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Urban soils exposed to industrial dust deposition: bioavailability of dust-borne metals and ecotoxicity of soil matrices (Gravelines, Northern France)

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Metal pollution of soils and the atmosphere has become a significant problem in urban areas (metallurgical activities, road traffic...). In the area of Dunkirk (Northern France), the intense industrial activities (related to the large seaport) generate the emission of industrial dusts, which have been qualitatively and quantitatively monitored since 2008. These dust emissions resulting from those production and storage activities can be chemically defined by specific major (Al, Si, Ca, Fe), minor and trace elements (Mn, Cr, Zn, Ni, Cu). The city of Gravelines (1 to 2 km South-West of major industries) is particularly exposed to the dust, especially during North-East windy and dry events. Therefore, a previous study was carried out on spatial investigations on trace metal contamination of Gravelines topsoils (Casetta et al, in prep).

This new study focuses on the fate and distribution of metal contaminants in Gravelines soils with depth, according to the distance from the sources of dust emissions and the nature of soil matrices. Pedological and chemical parameters of topsoils (first 10 cm) sampled in the city of Gravelines were characterized (every centimeters) in order to interpret their reactivity to dust and related metal inputs. The total and "available" fractions (HCl 1M) of soil samples were determined by ICP–MS for their trace metal concentrations. This protocol aimed at (1) characterizing the evolution of metal concentration in soils with depth, (2) determining the potential bioavailable metal fraction and (3) highlighting the influence of soil matrix on the metal behavior in Gravelines. In addition, the *Vibro fischerii* bioluminescence assay (LumoplateTM) was performed on the topsoil samples in order to characterize their ecotoxicity.

The first results on the metal contents measured in the topsoil samples show higher trace metal concentrations in the vicinity of dust emission sources and in the soil subsurface. The soil toxicity seems to follow the same spatial and depth trend. These results will be discussed according to the nature of soils matrices. Finally, the "available" fractions do not exhibit significant differences with depth but highlights notable differences between the sampling sites and according to the metallic element considered.