N.J.A.C. 7:26D

REMEDIATION STANDARDS

Statutory authority:

N.J.S.A. 13:1D-1 et seq., 58:10-23.11a et seq., 58:10A-1 et seq. and 58:10B-1 et seq.

Date last amended:

February 3, 2025

For regulatory history and effective dates, see the New Jersey Administrative Code.

Table of Contents

CHAPTER 26D

REMEDIATION STANDARDS

SUBCHAPTER 1. GENERAL INFORMATION

7:26D-1.1 Purpose

This chapter implements the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq., and other statutes, by establishing remediation standards for ground water, surface water, soil, soil leachate, and indoor air.

7:26D-1.2 Scope

(a) Unless otherwise provided by rule or statute, this chapter shall constitute the rules of the Department concerning standards for the remediation of contaminants in ground water, surface water, soil, soil leachate, and indoor air.

(b) Remediating ground water, surface water, soil, or indoor air to any applicable remediation standard set forth in this chapter shall not relieve any person from:

1. Complying with more stringent requirements or provisions imposed under any other Federal, State, or local applicable statutes, rules, or regulations; and

2. Obtaining any and all permits required by Federal, State, or local statutes, rules, or regulations.

(c) No provision of this chapter shall be construed to limit the Department's authority to require additional remediation based upon site-specific conditions in order to protect human health, safety and the environment.

(d) Nothing in this chapter shall be construed to limit the authority of the Department to establish discharge limits for pollutants, or to prescribe penalties for violations of those limits pursuant to any statutory authority, or to require the complete removal of any illegally discharged hazardous substances, hazardous waste, or pollutants pursuant to law.

(e) The person responsible for conducting the remediation shall not be required to remediate to a level or concentration that is lower than the regional natural background level.

7:26D-1.3 Construction and severability

(a) This chapter shall be liberally construed to permit the Department to effectuate the purposes of the statutes listed in N.J.A.C. 7:26D-1.4(a).

(b) If any subchapter, section, subsection, provision, clause, or portion of this chapter, or the application thereof to any person, is adjudged unconstitutional or invalid by a court of competent jurisdiction, such judgment shall be confined in its operation to the subchapter, section, subsection, provision, clause, portion, or application directly involved in the controversy in which such judgment shall have been rendered and it shall not affect or impair the remainder of this chapter or the application thereof to other persons.

7:26D-1.4 Applicability

(a) This chapter establishes the remediation standards for ground water, surface water, soil, soil leachate, and indoor air for contaminated site**s** in New Jersey including, without limitation, those sites subject to:

1. The Industrial Site Recovery Act (ISRA), N.J.S.A. 13:1K-6 et seq.;

2. The New Jersey Underground Storage of Hazardous Substances Act (UST), N.J.S.A. 58:10A-21 et seq.;

3. The Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq.;

4. The Solid Waste Management Act, N.J.S.A. 13:E-1 et seq.;

5. The Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.;

6. The Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq.;

7. The Comprehensive Regulated Medical Waste Management Act, N.J.S.A. 13:1E-48.1 et seq.;

8. The Major Hazardous Waste Facilities Siting Act, N.J.S.A. 13:1E-49 et seq.;

9. The Sanitary Landfill Facility Closure and Contingency Fund Act, N.J.S.A. 13:1E-100 et seq.; and

10. The Regional Low-Level Radioactive Waste Disposal Facility Siting Act, N.J.S.A. 13:1E-177 et seq.

(b) The person responsible for conducting the remediation shall comply with the remediation standards set forth in this chapter, except as provided at (b)1, 2, and 3 below. The exceptions provided at (b)1, 2, and 3 below may be applied only to a site or an area of concern that is identified in a remedial action workplan or remedial action report.

