A comparison of occupational and non-occupational exposure to diesel exhausts and its consequences for studying health effects

Diesel exhausts are common both in occupational and non-occupational settings. They are considered as a cause of lung cancer, and International Agency for Research on Cancer (IARC) recently upgraded the evidence from probable to sufficient (http://www.iarc.fr). However, the opinions about the health effects are not consistent. A recent review concluded that the published studies lack consistency.[1] A pooled analysis of case-control studies and a study of miners were interpreted as consistent with an increased risk but questioned by others.[2,3] Some of the studies of lung cancer risk from diesel exhaust are evaluating the risk in drivers of vehicles like buses, trains or heavy equipment operators.[1,2,4]

The possibility to find an association in epidemiological study depends on the contrast in exposure between groups. We used nitrous dioxide as a marker of diesel exhausts and estimated exposure during working time (1700 h/year), time in city for commuting and so on (700 h/year) and to the average concentration in the city ('city background'; 6360 h/year). City concentrations were from a Swedish data base (http://www.ivl.se).

Iron miners in Kiruna had an average concentration of 280 μg/m^3[5] during work in the mine. The average concentration in the city streets was 15 μg/m^3 and the city background 8 μg/m^3. Thus, the cumulative exposure was 5.4×10^5 h×μg/m^3 ($1700\times280+700\times15+6360\times8=537\,380$) of which the occupational exposure constituted 89%. The concentration for tunnel workers in the Stockholm area was reported to 350 μg/m^3,[6] the concentrations for a busy street 38 (average of a street 2005–2010) and city background 18 μg/m^3 (average of two sites 2010). Thus, the occupational exposure constituted 81% for the tunnel workers assuming that they worked all their working time in the tunnel. There have been some measurements on bus, truck and taxi drivers in the Stockholm area, indicating an average concentration of 53 μg/m^3,[6] indicating an occupational contribution of 29% in drivers (figure 1).

These are the occupational contributions of diesel exhausts during a year in which the worker is occupationally active. If the life-time cumulative exposure would be estimated the occupational contribution would decrease considerably. The recent US study of miners found an average concentration of 128 μg/m^3 elementary carbon in underground workers while the concentration for surface worker was only 1.7 μg/m^3.[3] However, if the lung cancer risk at the age of 70 is proportional to the life-time cumulative risk, the occupational contribution would be just about 50% for a worker who had worked 5 years underground in the mine and 70% if he had worked underground for 10 years.

We conclude that occupational studies of the risk with diesel exhausts would considerably underestimate the risk if they do not consider the non-occupational exposure. This especially concerns studies of modestly exposed groups like drivers in non-confined spaces.

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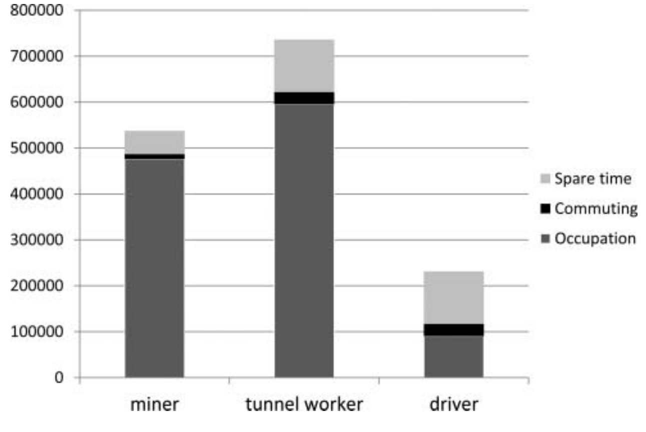

Figure 1 Contribution of cumulative exposure to NO_2 (hours×μg/m^3) during a year from different sources.

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