

Reference values for the biological monitoring of trace elements in environmental and occupational health

Report of a panel discussion in Stockholm 25 May 1992¹

The panel discussed quality criteria for biological monitoring and how to establish reference values for occupational and environmental exposures to metals. Quality criteria for future publications and the evaluation and grading of published information have been specified by the International Union of Pure and Applied Chemistry (IUPAC), as well as by the TRACY group. It was suggested that editors of scientific journals should be made aware of these criteria and that the criteria should be widely used so that the consistency and quality of future publications can be improved. The general need for strict quality control in exposure assessment was emphasized, and it was considered particularly important that the quality control data be available together with the monitoring data. A program which takes full account of these aspects is the Health Effects and Location (HEAL) program of UNEP/WHO. The importance of future cooperation between the HEAL program, the IUPAC Commission on Toxicology, and the TRACY project was discussed, and such cooperation was recommended.

In relation to the issue of mercury toxicity, it was pointed out that amalgam restoration is the main source of exposure to inorganic mercury in the general population (1, 2). In persons with bruxism, exposure appears to approach levels found in occupationally exposed persons. In recent years several reviews of the problem have emphasized either the inertness of amalgams or the risks of this type of exposure. There is therefore a pressing need for a thorough international and independent review of low-dose exposure to inorganic mercury with respect to both the evaluation of toxicity and the means with which it can be biologically monitored. This evaluation should include a consideration of populations at special risk and the possible synergistic effects of methylmercury, since the mechanism(s) of toxicity may be similar at the cellular level.

The panel discussed the utility of creatinine correction and the desirability of timed samples for the biological monitoring of metals and metabolic products in urine. More-detailed discussions of the general problem area have been presented by other independent review committees (3, 4). The panel also discussed the desirability of estimating exposures to hexavalent and trivalent chromium on the basis of the chemical speciation of chromium in urine and blood samples during biological monitoring.

The panel also considered future needs in the biological monitoring of metals. One example concerned the semiconductor industry, where exposure to complex materials such as gallium arsenide and indium arsenide can occur. Recent studies (5) have shown that the maximal urinary excretion of indium and arsenic after exposure to indium arsenide particles occurs at different times. The renal cellular toxicity of indium arsenide appears to be a product of both elements. There is thus a need to monitor both elements in the urine continuously in order to predict toxicity more accurately. Several elements, such as gallium, indium, germanium, arsenic, and antimony, used in the production of high-speed semiconductor devices should be considered in this research. A special problem of biological monitoring is found in the hard-metal industry, where exposure to several elements can occur (wolfram, tantalum, titanium, niobium, vanadium, cobalt, chromium, nickel, molybdenum) (6). Rare metals such as platinum, palladium, rhodium, and gadolinium, which are used in automotive catalytic converters and in medicine for therapeutic and diagnostic applications, should also be evaluated in regard to the suitability of biological monitoring for the evaluation of risks of adverse health effects.

References

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