release of contaminants from a steel slag landfill and its impact on groundwater

O. HOUÉCANDE [1], V. LAVASTRE [2], J. MOUTTE [1]*

[1] Ecole des Mines de Saint Etienne, CNRS UMR 5600, 42023 Saint Etienne, France (* correspondence: moutte@emse.fr)

[2] Université Jean Monnet, CNRS, UMR 6524, 42023 Saint Etienne, France

The steel industry produces high amounts of waste that were in the past merely dumped near the production sites, generating voluminous accumulations of potentially harmful material. The dynamics of contaminant release by a large historical dump site near Saint Etienne, France, and its impact on the chemistry of the underlying groundwater have been studied at different scales: 1/ in laboratory (batch and column tests), 2/ at the site scale, using large lysimeters to collect infiltration water at 1.5 m depth and monitor its evolution over 3 years, and 3/ at the regional scale, using piezometers to sample the underlying watertable up- and downstream the dump site.

The most reactive component of the landfill is the fusion slag material; its Ca-bearing minerals (larnite, brownmillerite, ...) being quickly leached, the infiltration waters are Ca-rich (300 – 500 ppm) and hyper-alkaline (pH>12), with consequently high amounts in oxyanion-forming metals, Cr (300-500 ppb) and Mo (2-3 ppm). Conversely, the high pH limits significantly the mobility of other metals present in the slags (Fe, Ni, Pb, Zn). On the long term, slag carbonation is known to decrease the leachability of the material, but it operates only near the surface: the waters collected at depth did not show significant changes in composition during the three years of monitoring. The slag heap appears thus to have regularly exported potential contaminants at relatively high levels, but, except for a molybdenum anomaly in one piezometer downstream the slag heap, the groundwater composition is not affected by the infiltration input from the landfill. This is possibly due to the fact that the heap base is always above the piezometric level, so that the alkaline waters may interact with underlying alluvial formations before reaching the saturated zone.