

## **Exposure, neurobehavioural performance and hormone status of workers exposed to manganese in the production of manganese alloys**

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### **ABSTRACT**

One hundred randomly selected workers (participation rate 91%) from three Norwegian manganese alloys producing facilities were compared to 100 age-matched referents (participation rate 91%), recruited from silicon and titanium producing plant, in a cross-sectional study.

Personal exposure to inhalable and respirable manganese in the work room air was assessed with IOM sampler (SKC Inc.) and cyclone (Casella) in parallel. The aerosol collected was separated into «soluble» and «non-soluble» Mn-fractions by sequential extraction. Neurobehavioural tests, including motor, cognitive, hand-eye coordination and reaction time tests, and symptom questionnaires were administered. Serum hormone concentrations were measured.

The mean ages of the exposed and referent subjects were 44.2 (range 27.6-61.9) and 44.2 years (range 27.7-61.4), respectively. More current smokers was recorded in the exposed group (50% vs 45%). The mean duration of manganese exposure was 20.2 years (range 2.1-41.0). The geometric mean concentration of inhalable manganese measured at the time of examination was 0.3 mg/m<sup>3</sup> (range 0.01-11.5), 10.6% (geometric mean) (95% CI 8.9-12.5) being respirable, and 26% (95% CI 22-31) being «non-soluble». Higher manganese mean concentrations in the exposed subjects were measured in whole blood (189 nmol/l vs 166 nmol/l) and urine (0.9 nmol/mmol Creatinine vs 0.4 nmol/mmol Creatinine).

No increase in subjective symptoms, and no association between manganese exposure and cognitive test results, simple reaction time or hand-eye coordination, were found. However, performance on the static steadiness test (no. of touches) was poorer in the exposed group (geometric mean 65.2 vs 40.2,  $p < 0.001$ ). The performance was statistically significantly associated with the exposure duration, and nearly significantly associated with the whole blood manganese concentration. A slightly increased concentration of serum prolactin was found (geometric mean 229 mIE/l vs 197 mIE/l,  $p = 0.06$ ). Prolactin was statistically significantly associated with the air concentration of «soluble» manganese, and nearly significantly associated with the exposure duration. Tobacco smoking modified the static steadiness test performance and the serum prolactin concentrations.