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Speciation of hazardous elements released from glass-works fly ash into soils.

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The release of hazardous elements from anomalous geomaterials represents risk for the environment. In our research, we focused on exogenic alteration of fly ash (FA) originating from glass-works in Svetla nad Sazavou (Czech Republic). This factory produces glass with high amounts of PbO. Fly ash from electrostatic filter contains elevated concentrations of Pb (800 ppm), Zn (13 500 ppm), Sb (31 500 ppm) and Ba (67 000 ppm). In present history, small amount of FA may be emitted from factory and can settle in the surrounding environment (soil).

To assess possible risk for the environment we placed samples (0.5 g) of the FA in small nylon bags into soils with different vegetation cover (spruce, beech and unforested area) situated near village Načetín in the Krušné hory Mts. (Ore Mts.), northwest Czech Republic. This locality was selected as a representative example of contaminated place; it neighbours industrial cities and thermal power plants and this area was severally polluted in the past (several decades till early 1990s) mainly by sulphur compounds. The individual sites have the same geological background, climatic conditions and also the same pollution input levels. The distances between sites are about 500 meters.

Bags with samples of the FA was placed into individual soil horizons (litter (A0), A, B and C horizons for spruce; litter (A0), A, B and C horizons for beech and A, B and C horizons for unforested area). The pH of all horizons did not exceed value 4.6 and the lowest pH values were observed in upper horizons. Samples of the FA were exposed in soils for a period of one year (October 2010 – October 2011), and then were removed together with samples of soils, which immediately surrounded the bags with the FA.

Concentrations of studied elements in the FA and concentrations of these elements in the soil samples (initial and after exposition) were determined by inductively coupled plasma mass spectrometry (ICP-MS), after a total decomposition in a mixture of HF and $HClO_4$.

The speciation of studied elements was determined by BCR sequential extraction procedure. We determined concentrations of elements bounded in extractable, reducible, oxidizable and residual fraction.

We observed changes in concentrations of monitored elements in several forms in all monitored sites and in individual horizons and also changes in total concentrations of these elements throughout the sites and horizons.