

Urinary Excretion of Chromium Following Ingestion of Chromite-Ore Processing Residues in Humans: Implications for Biomonitoring

Michael L. Gargas,¹ Robin L. Norton,¹ Mark A. Harris,² Dennis J. Paustenbach,¹ and Brent L. Finley¹

Biomonitoring programs for urinary chromium (Cr) typically attempt to evaluate occupational exposure via the inhalation route. This study investigated whether Cr can be detected in the urine of people following the ingestion of soils that contain relatively high concentrations of chromium in chromite ore processing residue (COPR). To evaluate the reasonableness of using urinary monitoring to assess environmental exposure, six volunteers ingested 400 mg of soil/day (low-dose group), two others ingested 2.0 g of soil/day (high-dose group) for 3 consecutive days, and one person ingested a placebo on each of 3 days. The soil and COPR mixture contained concentrations of total chromium (Cr) and hexavalent chromium [Cr(VI)] of 103 ± 20 and 9.3 ± 3.8 mg/kg, respectively. Therefore, the low-dose group ingested 41 μ g Cr/day [including 3.7 μ g Cr(VI)] and the high-dose group ingested 206 μ g Cr/day [including 18.6 μ g Cr(VI)] on each of 3 consecutive days. All urine samples were collected and analyzed individually for total Cr on the day prior to dosing, during the 3 days of dosing, and up to the first void 48 h after the last dose. No significant increases in urinary Cr excretion were found when background excretion data were compared with data following each of the 3 days of dosing or in daily mean urine concentrations of the high- vs the low-dose groups. It appears that Cr present in a soil and COPR mixture at Cr doses up to 200 μ g/day is not sufficiently bioavailable for biomonitoring of urine to be informative. These results are consistent with previously published findings suggesting that incidental exposure to dusts and soils containing comparable levels of Cr will not result in increased concentrations of Cr in urine.

KEY WORDS: Chromium; bioavailability; chromite ore processing residue; biological monitoring.