

Manganese Health Research Program: Recent published literature

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Introduction

This report presents bibliographic details of recent literature addressing a number of research areas that are considered of direct relevance to the health effects of Manganese (Mn), and include:

Section 1 - EXPOSURE MEASUREMENT AND MODELLING: Papers relating to the measurements or modelling of environmental and occupational Mn exposure, the development of biomarkers of exposure or effect.

Section 2 - HEALTH EFFECTS: Papers on the influence of Mn on health, disease and dysfunction.

Section 3 - MECHANISM: Papers on the physiological, biochemical and cellular mechanisms underlying the toxic effects of Mn.

Section 4 - HUMAN SUSCEPTIBILITY: Papers relating to assessment of the influence of genetic and epigenetic factors on human susceptibility to the effects of Mn.

Section 5 - TREATMENT AND IMAGING: Papers on the development and implementation of new medical approaches to the treatment of excessive Mn exposure.

Section 6 - MISCELLANEOUS: Other papers considered of interest or potential relevance to the study of the health effects of Mn.

The papers presented herein were identified using a series of structured searches of the following on-line databases: Medline, Toxline, Biological Sciences and Proquest Health. The paper abstracts were reviewed and categorised by an experience Scientist to confirm their relevance before inclusion in this report.

The papers presented were identified as being first published between **June 2006** and **August 2006**, together with some earlier papers not previously included in the on-line databases used to identify publications. Future reports will present the literature published during subsequent 3-monthly (quarterly) intervals.

1. EXPOSURE MEASUREMENT AND MODELLING

Agusa, T., Kunito, T. & Fujihara, J., *et al* (2006) Contamination by arsenic and other trace elements in tube-well water and its risk assessment to humans in Hanoi, Vietnam. *Environmental Pollution*, 139(1), 95-106.

Antonini, J.M., Santamaria, A.B. & Jenkins, N.T., *et al* (2006) Fate of manganese associated with the inhalation of welding fumes: Potential neurological effects. *Neurotoxicology*, 27(3), 304-10.

Bast Pettersen, R., Ellingsen, D.G. & Hetland, S.M., *et al* (2004) Neuropsychological function in manganese alloy plant workers. *International Archives of Occupational and Environmental Health*, 77(4), 277-287.

Bellido-Milla, D., Garcla-Verdugo-Caso, C. & HernAndez-Artiga, M.P. (2002) Classification and Prediction Techniques Applied to Metal Concentrations Produced by Welding Fumes in a Shipyard. *Toxicological and Environmental Chemistry*, 83(1-4), 45-53.

Bocio, A., Nadal, M. & Domingo, J.L. (2005) Human exposure to metals through the diet in Tarragona, Spain: temporal trend. *Biological Trace Element Research*, 104(3), 193-201.

Bocio, A., Nadal, M. & Garcia, F., *et al* (2005) Monitoring metals in the population living in the vicinity of a hazardous waste incinerator: concentrations in autopsy tissues. *Biological Trace Element Research*, 106(1), 41-50.

Botta, C., Iarmarcovai, G. & Chaspoul, F., *et al* (2006) Assessment of occupational exposure to welding fumes by inductively coupled plasma-mass spectroscopy and by the alkaline Comet assay. *Environmental and Molecular Mutagenesis*, 47(4), 284-295.

Colquitt, P.J. (2002) Do powered toothbrushes contaminate toothpaste with metals? *The Science of the Total Environment*, 289(1-3), 25-32.

Crinella, F.M. (2006) Childhood behavior disorders: Neuropsychological deficits in neonatal dietary manganese exposure. *46th Annual Meeting of the Teratology Society*, 24 - 29 June 2006.

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Godderis, L., Vanderheyden, W. & Van Geel, J., *et al* (2005) Exposure and inhalation risk assessment in an aluminium cast-house. *Journal of Environmental Monitoring*, 7(12), 1359-1363.

Granero, S. & Domingo, J.L. (2002) Levels of metals in soils of Alcalá de Henares, Spain: human health risks. *Environment International*, 28(3), 159-164.

Hałatek, T., Sinczuk-Walczak, H. & Szymczak, M., *et al* (2005) Neurological and respiratory symptoms in shipyard welders exposed to manganese. *International Journal of Occupational Medicine and Environmental Health*, 18(3), 265-274.

Harris, M.K., Ewing, W.M. & Longo, W., *et al* (2005) Manganese exposures during shielded metal arc welding (SMAW) in an enclosed space. *Journal of Occupational and Environmental Hygiene*, 2(8), 375-382.

Homady, M., Hussein, H. & Jiries, A., *et al* (2002) Survey of some heavy metals in sediments from vehicular service stations in Jordan and their effects on social aggression in prepubertal male mice. *Environmental Research*, 89(1), 43-49.

Kim, J.Y., Hauser, R. & Wand, M.P., *et al* (2003) Association of expired nitric oxide with urinary metal concentrations in boilermakers exposed to residual oil fly ash. *American Journal of Industrial Medicine*, 44(5), 458-466.

