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COMPARATIVE EVALUATION OF A PORTABLE X-RAY FLUORESCENCE ANALYZER FOR AIR FILTER SAMPLES FROM A SOLDER MANUFACTURER AND A BRONZE FOUNDRY

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Where metal containing lead is melted there is a potential for worker exposure to lead fume and airborne dust. A common use of lead is in solder products, and personal samples were taken in a solder manufacturing facility. While other metals such as silver and tin may also be present depending on the specific alloy being produced, lead is the dominant metal found in these samples. Lead also is commonly added in small quantities to bronze to improve casting. Personal samples were taken at a bronze foundry, where copper, iron and zinc are also present in the airborne dusts at similar concentrations to lead. Samplers used included the closed-face 37mm styrene/acrylonitrile filter cassette (the current U.S. standard method for lead sampling), the 37mm GSP or "cone" sampler, the 25mm Institute of Occupational Medicine (IOM) inhalable sampler, the 25mm Button sampler (developed by the University of Cincinnati), and the open-face 25mm styrene/acrylonitrile cassette (used in some European countries). Mixed cellulose-ester filters were used in all samplers. Approximately 30 samples were taken with each sampler in each facility. The filters were analyzed after sampling for their content of the various metals using a portable x-ray fluorescence (XRF) analyzer and then were extracted with acid and analyzed by inductively coupled plasma optical emission spectroscopy (ICP). The 25mm filters were analyzed using a single XRF reading, while three XRF readings on different parts of the filter were taken from the 37mm filters. The single reading from the 25mm filters was adjusted for the nominal area of the filter to obtain the mass loading, while the three readings from the 37mm filters were inserted into two different published algorithms for calculating the mass loadings. In addition, the middle reading only and the unweighted average of all three readings for the GSP filters, were adjusted for the nominal filter area. All samplers gave good correlations ($r^2 > 0.80$) between the two analytical methods over the entire range of found lead mass, which encompassed both the action level and the permissible exposure limit enforced in the USA by the Occupational Safety and Health Administration (OSHA). A bias was found in the XRF analysis of lead in the bronze foundry samples, probably caused by matrix interferences from the other metals present. The samplers may be ranked in terms of accuracy, and a selection may be made based on the level of desired accuracy, but also on other criteria, such as speed of analysis and ease of use. The applicability of the XRF technique depends also on the accuracy requirements for compliance and screening methods, and how accuracy is calculated, and this will be discussed.

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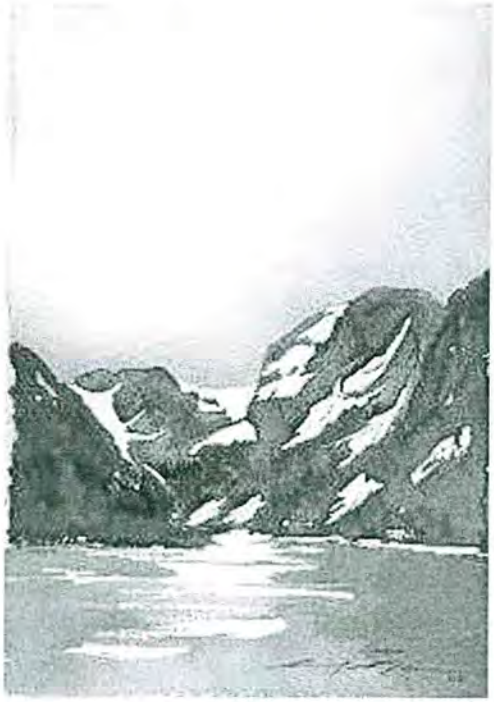

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