

ARCHIVE: Archived because this document no longer provides current guidance.

TITLE: Evaluating Carcinogenic and Noncarcinogenic Risk Posed by Chromium (III) and Chromium (VI)

DATE EFFECTIVE: 1995

KEYWORDS: Carcinogenic risk, non-carcinogenic risk, Chromium III, Chromium VI, Chromium species

RULES: VAP rule related to this issue: OAC 3745-300-09(D)

QUESTION: How should carcinogenic and non-carcinogenic risk be determined for Chromium considering the differences in toxicity between Chromium (III) and Chromium (VI)?

ANSWER: Ideally, Chromium (VI) (Cr(VI)) should be quantified by a separate analysis and Chromium (III) (Cr(III)) represented as the difference between the total chromium and Cr(VI) concentration. When this cannot or has not been done, using the 6:1 (Cr III to Cr VI) ratio is a reasonable estimate of the relative abundance of the two species when determining **non-carcinogenic** risk, provided that conditions likely exist in the soil and *in vivo* which would promote the reduction of Cr(VI) to the less toxic Cr(III). The 6:1 ratio for Cr III to Cr VI is **not appropriate** to use when assessing carcinogenic risk due to the fact that Cr(VI) is a Class A carcinogen and Cr(III) is a Class D carcinogen. Because of this significant difference in carcinogenic toxicity between the two Chromium species, guidance in IRIS states that use of a 6:1 ratio for relative abundance of Cr(III):Cr(VI) may underestimate carcinogenic risk. Therefore, assuming all chromium is in the form of Cr(VI) for purposes of calculating carcinogenic risk is appropriate if the Cr(VI) has not been quantified by a separate analysis.

Another important point to keep in mind is when assessing the non-carcinogenic risk for Chromium, the ingestion pathway for Cr(VI) should **not** be ignored as has been proposed in some VAP risk assessments. The fact that the Cr(VI) RfD_{oral} value in IRIS has a low confidence assigned to it does not provide sufficient justification to dismiss the value. If the ingestion pathway for Cr(VI) is ignored, then a greater degree of uncertainty will be introduced into the non-carcinogenic risk calculations. In addition the Cr (VI) RfD_{oral} should be

used to extrapolate an inhalation reference dose ($RfD_{inhalation}$). The April 1993 ATSDR Toxicological Profile for Chromium describes existing information on the database for Cr(VI) noncarcinogenic toxicity by oral and inhalation pathways (pp.117-120); the inhalation pathway has more effect endpoints described, but the oral intake effects are potentially more deleterious (death). Thus, the Cr(VI) RfD_{oral} value should be used for the ingestion pathway and extrapolated to address the inhalation pathway.

SUMMARY:

When Cr(VI) cannot be quantified by a separate analysis and hence Cr(III) represented as the difference between the total chromium and Cr(VI) concentration, the VAP recommends that the 6:1 ratio of Cr(III) to Cr(VI) be used to determine the relative **non-carcinogenic** risk of the two chromium species. The 6:1 ratio for Cr III to Cr VI is **not appropriate** to use when assessing carcinogenic risk. Because of the significant difference in carcinogenic toxicity between the two Chromium species, guidance in IRIS states that use of a 6:1 ratio for relative abundance of Cr(III):Cr(VI) may underestimate carcinogenic risk. Therefore assuming all chromium is in the form of Cr(VI) for purposes of calculating carcinogenic risk is appropriate if the Cr(VI) has not been quantified by a separate analysis.

**OHIO EPA
CONTACT:**

For any questions concerning this issue, please contact the VAP central office at (614) 644-2924.