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Confronting the Health Burden of Fine Particulate Matter Exposures in Product-Oriented Impact Assessment

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Abstract: Fine particulate matter (PM2.5) is one of the most important environmental factors contributing to global human disease burden. However, lacking a clear guidance on how to address health effects from PM2.5 exposure in a product life cycle perspective, practitioners often fail to report life cycle impacts for this category. To address this need, a task force was initiated to build a PM2.5 health impact framework and exposure factors. Existing literature was reviewed and expert input was collected and discussed in an initial Guidance Workshop. Subsequent work combined existing models and methods based on a set of defined criteria to develop initial guidance and recommendations for quantifying health effects from PM2.5 exposure. Recommendations include: (1) the framework proposed by Humbert et al. (doi:10.1021/es103563z) provides an assessment starting point; (2) intake fraction can be used as exposure metric with breathing rate linking air concentration and intake; (3) disability-adjusted life years without age-weighting and discounting can be used as a health metric; (4) archetypes can account for aspects influencing intake fractions; (5) spatial differentiation should be established for all archetypes; (6) emission-weights are needed in all cases where emission and/or exposure conditions are unclear; (7) the 2010 Global Burden of Disease Study provides a useful starting point for effect assessments; (8) cause-specific mortality can provide an informative basis as metric, but disability weights need further analyses; and (9) it remains to be discussed how to address non-linear exposure-response. There is insufficient evidence to differentiate between different PM2.5 sources or particle sizes regarding toxicity. Our study constitutes a first step towards providing guidance for how to account for health effects of PM2.5 exposures in product-oriented impact assessments. However, some inconclusive aspects require further analysis.

Keywords: A-life cycle analysis, B-particulate matter, C-air, intake fraction, health effects, intake fraction, health effects

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Unravelling the Exposome through Health and Environment-wide Associations based on Large population Surveys

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Abstract: The exposome represents the totality of exposures from conception onwards, identifying, characterizing and quantifying the exogenous and endogenous exposures and modifiable risk factors that predispose to and predict diseases throughout a person's life span. Unravelling the exposome implies that both environmental exposures and genetic variation are reliably measured simultaneously. The HEALS methodology brings together a comprehensive array of novel technologies, data analysis and modeling tools that support efficiently exposome studies. In addition it collates environmental, socio-economic, exposure, biomarker and health effect data and puts in place the procedures and computational sequences necessary for applying advanced bioinformatics coupling thus effective data mining, biological and exposure modeling so as to ensure that environmental exposure-health associations are studied comprehensively. The overall approach will be verified in a series of population studies across Europe, tackling different levels of environmental exposure, age windows of exposure, and socio-economic and genetic variability. The main objective of HEALS is the refinement of an integrated methodology and the application of the corresponding analytical and computational tools for performing environment-wide association studies in support of EU-wide environment and health assessments. To achieve this aim, HEALS integrates a lot of novel applications for refining external exposure (use of satellite data, ubiquitous sensors, agent based models), internal exposure (life-span internal dosimetry models). Understanding of the interaction between human biomonitoring (HBM) and exposure modeling (EM) is another key factor for elucidating the exposome. Finally, the effect of socioeconomic status (SES) on the several exposure variables will also be investigated. Examples of the HEALS approach to respiratory morbidity in Greek cities associated to energy poverty will be given in this work.

Keywords: A-aggregate exposure, A-biomonitoring, A-cumulative exposure, A-global health, A-epidemiology