

15A NCAC 02L .0411 ESTABLISHING MAXIMUM SOIL CONTAMINATION CONCENTRATIONS

The Department shall publish on the Department website and annually revise maximum soil contaminant concentrations to be used as soil cleanup levels for contamination from petroleum underground storage tank systems. The Department shall establish maximum soil contaminant concentrations for residential, industrial/commercial, and soil-to-groundwater exposures as follows:

- (1) The following equations and references shall be used in establishing residential maximum soil contaminant concentrations. Equation 1 shall be used for each contaminant with an EPA carcinogenic classification of A, B1, B2, C, D or E. Equation 2 shall be used for each contaminant with an EPA carcinogenic classification of A, B1, B2 or C. The maximum soil contaminant concentration shall be the lower of the concentrations derived from Equations 1 and 2.
 - (a) Equation 1: Non-cancer Risk-based Residential Ingestion Concentration
$$\text{Soil mg/kg} = [0.2 \times \text{oral chronic reference dose} \times \text{body weight, age 1 to 6} \times \text{averaging time noncarcinogens}] / [\text{exposure frequency} \times \text{exposure duration, age 1 to 6} \times (\text{soil ingestion rate, age 1 to 6} / 10^6 \text{ mg/kg})]$$
 - (b) Equation 2: Cancer Risk-based Residential Ingestion Concentration
$$\text{Soil mg/kg} = [\text{target cancer risk of } 10^{-6} \times \text{averaging time carcinogens}] / [\text{exposure frequency} \times (\text{soil ingestion factor, age adjusted} / 10^6 \text{ mg/kg}) \times \text{oral cancer slope factor}]$$

The age adjusted soil ingestion factor shall be calculated by: $[(\text{exposure duration, age 1 to 6} \times \text{soil ingestion rate, age 1 to 6}) / (\text{body weight, age 1 to 6})] + [((\text{exposure duration, total} - \text{exposure duration, age 1 to 6}) \times \text{soil ingestion, adult}) / (\text{body weight, adult})]$.
 - (c) The exposure factors selected in calculating the residential maximum soil contaminant concentrations shall be within the recommended ranges specified in the following references or the most recent version of these references:
 - (i) EPA, 2011. Exposure Factors Handbook, incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252>;
 - (ii) EPA, 1991. Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part B, Development of Risk Based Preliminary Remediation Goals), incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part-b>;
 - (iii) EPA. Regional Screening Level Generic Tables (RSL) and User's Guide, incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://www.epa.gov/risk/regional-screening-levels-rsls>; and
 - (iv) EPA, 2018. Region 4 Human Health Risk Assessment Supplemental Guidance, incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at https://www.epa.gov/sites/production/files/2018-03/documents/hhra_regional_supplemental_guidance_report-march-2018_update.pdf.
 - (d) The following references or the most recent version of these references, in order of preference, shall be used to obtain oral chronic reference doses and oral cancer slope factors:
 - (i) EPA. Integrated Risk Information System (IRIS) Computer Database, incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://www.epa.gov/iris>;
 - (ii) EPA. Health Effects Assessment Summary Tables (HEAST), incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://epa-heast.ornl.gov>;

- (iii) EPA. Regional Screening Level Generic Tables (RSL) and User's Guide;
 - (iv) EPA, 2018. Region 4 Human Health Risk Assessment Supplemental Guidance; and
 - (v) Other scientifically valid peer-reviewed published health risk assessment data, and scientifically valid peer-reviewed published toxicological data.
- (2) The following equations and references shall be used in establishing industrial/commercial maximum soil contaminant concentrations. Equation 1 shall be used for each contaminant with an EPA carcinogenic classification of A, B1, B2, C, D or E. Equation 2 shall be used for each contaminant with an EPA carcinogenic classification of A, B1, B2 or C. The maximum soil contaminant concentration shall be the lower of the concentrations derived from Equations 1 and 2.
 - (a) Equation 1: Non-cancer Risk-based Industrial/Commercial Ingestion Concentration

$$\text{Soil mg/kg} = [0.2 \times \text{oral chronic reference dose} \times \text{body weight, adult} \times \text{averaging time noncarcinogens}] / [\text{exposure frequency} \times \text{exposure duration, adult} \times (\text{soil ingestion rate, adult} / 10^6 \text{ mg/kg}) \times \text{fraction of contaminated soil ingested}].$$
 - (b) Equation 2: Cancer Risk-based Industrial/Commercial Ingestion Concentration

