

1996 Connecticut Remediation Standard Regulations

Derivation of Direct Exposure Criteria

Direct Exposure Criteria were designed to establish health-protective concentrations of constituents in soil assuming that people may be exposed to such chemicals through incidental ingestion of soil. For simplicity, other pathways such as absorption across the skin from dermal contact, inhalation of soil particulates, and ingestion of produce grown on affected soil were not included in the exposure estimates.

Residential Direct Exposure Criteria Formulas

For substances that are non-carcinogenic:

$$DEC_{RB} = \frac{RfD \times HI}{\frac{IRc \times EDc \times EF \times CF}{BWc \times ATc} + \frac{IRa \times EDa \times EF \times CF}{BWa \times ATa}}$$

For substances that are carcinogenic:

$$DEC_{RB} = \frac{(RL / CSF)}{\frac{IRc \times EDc \times EF \times CF}{BWc \times AT} + \frac{IRa \times EDa \times EF \times CF}{BWa \times AT}}$$

Where:

Variable	Description	Value	Units
AT	Averaging Time – Carcinogen	25550	days
ATa	Averaging Time – Adult Non-carcinogen	8760	days
ATc	Averaging Time – Child Non-carcinogen	2190	days
BWa	Body Weight – Adult	70	kg
BWc	Body Weight – Child	15	kg
CF	Conversion Factor	0.000001	kg/mg
CSF	Cancer Slope Factor	chemical specific	1/mg/kg/d
DEC _{RB}	Direct Exposure Criteria – Risk-based	chemical specific	mg/kg
EDa	Exposure Duration – Adult Non-carcinogen	24	years
EDc	Exposure Duration – Child Non-Carcinogen	6	years
EF	Exposure Frequency	365	days/year
HI	Hazard Index	1	unitless
IRa	Ingestion Rate – Adult	100	mg/day
IRc	Ingestion Rate – Child	200	mg/day
RfD	Reference Dose	chemical specific	mg/kg/d
RL	Risk Level	0.000001	unitless

Simplified Formulas:

<u>Substance Type</u>	<u>Residential DEC</u>
Non-carcinogen	67,741.935 x RfD
Carcinogen	0.6125 / CSF

Industrial/Commercial Direct Exposure Criteria Formulas

For substances that are non-carcinogenic:

$$DEC_{RB} = \frac{RfD \times HI \times BW \times AT_{nc}}{IR \times EF \times ED \times CF}$$

For substances that are carcinogenic:

$$DEC_{RB} = \frac{(RL / CSF) \times BW \times AT}{IR \times ED \times EF \times CF}$$

Where:

Variable	Description	Value	Units
AT	Averaging Time – Carcinogen	25550	days
AT _{nc}	Averaging Time –Non-carcinogen	9125	days
BW	Body Weight – Adult	70	kg
CF	Conversion Factor	0.000001	kg/mg
CSF	Cancer Slope Factor	chemical specific	1/mg/kg/d
DEC _{RB}	Direct Exposure Criteria – Risk-based	chemical specific	mg/kg
ED	Exposure Duration	25	years
EF	Exposure Frequency	250	days/year
HI	Hazard Index	1	unitless
IR	Ingestion Rate	50	mg/day
RfD	Reference Dose	chemical specific	mg/kg/d

Simplified Formulas:

Substance Type	Industrial/Commercial
Non-carcinogen	2,044,000 x RfD
Carcinogen	5.7232 / CSF