frac{V}{R_m} \frac{\partial p}{\partial t} = \sum_{r=1}^{N_r} m_r T_r \sum_{s=1}^{N_s} \frac{1}{M_s} \frac{\partial \xi_{rs}}{\partial t} + \sum_{r=1}^{N_r} m_r \frac{\partial T_r}{\partial t} \sum_{s=1}^{N_s} \frac{\xi_{rs}}{M_s}$$
$$+ \sum_{r=1}^{N_r} T_r \frac{\partial m_r}{\partial t} \sum_{s=1}^{N_s} \frac{\xi_{rs}}{M_s}. \tag{3}$$

This shows that in general it is necessary to have an algorithm that simultaneously selects the distribution of the DR internal points and surface elements, eqn. (6), as suggested by the error analysis for the DRM

The references given below are examples of the following: (1) book; (2) paper in a journal; (3) chapter in a book; (4) edited book; (5) paper in a conference proceedings; (6) personal communication; (7-9) web site

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