

HUMAN HEALTH RISK ASSESSMENT (HHRA) NOTE NUMBER 1: Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Hazardous Waste Sites and Permitted Facilities.



CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL (DTSC) OFFICE OF HUMAN AND ECOLOGICAL RISK (HERO)

ISSUE DATE: April 9, 2019

SUMMARY

The attached table summarizes exposure factors which may be used as default values in human health risk assessments for California hazardous waste sites and permitted facilities. The recommended values were obtained primarily from US EPA and Cal-EPA DTSC guidance documents, and references for each of the exposure factors are provided.

WHAT'S NEW (April 2019)

The values for child skin surface area for soil contact and the adult and child skin surface area for the bath/showering scenario were updated to be consistent with the exposure parameters used to calculate the US EPA Regional Screening Levels (RSLs) and current USEPA guidance¹.

EXPOSURE PARAMETERS DISCUSSION

The exposure parameters shown in Table 1 should generally be used to calculate reasonable maximum exposure (RME) estimates for residential, industrial, and construction worker receptors. Site-specific data may warrant deviation from these values. For any cases in which site-specific alternate values are used, appropriate justification and documentation should be included in the risk assessment report.

¹ USEPA OSWER Directive 9200.1-120, *Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors*

Inhalation rates are provided in the attached table, US EPA's Risk Assessment Guidance for Superfund (RAGS) Part F (Supplemental Guidance for Inhalation Risk Assessment)² was finalized in January 2009 and should be consulted regarding recommendations for evaluation of inhalation exposures. RAGS Part F recommends that concentrations of the chemical in air (e.g. mg/m³) be used to assess risk, rather than inhalation intake of a contaminant in air based on inhalation rate and body weight (e.g. mg per kg body weight per day).

Note that the default exposure parameter values listed in this table are summarized for California hazardous waste sites and permitted facilities but may not be appropriate for certain properties and exposure scenarios (e.g. schools). The HERO Section Chiefs³ should be consulted for default exposure factors in such cases.

HERO ISSUE CONTACT PERSON:

Kimberly Gettmann, Ph.D.
Staff Toxicologist
VOICE: 916.255.6685
EMAIL: Kimberly.Gettmann@dtsc.ca.gov

²<https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part-f>

³Northern California Section (Claudio Sorrentino, Ph.D., Senior Toxicologist, 916-255-6656); Southern California Section (Shukla Roy-Semmen, Ph.D., Senior Toxicologist, 714-484-5448); Central California Section (Brian Endlich, Ph.D., Senior Toxicologist, 510-540-3804); DSMOA Military Facilities Section (Thomas F. Booze, Ph.D., Senior Toxicologist, 916-255-6653).

TABLE 1. RECOMMENDED DTSC DEFAULT EXPOSURE FACTORS FOR USE IN RISK ASSESSMENT AT CALIFORNIA HAZARDOUS WASTE SITES AND PERMITTED FACILITIES

EXPOSURE PARAMETERS	Residential Scenario	Industrial Scenario	Construction Scenario
Body Weight Adult (kg)	80 ⁱ	80 ⁱ	80 ⁱ
Body Weight Child	15 ⁱ	NA	NA
Averaging time (AT) carcinogens (days)	25550 ^{a,i}	25550 ^{a,i}	25550 ^{a,i}
Averaging time (AT) noncarcinogens (days)	ED x 365 ^{a,i}	ED x 365 ^{a,i}	ED x 365 ^{a,i}
Exposure duration (ED) (year) Adult	20 ⁱ	25 ⁱ	Site-specific, HERO default = 1
Exposure duration (ED) (year) Child	6 ⁱ	NA	NA
Exposure frequency (EF) (days/yr)	350 ⁱ	250 ⁱ	Site-specific, HERO default = 250
Exposure duration (ED) (hours/day)	24 ^k	8 ^k	NA
Inhalation rate (InhR) Adult	20 (m ³ /day) ⁱ	14 m ³ /day for the 8 hr workday ^b	20 m ³ /day for the 8 hr workday ^c
Inhalation rate (InhR) Child	10 (m ³ /day) ⁱ	NA	NA
Drinking water ingestion (IR) (L/day) Adult	2.5 ⁱ	2 ^{c,j}	0, HERO default = 2 if on-site water is consumed
Drinking water ingestion (IR) (L/day) Child	0.78 ⁱ	NA	NA
Soil ingestion (IR) (mg/kg) Adult	100 ^{a,i}	100 ^c	330 ^c
Soil ingestion (IR) (mg/kg) Child	200 ^{a,i}	NA	NA

