

Atmospheric deposition studies based on a 20-year period of moss biomonitoring in the vicinity of a lead-zinc plant in Kardzhali, Bulgaria (1995/6-2015/6)

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In 2015, for the fifth consecutive time Bulgaria participated in the moss survey carried out in the framework of the UNECE ICP Vegetation (United Nations Economic Commission for Europe, International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops). Over the years, the areas studied included several 'environmental hotspots', one of which was a hazardous industrial enterprise –the Kardzhali lead-zinc smelter. It was known to be the main source of lead, cadmium, zinc, and sulfur oxide contamination in the country. An overview of the available data was made to reveal temporal and spacial deposition trends for the investigated metals and metalloids during the 20-year period of participation. Throughout the surveys, three analytical techniques were used: neutron activation analysis, atomic absorption spectrometry, and inductively coupled plasma-atomic emission spectrometry. Up to 47 elements were determined in 2005/6, 2010/11 and in 2015/16 (Ag, Al, As, Au, Ba, Br, Ca, Cd, Ce, Cl, Co, Cr, Cs, Cu, Dy, Fe, Hf, Hg, I, In, K, La, Li, Mg, Mn, Mo, Na, Nd, Ni, P, Pb, Rb, Sb, Sc, Se, Sm, Sr, Ta, Tb, Th, Ti, Tm, U, V, W, Yb, and Zn). The results were anticipated to be an extension to the available data on a small number of elements investigated by the State regulatory bodies. A temporary shutting down of the production processes took place during the 2010/11 moss survey, as a penalty for failure to observe the state environmental policy. Thus, it could be assumed that biomonitoring took place around the time when the deposition rates from the emissions were the highest, and then continued through 2015/16, while there was no industrial output. Soon, the smelter in Kardzhali is going to re-open after a major renovation. The data could be used to assess the new pollution-control equipment efficacy, and for estimation of health and environmental risks, and aid risk-management decisions.

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