Current Diesel Engine Exhaust Exposure in the Ontario Construction Industry

Stephanie Ziembicki^{1,2}, Tracy L. Kirkham^{1,2}, Paul A. Demers^{1,2}, Cheryl E. Peters^{3,4,5}, Melanie Gorman-Ng^{6,7}, Hugh W. Davies⁶, Thomas Tenkate⁸, Sheila Kalenge², Nicola Blagrove-Hall², Kate Jardine² and Victoria H. Arrandale^{1,2}

¹ Dalla Lana School of Public Health, University of Toronto, Toronto, Canada

² Occupational Cancer Research Centre, Ontario Health, Toronto, Canada

³ Department of Cancer Epidemiology and Prevention Research, Alberta Health Services, Calgary, Canada

⁴ Departments of Community Health Sciences and Oncology, University of Calgary, Calgary, Canada

⁵ CAREX Canada, Vancouver, Canada

⁶ School of Population and Public Health, University of British Columbia, Vancouver, Canada

⁷ BC Construction Safety Alliance, New Westminster, Canada

⁸ School of Occupational and Public Health, Ryerson University, Toronto, Canada

E-mail: victoria.arrandale@utoronto.ca

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Abstract

Introduction: Diesel engine exhaust (DEE) is a known carcinogen and a common occupational exposure in Canada, particularly within construction. The use of diesel-powered equipment in the construction industry is widespread, but little is known about DEE exposures and occupational disease in this work setting. The objective of this study was to characterize and identify key determinants of DEE exposure at construction sites in Ontario.

Methods: Diesel particulate matter (DPM) measurements were taken from workers employed on seven infrastructure construction worksites in Ontario. Full-shift personal air samples were collected from workers using a constant-flow pump and SKC aluminum cyclone with 37-mm quartz fibre filters in an open-faced cassette. Samples were analyzed for elemental carbon (EC), a surrogate of DEE exposure, following NIOSH method 5040. Exposures were compared to recommended health-based limits, including the Dutch Expert Committee on Occupational Safety (DECOS) limit (1.03 µg/m³ respirable EC) and the Finnish Institute of Occupational Health (FIOH) recommendation (5 µg/m³ respirable EC). A determinants of exposure model was constructed.

Results: In total, 126 DPM samples were collected, ranging from <0.47–52.58 µg/m³ with a geometric mean (GM) of 4.23 µg/m³ (geometric standard deviation (GSD)=3.05). Overall, 44.8% of samples exceeded the FIOH limit, mostly within underground worksites (93.5%), and 88.8% exceeded the DECOS limit. Underground workers (GM=13.20 µg/m³, GSD=1.83) had exposures approximately 4-times higher than below grade workers (GM=3.56 µg/m³, GSD=1.94) and 9-times higher than aboveground workers (GM=1.49 µg/m³, GSD=1.75). Work grade, enclosed cabs, and seasonality were identified as the major determinants of exposure.

Conclusions: This study provides a better understanding of current DPM exposure in Canadian construction. Most exposures were above recommended health-based limits, signifying a need to further reduce DPM levels in construction. These results can inform a hazard reduction strategy including a new occupational exposure limit and targeted intervention/control measures to reduce DPM exposure and the burden of occupational cancer.