CANCER RISK ASSOCIATED WITH THE INHALATION OF PM-BOUND PAHS FROM THE GRILLING PROCESS

Artur Jerzy BADYDA 1,7, Wioletta ROGULA-KOZŁOWSKA 2, Grzegorz MAJEWSKI 3, Przemysław OBERBEK 4, Kamila WIDZIEWICZ 5, Izabela JURECZKO 6, Mariusz ROGULSKI 1

1Warsaw University of Technology, Faculty of Building Services, Hydro-and Environmental Engineering, Department of Informatics and Environment Quality Research, Warsaw, Poland
2The Main School of Fire Service, Faculty of Fire Safety Engineering, Warsaw, Poland
3Warsaw University of Life Sciences, Faculty of Civil and Environmental Engineering, Warsaw, Poland
4Central Institute for Labour Protection – National Research Institute, Warsaw, Poland
5Polish Academy of Sciences, Institute of Environmental Engineering, Zabrze, Poland
6Power Research & Testing Company “ENERGOPOMIAR” Ltd, Gliwice, Poland
7Polish Federation of Asthma, Allergy and COPD Patients’ Associations, Warsaw, Poland

Objective: The main goal was to assess cancer risk from the exposure to PM-bound PAHs generated during grilling process. The exposure of the grill master and people witnessing the grilling process has been measured.

Materials and Methods: The investigation encompassed 4 types of grill/fuel: lump charcoal (LC), charcoal briquettes (CB), as well as grills powered by liquid propane (LP) and electric energy (E). 3 separate samples of respirable fraction (PM$_{4}$) has been collected: during the combustion of fuel itself, while grilling vegetables and meat dishes. 16 polycyclic aromatic hydrocarbons (PAHs) congeners were extracted and measured quantitatively using GC chromatograph. A probabilistic risk model was developed to assess the incremental lifetime cancer risk (ILCR) in people exposed by breathing carcinogenic PAHs.

Results: The inhalation-ILCR followed a lognormal distribution with a geometric mean of $2.99\times10^{-2}$-$2.71\times10^{-1}$ in case of exposure to PM$_{4}$-bound PAHs emitted by unloaded grills, $6.40\times10^{-2}$-$5.54\times10^{-1}$ while grilling vegetables and $4.98\times10^{-2}$-$6.08\times10^{-1}$ when grilling meat. The highest values concern the grill powered by CB. Personal exposure risk of people participating in the grilling process but not being grill masters was lower and varied from $1.55\times10^{-2}$ to $2.52\times10^{-2}$ and in the control area from $5.33\times10^{-3}$ to $8.61\times10^{-3}$.

Conclusion: CB is most dangerous concerning PAHs inhalation exposure from barbecue exhausting gases. PAHs exposure while grilling meat dishes is higher than in case of vegetables. The risk of grill emission gases inhalation exceeded $10^{-3}$ suggesting high probability of cancer occurrences due to PAHs exposure.