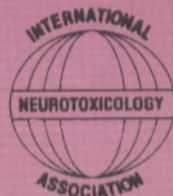


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A Review of the Health Effects from Occupational Manganese Exposures

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Occupational exposure to manganese (Mn) can take place in a variety of industrial settings and is constantly increasing on a global scale. Currently Mn is being used in new applications such as electronics, new steel and alloys with cryogenic and non-magnetic properties, in addition to the traditional sectors of ore, ferroalloy and dry-cell batteries production.

Although much literature is available on the clinical manifestation of Mn poisoning, quite a few studies have been conducted on the early effects of prolonged exposure to "low" doses. They are mainly of cross-sectional type, but some follow-up experiences are now available. Important information can be derived from this research, useful for the identification of more precise health-based limit values for occupational exposure. Sensitive neurobehavioral and neuro-physiological methods were used to assess the central nervous system functions, together with biochemical and neuro-endocrinal indicators to evaluate the integrity of neurotransmitter systems. All these different methodologies coherently support the hypothesis of an impairment of extrapyramidal function and a tendency to aggressive behavior, that are possible consequences of an interference with the dopaminergic system.

Since Mn accumulates in the brain and is released with an extremely slow elimination kinetics, the exposure limit values should be able to protect the integrity of neurobehavioral functions over a prolonged period of exposure, to prevent the onset of parkinsonian disturbances in the geriatric age. Therefore, the annual average airborne Mn concentrations should be low enough not to exceed a certain cumulative dose that can be reached after the average period of working life.

Taken together all the indications provided by the available occupational studies, a TLV-TWA of 100 $\mu\text{g}/\text{m}^3$ should be adopted for the airborne concentration of Mn in total dust, measured with personal sampling. Although a lack of accuracy of biological monitoring may occur due to high individual variability, the concentration of 7.5 $\mu\text{g}/\text{l}$ could be tentatively suggested for Mn in total blood as a possible biological exposure limit for occupationally exposed workers.