Liu, Y., Woodin, M.A. & Smith, T.J., *et al* (2005) Exposure to Fuel-Oil Ash and Welding Emissions During the Overhaul of an Oil-Fired Boiler. *Journal of Occupational and Environmental Hygiene*, 2(9), 435-443.

Lu, L., Zhang, L-L. & Li, G.J., *et al* (2005) Alteration of serum concentrations of manganese, iron, ferritin, and transferrin receptor following exposure to welding fumes among career welders. *Neurotoxicology*, 26(2), 257-265.

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Myers, J.E., Thompson, M.L. & Naik, I., *et al* (2003) The utility of biological monitoring for manganese in ferroalloy smelter workers in South Africa. *Neurotoxicology*, 24(6), 875-883.

Nadal, M., Schuhmacher, M. & Domingo, J.L. (2004) Metal pollution of soils and vegetation in an area with petrochemical industry. *The Science of the Total Environment*, 321(1-3), 59-69.

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Sharma, R. & Pervez, S. (2005) Toxic metals status in human blood and breast milk samples in an integrated steel plant environment in Central India. *Environmental Geochemistry and Health*, 27(1), 39-45.

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Spiegel-Ciobanu, V. (2006) Parkinson's disease and exposure to manganese during welding. *Welding and Cutting*, (2), 108-111.

Sukumar, A. & Subramanian, R. (2003) Elements in the Hair of Non-Mining Workers of a Lignite Open Mine in Neyveli. *Industrial Health*, 41(2), 63-68.

Tsai, J-L., Horng, P-H. & Hwang, T-J., *et al* (2004) Determination of urinary trace elements (arsenic, copper, cadmium, manganese, lead, zinc, selenium) in patients with Blackfoot disease. *Archives of Environmental Health*, 59(12), 686-692.

Tuerkdogan, M.K., Kilicel, F. & Kara, K., *et al* (2003) Heavy metals in soil, vegetables and fruits in the endemic upper gastrointestinal cancer region of Turkey. *Environmental Toxicology and Pharmacology*, 13(3), 175-179.

Welch, L.S., Rappaport, S.M. & Susi, P. (2004) Construction welding exposures to manganese likely to exceed proposed TLV. *Journal of Occupational and Environmental Hygiene*, 1(6), D63-5.

Wongwit, W., Kaewkungwal, J. & Chantachum, Y., *et al* (2004) Comparison of biological specimens for manganese determination among highly exposed welders. *The Southeast Asian Journal of Tropical Medicine and Public Health.*, 35(3), 764-769.

Young, T., Myers, J.E. & Thompson, M.L. (2005) The nervous system effects of occupational exposure to manganese--measured as respirable dust--in a South African manganese smelter. *Neurotoxicology*, 26(6), 993-1000.

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Crinella, F.M. (2006) Childhood behavior disorders: Neuropsychological deficits in neonatal dietary manganese exposure. 46th Annual Meeting of the Teratology Society, 24 - 29 June 2006.

Donbak, L., Rencuzogullari, E. & Yavuz, A., *et al* (2005) The genotoxic risk of underground coal miners from Turkey. *Mutation Research-Genetic Toxicology and Environmental Mutagenesis*, 588(2), 82-87.

Dynerowicz-Bal, E., Andrzejak, R. & Antonowicz-Juchniewicz, J., *et al* (2005) [The influence of occupational exposure to arsenic and heavy metals on the activity of cathepsins and their inhibitors in blood serum of copper smelters]. *Medycyna Pracy*, 56(5), 347-361.

Erikson, K.M., Syversen, T. & Aschner, J.L., *et al* (2005) Interactions between excessive manganese exposures and dietary iron-deficiency in neurodegeneration. *Environmental Toxicology and Pharmacology*, 19(3), 415-421.

Gao, Y-Q., Jiang, Y-M. & Lu, J-P. (2006) Effects of Manganese Fume and Dust on Lipid Peroxidation and Antioxidant Enzymes in Blood of Exposed Male Workers. *Industrial Health and Occupational Diseases -Beijing-*, 32(PART 2), 88-90.