$$\text{Soil mg/kg} = [\text{target cancer risk of } 10^{-6} \times \text{body weight, adult} \times \text{averaging time carcinogens}] / [\text{exposure frequency} \times \text{exposure duration, adult} \times (\text{soil ingestion rate, adult} / 10^6 \text{ mg/kg}) \times \text{fraction of contaminated soil ingested} \times \text{oral cancer slope factor}].$$
 - (c) The exposure factors selected in calculating the industrial/commercial maximum soil contaminant concentrations shall be within the recommended ranges specified in the following references or the most recent version of these references:
 - (i) EPA, 2011. Exposure Factors Handbook;
 - (ii) EPA, 1991. Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part B, Development of Risk Based Preliminary Remediation Goals);
 - (iii) EPA. Regional Screening Level Generic Tables (RSL) and User's Guide; and
 - (iv) EPA, 2018. Region 4 Human Health Risk Assessment Supplemental Guidance.
 - (d) The following references or the most recent version of these references, in order of preference, shall be used to obtain oral chronic reference doses and oral cancer slope factors:
 - (i) EPA. Integrated Risk Information System (IRIS) Computer Database;
 - (ii) EPA. Health Effects Assessment Summary Tables (HEAST);
 - (iii) EPA. Regional Screening Level Generic Tables (RSL) and User's Guide;
 - (iv) EPA, 2018. Region 4 Human Health Risk Assessment Supplemental Guidance; and
 - (v) Other scientifically valid peer-reviewed published health risk assessment data, and scientifically valid peer-reviewed published toxicological data.
- (3) The following equations and references shall be used in establishing the soil-to-groundwater maximum contaminant concentrations:
 - (a) Organic Constituents:

$$\text{Soil mg/kg} = \text{groundwater standard or interim standard} \times [(.02 \times \text{soil organic carbon-water partition coefficient}) + 4 + (1.733 \times 41 \times \text{Henry's Law Constant (atm.-m}^3\text{/mole)})].$$
 - (i) If no groundwater standard or interim standard has been established under Rule .0202 of this Subchapter, the practical quantitation limit shall be used in lieu of a standard to calculate the soil-to-groundwater maximum contaminant concentrations.
 - (ii) The following references or the most recent version of these references, in order of preference, shall be used to obtain soil organic carbon-water partition coefficients and Henry's Law Constants:
 - (A) EPA. Superfund Chemical Data Matrix (SCDM), incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://www.epa.gov/superfund/superfund-chemical-data-matrix-scdm>;

- (B) EPA, 1991. Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part A), incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Environmental Protection Agency website at <https://www.epa.gov/risk/risk-assessment-guidance-superfund-rags-part/>; it is Volume I of the three-volume set called Risk Assessment Guidance for Superfund;
 - (C) Agency for Toxic Substances and Disease Registry, "Toxicological Profile for [individual chemical]," incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Agency for Toxic substances and Disease Registry website at <https://www.atsdr.cdc.gov/substances/index.asp>;
 - (D) Montgomery, J.H., 2007. Groundwater Chemicals Desk Reference. CRC Press. This document is incorporated by reference including subsequent amendments and editions, and may be obtained for a charge of two hundred ninety six dollars (\$296.00) at <https://www.crcpress.com/Groundwater-Chemicals-Desk-Reference/Montgomery/p/book/9780849392764/> or a copy may be reviewed at the Division of Waste Management, Underground Storage Tank Section office at 217 West Jones Street, Raleigh, N.C. 27603; and
 - (E) Other scientifically valid peer-reviewed published data.
- (b) Inorganic Constituents:
- Soil mg/kg = groundwater standard or interim standard x [(20 x soil-water partition coefficient for pH of 5.5) + 4 + (1.733 x 41 x Henry's Law Constant (atm.-m3/mole))].
- (i) If no groundwater standard or interim standard has been established under Rule .0202 of this Subchapter, the practical quantitation limit shall be used in lieu of a standard to calculate the soil-to-groundwater maximum contaminant concentrations.
 - (ii) The following references or the most recent version of these references, in order of preference, shall be used to obtain soil-water partition coefficients and Henry's Law Constants:
 - (A) EPA. Superfund Chemical Data Matrix (SCDM);
 - (B) Baes, C.F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984. A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture. Oak Ridge National Laboratory, incorporated by reference including subsequent amendments or editions and may be obtained electronically free of charge from the United States Nuclear Regulatory Commission website at <https://www.nrc.gov>;
 - (C) Agency for Toxic Substances and Disease Registry, "Toxicological Profile for [individual chemical];" and
 - (D) Other scientifically valid peer-reviewed published data.

History Note: Authority G.S. 143-215.2; 143-215.3(a)(1); 143-215.94A; 143-215.94E; 143-215.94T; 143-215.94V; 143B-282; 1995 (Reg. Sess. 1996) c. 648,s. 1;
 Recodified from 15A NCAC 02L .0115(m);
 Amended Eff. December 1, 2005;
 Readopted Eff. June 1, 2019.