



# LUND UNIVERSITY

## Can PM2.5 be Used as a Proxy for Deposited Particle Dose in the Respiratory Tract?

Kristensson, Adam; Rissler, Jenny; Löndahl, Jakob; Johansson, C; Swietlicki, Erik

*Published in:*

Proceedings of the "Workplace and Indoor Aerosols Conference" (electronic version only)

2012

[Link to publication](#)

*Citation for published version (APA):*

Kristensson, A., Rissler, J., Löndahl, J., Johansson, C., & Swietlicki, E. (2012). Can PM2.5 be Used as a Proxy for Deposited Particle Dose in the Respiratory Tract? In *Proceedings of the "Workplace and Indoor Aerosols Conference" (electronic version only)* (pp. 35-35)

*Total number of authors:*

5

### General rights

Unless other specific re-use rights are stated the following general rights apply:

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

### Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117  
221 00 Lund  
+46 46-222 00 00

## Can PM<sub>2.5</sub> be used as a proxy for deposited particle dose in the respiratory tract?

Kristensson A.<sup>1</sup>, Rissler J.<sup>2</sup>, Löndahl J.<sup>2</sup>, Johansson C.<sup>3</sup>, and Swietlicki E.<sup>1</sup>

<sup>1</sup>Department of Physics, Lund University, P. O. Box 118, SE-221 00, Lund, Sweden

<sup>2</sup>Department of Design Sciences, Lund University, P. O. Box 118, SE-221 00 Lund, Sweden

<sup>3</sup>Department of Applied Environmental Science, Stockholm University, SE-106 91 Stockholm, Sweden

Keywords: H-TDMA, ICRP, source apportionment, hygroscopic, hydrophobic, size distribution

Presenting author email: adam.kristensson@nuclear.lu.se

### Introduction

There are a few studies available that relate health effects to ambient concentrations of particle matter in residential areas where the exposure is high to wood combusted particles (Naehrer et al., 2007). However, we do not know if particle measures such as PM<sub>2.5</sub> or PM<sub>10</sub> are good indicators of deposited dose in the respiratory tract. If they are, we cannot expect stronger associations with adverse health effects in short-term exposure epidemiological studies if we would use a different proxy for the deposited dose. On the other hand, if this is not the case, we would expect a stronger health association if we are able to predict the deposited dose in a more precise manner. In this study, we address this question and investigate whether PM<sub>2.5</sub> is a satisfactory proxy for the deposited surface area and volume in the respiratory tract.

### Methods

The respiratory tract deposition is obtained at a residential area in northern Sweden, in a town called Lycksele, where the contribution to air pollution from domestic wood combustion and road traffic is significant. The deposited surface area and volume have been calculated using hygroscopic particle data and data from the particle number size distribution. The particle measurement data is combined with the Multiple Part Particle Deposition model of respiratory tract deposition for hydrophobic particles (MPPD, version 1.0, Chemical Industry Institute of Toxicology, Research Triangle Park, NC, with inspiratory fraction of 0.5, particle density of  $1 \cdot 10^3 \text{ kg m}^{-3}$ , and nasal breathing). This has resulted in data of the deposited concentration of particle surface area and volume as function of size and two hygroscopic growth modes, one less hygroscopic and one more hygroscopic mode.

The principle methodology is described in more detail in Löndahl et al. (2009).

### Results and Conclusions

The results show that when averaged over many hours or longer, there is a high correlation between PM<sub>2.5</sub> and the deposited surface area and volume. For example, for an 11-hour running mean the Pearson product-moment correlation is  $p \sim 0.91$  ( $p^2 \sim 0.83$ ). This is proof that PM<sub>2.5</sub> is indeed a satisfactory proxy for the deposited dose in short-term exposure epidemiological studies. Hence, we cannot expect more adverse health outcomes or stronger associations even if we would have data on the deposited surface area and volume.

Conversely, the correlation between one-hour averages of PM<sub>2.5</sub> and the deposited surface area and volume is about  $p \sim 0.75$ , lower than for the 11-hour running mean. This might indicate that PM<sub>2.5</sub> is not representative for the deposited dose during hour-long episodes of very high particle exposure. On the other hand, the elevated episodes in Lycksele linger more than a few hours, and hence the lower correlation on an hour basis might not have any practical implications for Lycksele or other towns with similar conditions.

Löndahl, J. et al. (2009). *Env. Sci. Technol.* **43**, 4659-4664.

Naehrer, L. P., et al., (2007). *Inhal. Toxicol.*, **19**, 67-106.



# WORKPLACE AND INDOOR AEROSOLS CONFERENCE

Lund University, 19-20 April 2012

# PROCEEDINGS



The Swedish Research Council Formas  
Committed to excellence in research for sustainable development



TRUST. SCIENCE. INNOVAT

EXIS  
INSTRUMENTS & MEASUREMENTS

CAMBUSTION