The Mutagenic Hazards of PAH-Contaminated Settled House Dust

Paul White[1], Rebecca M. Maertens[1]

[1]Health Canada

SHD (settled house dust) is a complex matrix composed of biological derivatives, fibres, aerosols from consumer products, and mineral derivatives. The extensive variety of sources yields a heterogeneous matrix with temporal and spatial variability in particle size, shape, and composition. Although there is very little published information on dust mutagenicity, research to date suggests that SHD can pose a mutagenic hazard. Comparisons with other particulate matrices shows that SHD tends to be more mutagenic than outdoor soils, including those collected from contaminated industrial sites (60 – 950 TA98 rev/g), but less mutagenic than suspended particulates collected indoors (6,000 - 550,000 TA98 rev/g) or outdoors (17,920 -1,649,425 TA98 rev/g). A recent compilation of published SHD analyses indicates that SHD samples are often contaminated with mutagenic polycyclic aromatic hydrocarbons (PAHs). Although PAH concentrations can reach 550 mg/kg of PAHs (mean = 28.3 ± 8.1 mg/kg, N = 112), the observed concentrations can only account for a small fraction (i.e., 3 to 23%) of the SHD mutagenic activity. Our current analyses of SHD samples collected from 58 randomly selected homes in the Ottawa area reveals significant levels of Salmonella mutagenic activity, particularly frameshift activity assessed on strains TA98 and YG1041. Over 80% of the examined samples yielded potent positive responses, with maximum values reaching 11,600 TA98 rev/g (+S9) and 188,430 YG1041 rev/g (-S9). No significant responses were obtained for strains TA100 and TA102, and only a limited number of positive responses were obtained on the metabolically enhanced TA100 derivative YG1042. The observed pattern of mutagenic activity suggests the presence of PAHs, nitroarenes, and aromatic amines. Acid/base fractionation reveals mutagenic activity in both the basic and the neutral samples. Ongoing chemical analyses is assessing the presence of priority PAHs, PAH derivatives, and aromatic amines including the amino acid pyrolysis products PhiP, IQ, MeIQ and MeIQx.