OCCUPATIONAL EXPOSURE PROFILE OF Pb, Mn AND Cd IN NONFERROUS BRAZILIAN SANITARY ALLOY FOUNDRIES

Tiago S. Peixe\textsuperscript{1,2}, Elizabeth de S. Nascimento\textsuperscript{2}, Carlos S. Silva\textsuperscript{3} and Marco A. Bussacos\textsuperscript{4}

\textsuperscript{1}Department of Pathology, Clinical and Toxicological Analysis, State University of Londrina, Paraná, Brazil
\textsuperscript{2}Graduate Program in Toxicology and Analytical Toxicology, Department of Clinical and Toxicological Analysis, Faculty of Pharmaceutical Sciences, University of São Paulo, São Paulo, Brazil
\textsuperscript{3}Hygiene Division, Ministry of Labor, Fundacentro, São Paulo, Brazil
\textsuperscript{4}Statistics Division, Ministry of Labor, Fundacentro, Brazil

Abstract: Skimming, pouring, stirring, filling, and other operations associated with foundries may cause the release of large amounts of fumes in an occupational setting. Thus, they may be released into the environment where they are used as molten metals, metal dusts - which are small solid particles in the air - and smoke, solid even in small particles. Inhalation of metal fumes is more dangerous than that of metal dust because the lungs more easily absorb metal fumes. In addition to the primary components of alloys, approximately 5% of the formulation may contain other metals, including lead (Pb), cadmium (Cd), arsenic (As), manganese (Mn), iron (Fe), phosphorus (P), and nickel (Ni). Workers in the foundries are exposed to several compounds; therefore, it is important to assess the levels of injury that may reflect an additive, synergistic, or antagonistic effect caused by these compounds. The analytical methods proposed proved to be sensitive, precise, and accurate for the analysis of elements in the air of the work environment, as well as exposure indicators. The means of the environmental evaluation of the facilities range from 16.65 to 40.31 µg m\textsuperscript{-3} for Pb, 0.99 to 1.73 µg m\textsuperscript{-3} for Cd, and 0.91 to 1.70 µg m\textsuperscript{-3} for Mn. The means of the metal concentrations for furnace, mold, melting, and automatic melting activities range from 15.37 to 19.26 µg m\textsuperscript{-3} for Pb, 7.07 to 9.14 µg m\textsuperscript{-3} for Cd, and 8.83 to 16.00 µg m\textsuperscript{-3} for Mn. Biological samples were divided into two groups: control (n = 38) and exposed (n = 45). The obtained data are Pb (3.41 ± 3.40 and 14.89 ± 7.82 µg/dL), Cd (0.90 ± 0.80 and 1.91 ± 1.90 µg/g creatinine), and Mn (0.51 ± 0.40 and 3.17 ± 1.93µg/g creatinine). Statistical analysis showed significant differences (p < 0.05). Positive linear correlations were established between metal concentrations in the air and the biological matrixes: Pb (r = 0.68; p < 0.001); Cd (r = 0.81; p = 0.17); and Mn (r = 0.12; p < 0.03). Regression analysis showed that professional activities can interfer with element exposure profiles in occupational settings. The analysis in the event of exposure to metals in these companies allowed investigating whether the simultaneous exposure leads to biological damage even if the levels of the compounds are within the exposure limits that are considered to be safe.

Keywords: lead, manganese, cadmium, ICP-OES, GF-AAS, alloy foundry, sanitary metals, nonferrous.

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