

**A8.2-1 Industrial Surface Soil**

$$HQ = \frac{Cs \times EF \times ED \left[ \frac{IngSoil + (SA \times AF \times ABS)}{RfDo \times 10^6} + \left( \frac{InhRate}{RfDi} \left( \frac{1}{VF} + 7.6 \times 10^{-10} \right) \right) \right]}{BW \times ATn \times 365 \text{ days / yr}}$$

Where:

HQ = Hazard Quotient

Cs = Concentration in soil, (mg/kg)

EF = Exposure Frequency (250 days/year)

ED = Exposure Duration (default at 25 years)

IngSoil = Soil ingestion rate (default at 50 mg/day)

SA = Skin Surface Area (default at 3160 cm<sup>2</sup>)

AF = Soil to Skin Adherence Factor (default at 0.5 mg/cm<sup>2</sup>-day)

ABS = Skin absorbance (default at 0.1 for TPH fractions)

InhRate = Inhalation Rate (default at 20 m<sup>3</sup>/day)

BW = Body weight, (default at 70 kg)

ATn = Averaging time noncarcinogens (default at 25 years)

VF = Volatilization Factor, calculated as per 1996 EPA soil screening guidance

RfDo = Reference Dose, oral (chemical specific, mg/kg-day)

RfDi = Reference Dose, inhalation (chemical specific, mg/kg-day)

7.6 x 10<sup>-10</sup> = 1/ PEF (Particulate Emission Factor, from 1996 EPA soil Screening Guidance)

**A8.2-2 Residential Surface Soils**

$$HQ = \frac{Cs \times EF \times \left[ \left( \frac{IngFadj + (SFSadj \times ABS)}{RfDo \times 10^6} \right) + \left( \frac{InhFadj}{RfDi} \left( \frac{1}{VF} + 7.6 \times 10^{-10} \right) \right) \right]}{ATn \times 365 \text{ days / yr}}$$

Where:

HQ = Hazard Quotient

Cs = Concentration in soil, (mg/kg)

EF = Exposure frequency, (default at ~~250~~ **350** days/year)

IngFadj = Soil ingestion rate age adjusted, (default at 114 mg-yr/kg-day) (see below)

SFSadj = Skin Surface Area age adjusted, (default at 1,257 mg-yr/kg-day) (see below)

ABS = Skin absorbance rate, (unitless, default at 0.1 for TPH fractions)  
 InhFadj = Inhalation factor age adjusted, (default at ~~10.9~~ **9.9** m<sup>3</sup>-yr/kg-day)  
 (see below)

ATn = Averaging time noncarcinogens, (default at 30 years)

VF = Volatilization Factor, calculated as per 1996 EPA soil screening guidance (chemical specific, mg/kg-day)

RfDo = Reference Dose, oral (chemical specific, mg/kg-day)

RfDi = Reference Dose, inhalation (chemical specific, mg/kg-day)

$7.6 \times 10^{-10}$  = 1/ PEF (Particulate Emission Factor, from 1996 EPA Soil Screening Guidance)

The concentrations of individual compounds (benzene, PAHs, etc) should be compared to their RISC default closure levels.

### **A8.2-3 Subsurface Soil Leaching to Ground Water (Equation 7-1 from Technical Guide)**

$$C_{gw} = \frac{C_{soil}}{DAF \left[ K_{oc} \times f_{oc} + \left( \frac{\theta_w + \theta_a H'}{P_b} \right) \right]}$$

Where:

C<sub>gw</sub> = Concentration in groundwater, (mg/l)

C<sub>soil</sub> = Concentration in soil, (mg/kg)

K<sub>oc</sub> = Organic Carbon Partitioning Coefficient, (chemical specific, l/kg)

f<sub>oc</sub> = Fraction organic carbon in subsurface soil, (0.002 g/g)

θ<sub>w</sub> = Water filled soil porosity, (default at 0.3 l water/l soil,)

θ<sub>a</sub> = Air filled soil porosity, (default at 0.134 l air/l soil)

H' = Henry's Law Constant, HLC x 41 (chemical specific, dimensionless)

P<sub>b</sub> = Dry soil bulk density, (default at 1.5 kg/l)

DAF = Dilution attenuation factor (default at 20)

### **A8.2-4 Commercial/Industrial Ground Water (Non-Carcinogenic)**

$$HQ = \frac{C_{gw} \times EF \times ED \times \frac{IngRate}{RfDo}}{BW \times ATn \times 365 \text{ days / yr}}$$

Where:

HQ = Hazard Quotient

C<sub>gw</sub> = Concentration in water, (mg/l)

EF = Exposure frequency, (default at 250 days/year)

ED = Exposure Duration, (default at 25 years)

IngRate = Water ingestion rate, (default at 1.0 l/day)

BW = Body weight, (default at 70 kg)

AT<sub>n</sub> = Averaging time non-carcinogens, (default at 25 years)

RfDo = Reference Dose, oral (chemical specific)

### **A8.2-5 Residential Ground Water (Non-Carcinogenic)**

$$HQ = \frac{C_{gw} \times EF \times ED \left[ \left( \frac{IngR}{RfDo} \right) + \left( \frac{InhR \times K}{RfDi} \right) \right]}{BW \times AT_n \times 365 \text{ days/yr}}$$

Where:

C<sub>gw</sub> = Concentration in GW, mg/l

HQ = Hazard Quotient

EF = Exposure Frequency, (default at 350 days/yr)

ED = Exposure Duration, (default at 30 years)

IngR = Ingestion rate, (default at 2.0 l/day)

InhR = Inhalation rate, (default at 15 m<sup>3</sup>/day)

K = Indoor volatilization factor from GW, (default at 0.5 l/m<sup>3</sup>)

RfDo = Oral reference dose (chemical specific, mg/kg-day)

RfDi = Inhalation reference dose (chemical specific, mg/kg-day)

BW = Body weight, (default at 70 kg)

AT<sub>n</sub> = Noncarcinogenic averaging time, (default at 30 years)