

Historical analysis of airborne beryllium concentrations at a copper beryllium machining facility (1964–2000)

McAtee, B.L., E.P. Donovan, S.H. Gaffney, W. Frede, J.S. Knutsen, and D.J. Paustenbach

Copper beryllium alloys are the most commonly used form of beryllium; however, there have been few studies assessing occupational exposure in facilities that worked exclusively with this alloy versus those where pure metal or beryllium oxide may also have been present. In this paper, we evaluated the airborne beryllium concentrations at a machining plant using historical industrial hygiene samples collected between 1964 and 2000. With the exception of a few projects conducted in the 1960s, it is believed that >95% of the operations used copper beryllium alloy exclusively. Long-term (>120 min) and short-term (<120 min) personal and area samples were collected during a variety of activities including machining of copper beryllium-containing parts, as well as finishing operations (e.g., deburring and polishing) and decontamination of machinery. A total of 580 beryllium air samples were analyzed (311 personal and 269 area samples). The average concentration based on area samples (1964–2000) was $0.021 \mu\text{g m}^{-3}$ (SD $0.17 \mu\text{g m}^{-3}$; range $0.00012\text{--}2.5 \mu\text{g m}^{-3}$); 68.8% were below the analytical limit of detection (LOD). The average airborne beryllium concentration, based on all personal samples available from 1964 through the end of 2000 ($n = 311$), was $0.026 \mu\text{g m}^{-3}$ (SD $0.059 \text{ mg } \mu\text{g m}^{-3}$; range $0.019\text{--}0.8 \mu\text{g m}^{-3}$); 97.4% were below the LOD. Personal samples collected from machinists ($n = 78$) had an average airborne concentration of $0.021 \mu\text{g m}^{-3}$ (SD $0.014 \mu\text{g m}^{-3}$; range $0.019\text{--}0.14 \mu\text{g m}^{-3}$); 97.4% were below the LOD. Airborne concentrations were consistently below the Occupational Safety and Health Administration permissible exposure limit for beryllium ($2 \mu\text{g m}^{-3}$). Overall, the data indicate that for machining operations involving copper beryllium, the airborne concentrations for >95% of the samples were below the contemporaneous occupational exposure limits or the 1999 Department of Energy action level of $0.2 \mu\text{g m}^{-3}$ and, in most cases, were below the LOD.

Keywords: Beryllium, Copper beryllium alloy, Exposure assessment, Industrial hygiene