Ottawa-Carleton Chemical and Environmental Toxicology Seminar Series

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Mutagenicity and Carcinogenicity of Combustion Emissions: Biomarkers and Risk for Cancer

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Pollution (air, water, soil, etc.) is the major cause of mortality worldwide, and air pollution is most responsible for pollution-associated mortality. Combustion emissions are the primary contributor to the particulate fraction of air pollution, and research during more than 40 years has shown that the particulate fraction, also called particulate matter (PM), of air and combustion emissions is mutagenic and carcinogenic in experimental systems and humans. Although the mutagenic potency by mass of the extractable organics of PM from air and combustion emissions varies by only ~1 order of magnitude worldwide, the mutagenic potency of air by mass of PM/m3 varies by ~5 orders of magnitude worldwide, as does the carcinogenic potency of the extractable organics of PM on mouse skin. An emission factor (EF) is the amount of pollution produced per some activity, such as burning a kg of wood. The mutagenicity EF is highest for open (uncontrolled) burning, such as smoldering forest fires, and lowest for closed (highly controlled) burning, such as commercial boilers for producing electricity. The mutagenicity EF is influenced little by what is burned and mostly by how the material is burned. People exposed chronically to outdoor air pollution, such as traffic policemen, have higher levels of genotoxicity biomarkers, such as chromosome aberrations and DNA adducts, than do people working indoors, and the increased levels of such biomarkers are associated with increased cancer risk. We have shown that the primary mutations induced by the extractable organics of PM from air pollution, coal emissions, and cigarette smoke are G to T base substitutions, and these are the primary class of base substitution found in lung tumors of cigarette smokers and people exposed to coal emissions. Our recent studies of the gas phase of air pollution simulated in a smog chamber show that the gas phase induces primarily G to A base substitutions, and these are the primary class of base substitution found in the lung tumors of non-smokers. This suggests an important role for the gas phase of air pollution in lung cancer among non-smokers. Chronic exposures to combustion emissions and air pollution result in systemic exposures to mutagens, the induction of genotoxicity biomarkers and mutation, and an increased risk for cancer.

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Zoom- https://us02web.zoom.us/j/82211228996?pwd=RmlHMHlTUzNMSjFoVDZ4aWVtZ0xMUT09

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