Assessment of Rare Earth Elements anomalies in an urban area: study case of Bordeaux, France

A. LERAT[1], A. COYNEL[1]*, M-J. CAPDEVILLE[2], D. GRANGER[2], G. BLANC[1], J. SCHÄFER[1], C. BOSSY[1], L. DUTRUCH[1] AND M. CHAMBOLLE[2]

[1] Université de Bordeaux, UMR CNRS 5805 EPOC, Pessac cedex, France (* alexandra.coynel@u-bordeaux.fr)

[2] LyRE, Centre R&D de SUEZ, Bordeaux cedex, France

Control of urban pollutants is a major issue in a context of rapidly growing urbanization. New and rapidly developing technologies imply the emission of emerging potentially highly toxic contaminants such as Rare Earth Elements (REEs) which are also Technology-Critical Elements (TCEs) and excellent tracers of urban activities. Potential REEs sources in the urban area of Bordeaux (746,000 inhabitants) are numerous (e.g. domestic wastewater, medical wastewater, run-off). The Bordeaux metropolitan area hosts one of the most frequented urban highway of France (up to 135,000 vehicles per day) and the third hospital complex (CHU). The aim of this study is to determine the influence of the CHU and of the northern part of the highway on the REEs loads in the Jalle River, an urban river of Bordeaux entering the Gironde Estuary.

Two sampling campaign were carried out in September 2016. A first was performed during a rainstorm on the runoff waters of the highway (n=15 during ~3h) and at the outlet of the Jalle River (hourly frequency during one day). A second was carried out during a dry weather at the outlet of the sewers of the most important building of the CHU.

Different fractions of water samples (i.e. unfiltered + HNO_3; unfiltered + HNO_3 + HCl + H_2O_2 and filtered (<0.2 µm + HNO_3)) and highway sediments (digested with HNO_3, HCl and HF) were analysed to evaluate the partioning. The results show variable REEs concentrations and Ce anomalies during the rain event, reflecting the impact of car traffic (catalytic converter). Important dissolved Gd anomalies were observed for the CHU, reflecting the use of Gd as a contrast agent for MRI. Futhermore, sewer waters from the Bordeaux area can contain up to ~900 ng/L of dissolved Gd, 20 times more than the Jalle River.

Finally, first flux estimates for REEs in Bordeaux sewer waters (CHU and domestic) and run-off suggest strong anthropogenic contribution (e.g. ~80% for Gd in domestic wastewater), implying potential impact of urban REEs on the natural aquatic environment.