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# Dose-Response and Risk Assessment of Airborne Hexavalent Chromium and Lung Cancer Mortality

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This study evaluates the dose-response relationship for inhalation exposure to hexavalent chromium [Cr(VI)] and lung cancer mortality for workers of a chromate production facility, and provides estimates of the carcinogenic potency. The data were analyzed using relative risk and additive risk dose-response models implemented with both Poisson and Cox regression. Potential confounding by birth cohort and smoking prevalence were also assessed. Lifetime cumulative exposure and highest monthly exposure were the dose metrics evaluated. The estimated lifetime additional risk of lung cancer mortality associated with 45 years of occupational exposure to 1 $\mu g/m^3$ Cr(VI) (occupational exposure unit risk) was 0.00205 (90%CI: 0.00134, 0.00291) for the relative risk model and 0.00216 (90%CI: 0.00143, 0.00302) for the additive risk model assuming a linear dose response for cumulative exposure with a five-year lag. Extrapolating these findings to a continuous (e.g., environmental) exposure scenario yielded an environmental unit risk of 0.00978 (90%CI: 0.00640, 0.0138) for the relative risk model [e.g., a cancer slope factor of 34 $(mg/kg\text{-}day)^{-1}$] and 0.0125 (90%CI: 0.00833, 0.0175) for the additive risk model. The relative risk model is preferred because it is more consistent with the expected trend for lung cancer risk with age. Based on statistical tests for exposure-related trend, there was no statistically significant increased lung cancer risk below lifetime cumulative occupational exposures of 1.0 mg-yr/$m^3$, and no excess risk for workers whose highest average monthly exposure did not exceed the current Permissible Exposure Limit (52 $\mu g/m^3$). It is acknowledged that this study had limited power to detect increases at these low exposure levels. These cancer potency estimates are comparable to those developed by U.S. regulatory agencies and should be useful for assessing the potential cancer hazard associated with inhaled Cr(VI).

**KEY WORDS:** Air toxics; dose-response assessment; hexavalent chromium; occupational exposure; risk assessment