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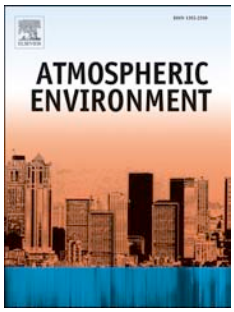

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PII: S1352-2310(14)01003-6

DOI: 10.1016/j.atmosenv.2014.12.055

Reference: AEA 13505

To appear in: *Atmospheric Environment*

Received Date: 21 August 2014

Revised Date: 19 December 2014

Accepted Date: 22 December 2014

Please cite this article as: Kasurinen, S., Jalava, P.I., Tapanainen, M., Uski, O., Happo, M.S., Mäki-Paakkanen, J., Lamberg, H., Koponen, H., Nuutinen, I., Kortelainen, M., Jokiniemi, J., Hirvonen, M.-R., Toxicological effects of particulate emissions – a comparison of oil and wood fuels in small- and medium-scale heating systems, *Atmospheric Environment* (2015), doi: 10.1016/j.atmosenv.2014.12.055.

Toxicological effects of particulate emissions – a comparison of oil and wood fuels in small- and medium-scale heating systems

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Abstract

The use of wood instead of oil fuels in heating systems is strongly encouraged in many countries. Yet it is unknown to what extent such a large-scale change from oil to wood fuels in heating systems would contribute to any negative health effects from their emissions. We compared the toxicological properties of particulate matter (PM) emissions from wood and oil fuels from two small-scale and two medium-scale heating systems. To assess whether oil or wood combustion emissions cause adverse effects and which PM emissions' effects are more profound, we measured cell viability and proliferation, inflammatory markers, as well as DNA damage in RAW264.7 mouse macrophages. We found that the medium-scale oil-fueled heating system induced a dose-dependent increase of DNA damage, short-term cytotoxic effects, and a cell cycle arrest in the G_2/M-phase. We did not detect an induction of DNA damage by the medium-scale wood-fired system. However, we detected significant short-term cytotoxicity. We found that both oil and wood combustion emission samples from the small-scale heating systems induced DNA damage. However, the short-term cytotoxic effects were greater for the PM emissions from the oil-fired heating system. PM mass emissions differed significantly between the tested heating systems. The lowest emissions, 0.1 mg/MJ, were produced by the small-scale oil-fired heating system; the highest emissions, 20.3 mg/MJ, by the medium-scale oil-fired heating system. The wood-fired heating systems' PM mass emissions were in between these concentrations, complicating the direct comparison of the emissions' health related toxic effects. Conclusively, our results indicate that the emissions from both the small- and the medium-scale wood-fueled heating systems cause overall less cytotoxicity and DNA damage in a cell model than the emissions from the corresponding oil-fueled heating systems. Hence, controlled wood-fueled heating systems may be good alternatives to heating systems fired with fuel oil.

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