

## Particulate Matter and Manganese Exposures in Toronto, Canada

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In the early 1990s, a commercial firm sought a permit from EPA to introduce into gasoline in the US the new manganese-containing anti-knock compound, MMT. When the permit was denied, the firm sued EPA, but the 4th District Court upheld EPA's position and required more research to be performed to ensure its safety to people. Research was needed to determine the levels of exposure people would experience if MMT were used in gasoline and whether any human adverse health effects might occur. This landmark paper reported results of human exposure to manganese in Toronto, Canada, where MMT had been added to gasoline for over 20 years.

During the Toronto Study, a personal exposure probability-based study, we recorded measurements from over 1,000 persons, which permitted us to estimate the 99th percentile of exposure ( $136 \mu\text{g}/\text{m}^3$ , with a standard error of  $\pm 18 \mu\text{g}/\text{m}^3$ ). Estimating the percentile distribution up to the 99th percentile allowed us to calculate the number of persons exposed to over  $50 \mu\text{g}/\text{m}^3$ , the US health criteria standard at the time.

Knowledge about human exposure levels to manganese and health effects from this exposure was needed in order to ensure that a repeat of the lead-additive experience would not occur, i.e., the impairment of cognitive development in children at very low lead levels of exposure. Neurological effects have been observed in adults at occupational levels of manganese; however, little is currently known about the effect on children's cognitive development from environmental exposure levels to manganese.

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