It has been well recognised that qualitative and quantitative aspects of soil biota are of prime significance to soil processes such as the redistribution and decomposition of organic matter. However, almost no study has addressed the effect of contaminants on ecological functioning of soil fauna. The issue of spatial distribution and functional redundancy of species within functional groups as affected by soil contamination remains unclear, limiting the understanding of disrupted soil ecosystems for diagnostic and prognostic purposes. The depth distribution of soil organisms is affected by stratified soil physical and chemical properties, and this vertical heterogeneity is reflected in the nature and rate of soil processes. Likewise, the total amounts and chemical speciation of contaminants usually show stratification in the soil profile as well. It may be hypothesised therefore, that exposure to contaminants will affect depth distribution, species diversity and abundancies of soil fauna, will cause retarded functioning of sensitive species, and consequently may affect organic matter fragmentation and decomposition. We propose to test this hypothesis for the process of fauna-mediated organic matter redistribution and decomposition along pollution gradients in two river flood plain grassland ecosystems. The functional group of litter fragmenters is particularly responsible for organic matter turnover in soil. Their impact on soil processes is a function of specific life-history characteristics, and we further hypothesise that burrowing species, e.g. some earthworm and isopod species, will be more exposed and accumulate higher body burdens as compared to epigeic and hemiedaphic taxa, as a consequence of vertical heterogeneity in concentration and speciation of contaminants. In this study we will quantify: Vertical stratification (i.e. composition and abundance) of litter fragmenting species along pollution gradients in two flood plain grassland ecosystems; functional redundancy of litter fragmenting species in respect to distribution and decomposition of organic matter in the soil profile, as affected by soil contamination; the impact of vertical stratification and species diversity of litter fragmenters on soil organic matter distribution and turnover; heavy metal and PAH accumulation in various species of litter fragmenters to identify food chains at risk for secondary poisoning; the relative impact and functional identity of single species, potentially identifying key species, to enable predictions of ecosystem process rates in contaminated soils from altered species composition. Our study aims to develop quantitative relations between toxicant availability and vertical distribution of soil fauna and soil processes, thus providing the mechanisms necessary for scenario studies and ecological risk assessment with respect to environmental heterogeneity, and facilitating the optimisation of soil management and landscape planning with minimum ecological risk. This project is part of the NWO stimulation program system-oriented ecotoxicology situated in the Afferdensche en Deestche river flood plains. The aim of the stimulation program is to promote scientific understanding of the way ecosystems react to chemical pollution of a chronic and diffuse nature, and to make use of fundamental and relevant knowledge to assist in formulating and implementing policy with respect to the ecological risks of chronic and diffuse pollution of the environment resulting from a combination of substances.