Study of the spatial distribution of toxic elements in an industrial area (Ajka, Hungary) based on attic dust sampling

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Anthropogenic activities such as mining, metal industry, coal fired power plants have produced large amount of by-products and wide-spread contamination, particularly in the period of the centrally dictated economy after WWII in Hungary. Several studies suggest that significant amount of these contaminants have been deposited in the urban environment. Nowadays, more than half of the world's population is living in urban areas and people spend almost 80 % of their lives indoors in developed countries increasing human health risk due to contamination present in urban dwellings. Attic dust sampling was applied to determine the long-term airborne contamination load in the industrial town of Ajka, Hungary. There has been a high industrial activity in Ajka since the end of the 19th century. In addition to aluminum and alumina industry, coal mining, coal fired power plant and glass industry sites have generated numerous waste heaps to act as multi-contamination sources in the area. In October 2010 the Ajka red mud tailings pond failed and caused an accidental regional contamination of international significance.

The major objective of this research was to study and map the spatial distribution of contamination in airborne attic dust samples. At 27 sampling sites 30 attic dust samples were collected. Sampling strategy followed a grid-based stratified random sampling design. In each cell a house for attic dust sample collection was selected that was located the closest to a randomly generated point in the grid cell. The project area covers an 8x8 grid of 1x1 km cells with a total area of 64 km2. In order to represent long-term industrial pollution, houses with attics kept intact for at least 30-40 years were chosen for sampling. Sampling included the collection of background samples remotely placed from the industrialized urban area.

The concentration of the major and trace elements were measured with ICP-OES and the mercury content was measured with atomic absorption spectrometry. The As, Cu, Hg, Pb and Zn concentrations vary between 6.5-29.3 ppm, 14.1-128 ppm, 0.1-1.8 ppm, 42.5-881 ppm and 90.2-954 ppm, respectively. Results show a good spatial correlation of contamination and sources and spatial trends are also revealed. Attic dust seems to be an efficient and cheap sampling medium to study long-term airborne contamination and possibly associated human health risk in an industrial area.

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