

Assessment of Personal Exposure to Manganese in Children Living Near a Ferromanganese Refinery

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Background and Aims: Airborne exposure to manganese (Mn) can result in neurologic effects. Stationary air sampling is the traditional technique to assess Mn exposure for communities, yet may not accurately reflect children's personal exposure. The study aimed to 1) determine personal air Mn exposure in children residing near a ferromanganese refinery, and 2) identify the relationship between personal air Mn, stationary air Mn, and time-weighted distance from the refinery (TWD).

Methods: A subset of children living in non-smoking households ages 7-9 enrolled in the Marietta Community Actively Researching Exposure Study during March – June 2009 and 2010 were invited to participate. Participants wore a PM_{2.5} sampler (Personal Modular Impactor) for 48 hours. TWD was based on time spent at home and school and the distance of each from the refinery. Stationary outdoor air sampling was conducted 8 km from the refinery using a Harvard-type PM_{2.5} impactor. The relationship between personal Mn exposure and TWD was examined by multiple regression controlling for stationary air Mn concentration, wind speed and direction, and average precipitation.

Results: We collected complete personal air sampling data on 38 children. TWD ranged from 4.7 km to 28.5 km with a mean distance of 11.1 (4.7 st.dev) km. Mn concentration in personal air samples ranged from 1.5 ng/m³ to 54.5 ng/m³ (mean, 11.7 ng/m³; st.dev, 12.5 ng/m³). TWD was the most significant predictor of personal air Mn concentration with an associated decrease of approximately 8% of the natural log of personal air Mn for each km TWD ($p < 0.005$, 95% CI -13% to -2%). Wind speed and stationary Mn levels were also significantly associated with personal exposure.

Conclusions: A child's location (home and school) relative to the refinery is a significant predictor of personal Mn exposure. Future analyses will evaluate ambient air Mn exposure on childhood neurobehavioral development.

References:

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