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Long-term airborne contamination studied by attic dust in an industrial area: Ajka, Hungary

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Heavy industrial activities such as mining, metal industry, coal fired power plants have produced large amount of by-products and wide-spread pollution, particularly in the period of centrally dictated economy after WWII, in Hungary. Several studies suggest that significant amount of these pollutants 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, generated numerous waste heaps which 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 heavy metal 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 a 8x8 grid of 1x1 km cells with a total area of 64 km^2. In order to represent long-term industrial pollution, houses with attics kept intact for at least 30-40 years were selected for sampling. Sampling included the collection of background samples remotely placed from the industrialized urban area.

The concentration of the major and toxic elements (Al, Ca, Fe, K, Mg, Mn, Na, P, S, and As, Ba, Cd, Co, Cr, Cu, Li, Mo, Ni, Pb, Se, Sn, Sr, Ti, V, Zn) were measured with ICP-OES and the mercury content was measured with atom absorption spectrometry. Our results show a good spatial correlation of contamination sources and attic dust sampling locations reveal spatial trends as well. Attic dust seems to be an efficient and cheep sampling medium to study long-term airborne contamination and possibly associated human health risk in an industrial area.