Vegetation sampling for the screening of subsurface pollution

U. G. Karlson (1), M. D. Petersen (1), M. Algreen (2), A. Rein (2), E. Sheehan (3), M. A. Limmer (3), J. G. Burken (3), P. Mayer (1), and S. Trapp (2)

(1) Department of Environmental Science, Aarhus University, 4000 Roskilde, Denmark (uka@dmu.dk), (2) Department of Environmental Engineering, Technical University of Denmark, 2800 Kgs. Lyngby, Denmark, (3) Department of Civil, Architectural and Environmental Engineering, Missouri University of Science & Technology, Rolla, MO, USA

Measurement of vegetation samples has been reported as an alternative, cheap method to drilling for exploring subsurface pollution. The purpose of this presentation is to give an update on some further developments of this field method – faster sampling and improved analysis for chlorinated solvents, and application of phytomonitoring to heavy metal contamination.

Rapid analysis of trees for chlorinated solvents was facilitated by employing automated headspace SPME-GC/ECD, resulting in a detection limit of 0.87 and 0.04 μg/kg fresh weight of wood for TCE and PCE, respectively, which is significantly lower than we have reported earlier, using manual injection of 1mL headspace air into a GC/MS. Technical details of the new method will be presented. As an even more direct alternative, time weighted average SPME analysis has been developed for in planta sampling of trees, using novel polydimethyl-siloxane/carboxen SPME fibres designed for field application.

In a different study, trees growing on a former dump site in Norway were analyzed for arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), nickel (Ni), and zinc (Zn). Concentrations in wood were in averages (dw) 30 mg/kg for Zn, 2 mg/kg for Cu, and <1 mg/kg for Cd, Cr, As and Ni. For all except one case, mean concentrations from the dump site were higher than those from a unpolluted reference site, but the difference was small and not always significant. Differences between tree species were typically higher than differences between the polluted and the unpolluted site. As all these elements occur naturally, and Cu, Ni, and Zn are essential elements, all trees will have a natural background of these elements, and the occurrence alone does not indicate soil pollution. For the interpretation of the results, a comparison to wood samples from an unpolluted reference site with the same tree species and similar soil conditions is required. This makes the tree core screening method less reliable for heavy metals than, e.g., for chlorinated solvents.