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- Martin, C.J. (2006) Manganese neurotoxicity: connecting the dots along the continuum of dysfunction. *Neurotoxicology*, 27(3), 347-9.
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- Nadal, M., Schuhmacher, M. & Domingo, J.L. (2004) Metal pollution of soils and vegetation in an area with petrochemical industry. *The Science of the Total Environment*, 321(1-3), 59-69.
- Namazbaeva, Z.I., Rakhishev, E.K. & Bud'kova, L.A., *et al* (2003) [Biochemical and hormonal characteristics of workers engaged into mining manganese-containing ores]. *Meditsina Truda i Promyshlennaia Ekologiya*, (10), 8-13.
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- Ostiguy, C., Asselin, P. & Malo, S. (2006) The emergence of manganese-related health problems in Quebec: an integrated approach to evaluation, diagnosis, management and control. *Neurotoxicology*, 27(3), 350-6.
- Park, J., Yoo, C-I. & Sim, C.S., *et al* (2006) A retrospective cohort study of Parkinson's disease in Korean shipbuilders. *Neurotoxicology*, 27(3), 445-9.
- Park, R.M., Bowler, R.M. & Eggerth, D.E., *et al* (2006) Issues in neurological risk assessment for occupational exposures: the Bay Bridge welders. *Neurotoxicology*, 27(3), 373-84.
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- Schaumburg, H.H., Herskovitz, S. & Cassano, V.A. (2006) Occupational manganese neurotoxicity provoked by hepatitis C. *Neurology*, 67(2), 322-323.
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Yuan, H., He, S. & He, M., *et al* (2006) A comprehensive study on neurobehavior, neurotransmitters and lymphocyte subsets alteration of Chinese manganese welding workers. *Life Sciences*, 78(12), 1324-8.

Zhang, W-H., Xue, M. & Hao, J-J. (2006) Survey of Neurobehavioral Function of Welders Exposed to Manganese. *Industrial Health and Occupational Diseases -Beijing-*, 32(PART 2), 98-99.

3. MECHANISM

Antonini, J.M., Afshari, A.A. & Stone, S., *et al* (2006) Design, construction, and characterization of a novel robotic welding fume generator and inhalation exposure system for laboratory animals. *Journal of Occupational and Environmental Hygiene*, 3(4), 194-203.

Brain, J.D., Heilig, E. & Donaghey, T.C., *et al* (2006) Effects of iron status on transpulmonary transport and tissue distribution of Mn and Fe. *American Journal of Respiratory Cell and Molecular Biology*, 34(3), 330-7.

Corsini, E., Viviani, B. & Birindelli, S., *et al* (2006) Molecular mechanisms underlying mancozeb-induced inhibition of TNF-alpha production. *Toxicology and Applied Pharmacology*, 212(2), 89-98.

Donbak, L., Rencuzogullari, E. & Yavuz, A., *et al* (2005) The genotoxic risk of underground coal miners from Turkey. *Mutation Research-Genetic Toxicology and Environmental Mutagenesis*, 588(2), 82-87.

Dorman, D.C., McManus, B.E. & Marshall, M.W., *et al* (2004) Old age and gender influence the pharmacokinetics of inhaled manganese sulfate and manganese phosphate in rats. *Toxicology and Applied Pharmacology*, 197(2), 113-124.

Dorman, D.C., Struve, M.F. & Marshall, M.W., *et al* (2006) Tissue manganese concentrations in young male rhesus monkeys following subchronic manganese sulfate inhalation. *Toxicological Sciences*, 92(1), 201-10.

Erikson, K.M. & Aschner, M. (2006) Increased manganese uptake by primary astrocyte cultures with altered iron status is mediated primarily by divalent metal transporter. *Neurotoxicology*, 27(1), 125-30.

Fitsanakis, V.A., Amarnath, V. & Moore, J.T., *et al* (2002) Catalysis of catechol oxidation by metal-dithiocarbamate complexes in pesticides. *Free Radical Biology & Medicine*, 33(12), 1714-1723.

Goldoni, M., Vettori, M.V. & Alinovi, R., *et al* (2003) Models of neurotoxicity: extrapolation of benchmark doses in vitro. *Risk Analysis*, 23(3), 505-514.

Gwiazda, R.H., Lee, D. & Sheridan, J., *et al* (2002) Low cumulative manganese exposure affects striatal GABA but not dopamine. *Neurotoxicology*, 23(1), 69-76.

HaMai, D., Rinderknecht, A.L. & Guo-Sharman, K., *et al* (2006) Decreased expression of inflammation-related genes following inhalation exposure to manganese. *Neurotoxicology*, 27(3), 395-401.

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Ramesh, G.T., Ghosh, D. & Gunasekar, P.G. (2002) Activation of early signaling transcription factor, NF-kappaB following low-level manganese exposure. *Toxicology Letters*, 136(2), 151-158.

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Yazbeck, C., Moreau, T. & Sahuquillo, J., *et al* (2006) Effect of maternal manganese blood levels on erythrocyte calcium-pump activity in newborns. *The Science of the Total Environment*, 354(1), 28-34.

Yokel, R.A. & Crossgrove, J.S. (2004) *Manganese toxicokinetics at the blood-brain barrier*. Research Report (Health Effects Institute) no. 119.

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4. HUMAN SUSCEPTIBILITY

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5. TREATMENT AND IMAGING

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Du, F., Jiang, Y. & Mo, X. (2006) Study on Diagnostic Indicators of Manganese Poisoning. *Industrial Health and Occupational Diseases -Beijing-*, 32(PART 3), 185-188.

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6. MISCELLANEOUS

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Wyckoff, J. & McBride, M. (2004) Manganese Exposure from Welding: An Emerging Liability Risk. *Environmental Claims Journal*, 16(2), 117-134.