CSMRI Soil Trace Metals Risk and Hazard Index Determination

No Action / Institutional Controls

Trace Metal	Concentration (milligrams per kilogram)	Excavation				Recreational				Residential							
		Dermal		Inhalation		Dermal		Inhalation		Dermal		Ingestion - Adult		Ingestion -Child		Inhalation	
		Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient
Arsenic	130	1.7E-08	2.6E-03	3.3E-10		3.1E-06	1.6E-02	3.7E-08	--	1.5E-05	7.6E-02	3.0E-04	0.58	3.0E-04	5.5	1.7E-07	
Barium	960	--	4.8E-04	--	8.0E-06	--	3.0E-03	--	3.0E-04	--	1.4E-02	--	1.9E-02	--	1.8E-01	--	1.4E-03
Cadmium [1]	20	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	34	--	1.7E-05	--	3.3E-04	--	--	--	--	--	3.1E-05	--	2.9E-04	--	--	--	--
Lead [2]	2210	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mercury [3]	28	--	3.3E-03	--	0.23	--	2.1E-02	--	0.86	--	9.7E-02	--	0.13	--	1.2	--	4.0
Molybdenum	200	--	2.6E-04	--	--	--	1.6E-03	--	--	--	7.6E-03	--	5.4E-02	--	0.51	--	--
Selenium	6	--	6.7E-06	--	--	--	4.2E-05	--	--	--	2.0E-04	--	1.6E-03	--	1.5E-02	--	--
Silver	13	--	3.6E-05	--	--	--	2.2E-04	--	--	--	1.0E-03	--	3.6E-03	--	3.3E-02	--	--
Vanadium	110	--	3.7E-03	--	--	--	2.4E-02	--	--	--	0.11	--	2.1E-02	--	0.19	--	--
Zinc	2900	--	1.2E-04	--	--	--	7.4E-04	--	--	--	3.4E-03	--	1.3E-02	--	0.12	--	--
Total Risk	--	1.7E-08	--	3.3E-10	--	3.1E-06	--	3.7E-08	--	1.5E-05	--	3.0E-04	--	3.0E-04	--	1.7E-07	--
Hazard Index	--	--	1.1E-02	--	0.23	--	6.7E-02	--	0.86	--	0.31	--	0.82	--	7.7	--	4.0

Post Stabilization / Removal

Trace Metal	Concentration (milligrams per kilogram)	Excavation				Recreational				Residential							
		Dermal		Inhalation		Dermal		Inhalation		Dermal		Ingestion - Adult		Ingestion -Child		Inhalation	
		Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient	Risk	Hazard Quotient
Arsenic	13.5	NA	NA	NA	NA	3.3E-07	1.7E-03	3.9E-09	--	1.5E-06	8.0E-03	3.2E-05	6.2E-02	3.2E-05	0.58	1.8E-08	
Barium	337	NA	NA	NA	NA	--	1.1E-03		1.1E-04		5.0E-03		6.6E-03		6.2E-02		4.9E-04
Cadmium [1]	1.28	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	15.9	NA	NA	NA	NA	--	3.3E-05	--	--	--	1.5E-04	--	1.5E-05	--	1.4E-04	--	--
Lead [2]	81.3	NA	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--
Mercury [3]	0.575	NA	NA	NA	NA	--	4.4E-04	--	1.8E-02	--	2.1E-03	--	2.7E-03	--	2.6E-02	--	8.6E-02
Molybdenum	5.43	NA	NA	NA	NA	--	4.4E-05	--	--	--	2.1E-04		1.5E-03		1.4E-02	--	--
Selenium	1.40	NA	NA	NA	NA	--	9.9E-06	--	--	--	4.6E-05	--	3.8E-04	--	3.6E-03	--	--
Silver	0.0809	NA	NA	NA	NA	--	1.7E-06	--	--	--	8.1E-06	--	2.7E-05	--	2.6E-04	--	--
Vanadium	46.1	NA	NA	NA	NA	--	1.0E-02	--	--	--	4.8E-02	--	9.0E-03	--	8.4E-02	--	--
Zinc	226	NA	NA	NA	NA	--	5.9E-05	--	--	--	2.7E-04	--	1.0E-03	--	9.6E-03	--	--
Total Risk	--	--	--	--	--	3.3E-07	--	3.9E-09	--	1.5E-06	--	3.2E-05	--	3.2E-05	--	1.8E-08	--
Hazard Index	--	--	--	--	--	--	0.013	--	0.018	--	0.064	--	0.083	--	0.78	--	0.09

[1] No appropriate media for cadmium provided by model

[2] Model does not provide risk or hazard quotients for lead

[3] Assumes inorganic mercury for dermal exposure and elemental mercury for inhalation exposure

Definition of Risk and Hazard Index: Acceptable exposures to known or suspected carcinogens are generally those that represent an excess upper-bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6}. In addition, US EPA uses the 10^{-6} risk level as the point of departure for determining remediation goals for the National Priority List (NPL) sites. For noncarcinogens, the US EPA defines acceptable human exposure levels (including sensitive subgroups) as those that do not cause adverse effects during a lifetime or part of a lifetime, incorporating an adequate margin of safety. This acceptable exposure level is best approximated by a hazard index (HI) of 1. If a HI is less than 1, adverse effects usually are not expected. As the HI increases beyond 1, the possibility of adverse health effects also increases.

The hazard index is calculated by summing the hazard quotients (HQ) for substances that affect the same target organ or organ system (e.g., respiratory system). The HQ is the ratio of potential exposure to the substance and the level at which no adverse health effects are expected. If the HQ is calculated to be less than 1, then no adverse health effects are expected as a result of exposure. If the HQ is greater than 1, then adverse health effects are possible. The HQ cannot be translated to a probability that adverse health effects will occur, and is unlikely to be proportional to risk. It is especially important to note that a Hazard Quotient exceeding 1 does not necessarily mean that adverse effects will occur.