EXPOSURE PARAMETERS	Residential Scenario	Industrial Scenario	Construction Scenario
Particulate emission factor (PEF) (m³/kg)	1.36E+09 ⁱ	1.36E+09 ⁱ	1.0E+06 ^d
Skin surface area for soil contact (SA) (cm²) Adult	6032 ⁱ	6032 ⁱ	6032 ⁱ
Skin surface area for soil contact (SA) (cm²) Child	2373 ⁱ	NA	NA
Soil adherence factor (AF) (mg/cm²) Adult	0.07 ^{e,i}	0.2 ^e	0.8 ^e
Soil adherence factor (AF) (mg/cm²) Child	0.2 ^{e,i}	NA	NA
Dermal absorption fraction (ABS) (unitless)	Chemical specific ^f	Chemical specific ^f	Chemical specific ^f
Dermal permeability coefficient from water (K_p) (cm/hr)	Chemical specific ^g	Chemical specific ^g	Chemical specific ^g
Showering/Bathing Scenario^{h,i}			
Skin surface area for water contact (SA) (cm²) Adult	19,652		
Skin surface area for water contact (SA) (cm²) Child	6,365		
Exposure time (ET) (hr/day)			
Exposure time (ET) (hr/day) Adult	0.71		
Exposure time (ET) (hr/day) Child	0.54		
Exposure frequency (EF) (days/yr)	350		

REFERENCES

- ^a US EPA 1989, Risk Assessment Guidance for Superfund (RAGS) (Part A), EPA/540/1-89/002.
- ^b Cal-EPA DTSC estimated this value based on the following study cited in the US EPA Exposure Factors Handbook 1997 (EPA/600/P-95/002Fa): Linn W.S, Spier C.E., and J.D. Hackney. 1993. Activity patterns in ozone-exposed construction workers. J. Occ. Med. Tox. 2(1): 1-14.
- ^c US EPA 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.
- ^d This PEF value corresponds to a respirable dust concentration of 1 mg/m³. This is based on a maximum concentration of dust in air of 10 mg/m³ recommended by the American Conference of Governmental Industrial Hygienists (ACGIH 2004, Threshold Limit Values and Biological Exposure Indices), and the assumption that 10 percent of the mass of particles are in the respirable PM10 range.
- ^e Cal-EPA DTSC Draft 2000. Draft memorandum from S. DiZio, M. Wade, and D. Oudiz. Guidance for the Dermal Exposure Pathway. The DTSC recommendations detailed in the Draft 2000 memorandum were partially based on US EPA RAGS (Part E) Supplemental Guidance for Dermal Risk Assessment, Interim Guidance (1998).
- ^f Consult the PEA Manual, Cal-EPA DTSC, January 1994 (Interim Final-Revised October 2015), Note that the dermal absorption fraction for volatile organic compounds (VOCs) can be assumed to be 0. This is based on the assumption that VOCs volatilize from soil on skin and should be evaluated via the inhalation exposure pathway from soil.
- ^g Consult USEPA 2004, RAGS (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005. Exhibits B-3 and B-4 list KP values for organic and inorganic chemicals in water, respectively.
- ^h USEPA 2004, RAGS (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005.
- ⁱ USEPA 2014, Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER 9200.1-120.
- ^j If exposure pathway is complete for the commercial/industrial worker and/or construction worker, HERO recommends using 2 liters per day as the drinking water ingestion rate.
- ^{kj} USEPA 2009, RAGS (Part F, Supplemental Guidance for Inhalation Risk Assessment), EPA/540/R/070/002.