



HAL
open science

Industrial dust deposition in Gravelines (Northern France): first investigations on trace metal contamination of urban soils

Marine Casetta, J. Caillaud, Sylvie Philippe, Lucie Courcot, David Dumoulin, Vincent Cornille, Véronique Alaimo, Gabriel Billon, Michaël Hermoso

► To cite this version:

Marine Casetta, J. Caillaud, Sylvie Philippe, Lucie Courcot, David Dumoulin, et al.. Industrial dust deposition in Gravelines (Northern France): first investigations on trace metal contamination of urban soils. EGU23 General Assembly, Apr 2023, Vienna (AUSTRIA), Austria. 10.5194/egusphere-egu23-1045 . hal-04470069

HAL Id: hal-04470069

<https://hal.science/hal-04470069v1>

Submitted on 21 Feb 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution 4.0 International License

EGU23-1045, updated on 21 Feb 2024

<https://doi.org/10.5194/egusphere-egu23-1045>

EGU General Assembly 2023

© Author(s) 2024. This work is distributed under the Creative Commons Attribution 4.0 License.



Industrial dust deposition in Gravelines (Northern France): first investigations on trace metal contamination of urban soils

Marine Casetta¹, Jacinthe Caillaud¹, Sylvie Philippe¹, Lucie Courcot¹, David Dumoulin², Vincent Cornille¹, Véronique Alaimo², Gabriel Billon², and Michaël Hermoso¹

¹Univ. Littoral Côte d'Opale, CNRS, Univ. Lille, UMR 8187 - LOG - Laboratoire d'Océanologie et de Géosciences, France

²Univ. Lille, CNRS, UMR 8516 - LASIRE, Laboratoire Avancé de Spectroscopie pour les Interactions, la Réactivité et l'Environnement, F-59000 Lille, France

Through the discharge of pollutants, urbanization and industrial activities impact all the compartments of the environment and the ecosystems. Consequently, metal pollution of soils and atmosphere has become a significant problem in urban areas.

In the Dunkirk agglomeration (Northern France), the construction of a large seaport during the 20th century was accompanied by the installation of several metallurgical industries. Dust emissions resulting from their production and storage activities are mainly composed of atmospheric particles of soot, aluminosilicates, silica, calcium or iron. These industrial particles can be associated with specific minor and trace elements : Cr, Cu, K, Mg, Mn, Na, Pb, Ti, Zn or Cl. The composition and the size of the particles determine their fate after emission and influence their toxicity.

This study focuses on sedimentable particles (>20 µm) that cannot penetrate deeply into the respiratory system but can be ingested, especially by children. Due to its location (1 to 2 km South-West of major industries), the city of Gravelines is particularly exposed to dust deposition during North-East windy and dry events.

Among the studies conducted on particles emitted in the Dunkirk area, none was focused on soil matrices. Therefore, the question of the long-term fate of their deposition remains open : what is the influence of these dusts on the chemical quality of the soils of Gravelines ? Which areas of the city of Gravelines are the most affected by metal contamination (potentially associated with dust) ?

Pedological and chemical parameters of topsoils (the first 5 cm) sampled in the city of Gravelines were, first, characterized with the aim to interpret their reactivity to metal inputs. Then, the trace metal concentrations of topsoils and collected dust samples were determined by inductively coupled plasma-mass spectrometry (ICP-MS) to (1) map the areas contaminated by trace metals, (2) assess the levels of environmental pollution, (3) quantitatively characterize the metals associated with dust fallout, and (4) highlight the specific influence of industrial dusts on the potential soil contamination in Gravelines.

The first results on the metal contents measured in the topsoil samples of Gravelines rather reflect

a diffuse metallic contamination. The study of the entire topsoil samples may be questioned because of the dilution of the "dust" signal by the soil matrix. The relative youth of the large seaport of Dunkirk (between 30 and 40 years old), as well as the probable re-mobilization of dust by the winds, may partly explain the moderate contamination measured in soils of Gravelines. However, our results show higher levels of contamination (for some specific metals) and a significant Pollution Load Index (PLI) in the soils located near dust emission sources. Moreover, the combined mapping of metal contents and soil parameters allows the identification of possible differences in metal behavior depending on the nature of the matrix considered. This latter aspect will be discussed in particular according to the use of soils and vegetation (e.g. proximity of the vegetable gardens), in order to highlight areas requiring special attention from an ecotoxicological point of view.