1. The person responsible for conducting the remediation may use a standard or criterion the Department developed under N.J.S.A. 58:10B-12a, or other authority, prior to June 2, 2008, if:

i. The standard or criterion is not greater by an order of magnitude than the otherwise applicable remediation standard pursuant to this chapter;

ii. A remedial action workplan or a remedial action report containing standards or criteria developed for the site or an area of concern under N.J.S.A. 58:10B-12a, or other authority, was submitted to the Department before December 2, 2008;

iii. The remedial action workplan or remedial action report was either approved by the Department or certified by a licensed site remediation professional; and

iv. The person responsible for conducting the remediation completes the remedial action within the applicable remedial action regulatory timeframe pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.8.

2. The person responsible for conducting the remediation may use a remediation standard that was in effect between June 2, 2008, and September 17, 2017, which the Department adopted or developed under N.J.S.A. 58:10B-12a, or other authority, if:

i. The standard is not greater by an order of magnitude than the otherwise applicable remediation standard pursuant to this chapter;

ii. A remedial action workplan or a remedial action report containing standards or criteria developed for the site or an area of concern under N.J.S.A. 58:10B-12a, or other authority, was submitted to the Department between December 2, 2008, and March 17, 2018;

iii. The remedial action workplan or remedial action report was either approved by the Department or certified by a licensed site remediation professional; and

iv. The person responsible for conducting the remediation completes the remedial action within the applicable remedial action regulatory timeframe pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.8.

3. The person responsible for conducting the remediation may use a remediation standard the Department adopted or developed pursuant to N.J.S.A. 58:10B-12a, or other authority, that was in effect between September 18, 2017, and May 17,2021; if:

i. The standard is not greater by an order of magnitude than the otherwise applicable remediation standard pursuant to this chapter;

ii. A remedial action workplan or a remedial action report containing standards or criteria developed for the site or an area of concern under N.J.S.A. 58:10B-12a was submitted to the Department between March 18, 2018, and November 17, 2021;

iii. The remedial action workplan or remedial action report was either approved by the Department or certified by a licensed site remediation professional; and

iv. The person responsible for conducting the remediation completes the remedial action within the applicable remedial action regulatory timeframe pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.8.

(c) Notwithstanding any other provision of this chapter, all applicable remediation standards and remedial actions that involve real property located in the Pinelands area shall be consistent with the provisions of the Pinelands Protection Act, N.J.S.A. 13:18A-1 et seq., and any rules promulgated pursuant thereto, and with Section 502 of the National Parks and Recreation Act of 1978, 16 U.S.C. § 4711. (c).

7:26D-1.5 Definitions

The following words and terms, when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise:

"Alternative remediation standard" or "ARS" means a remediation standard that is established using site-specific factors following the procedures set forth at N.J.A.C. 7:26D-8 and 7:26D Appendices 6, 7, 8, and 9.

“Area of concern” has the same meaning as the definition of the term in the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-1.8.

"Carcinogen" means a contaminant capable of inducing a cancer response, including Group A (Human Carcinogen), Group B (Probable Human Carcinogen) and Group C (Possible Human Carcinogen) categorized in accordance with the USEPA Guidelines for Carcinogen Risk Assessment, 51 Fed. Reg. 33932 (1986), as amended and supplemented.

"Contaminated site" means a contaminated site as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Contamination" or "contaminant" means contamination or a contaminant as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

“Criterion” or “criteria” means, for the ingestion-dermal, inhalation, and vapor intrusion exposure pathways, the health-based value(s) that is (are) derived from the equations contained at N.J.A.C. 7:26D Appendices 2, 3, and 5 using the applicable chemical and physical properties of contaminants contained at N.J.A.C. 7:26D Appendix 10 and toxicity factors contained at N.J.A.C. 7:26D Appendix 11. For the migration to ground water exposure pathway, “criterion” or “criteria” means the soil-water partitioning value(s) that are derived from N.J.A.C. 7:26D Appendix 4, Equations 1 through 4, using the applicable chemical and physical properties of contaminants contained at N.J.A.C. 7:26D Appendix 10.

"Department" means the New Jersey Department of Environmental Protection.

"Discharge" means a discharge as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Exposure pathway" means the routes by which contaminants in soil, water, or other media come in contact with humans. Examples include the ingestion-dermal exposure pathway, the inhalation exposure pathway, the migration to ground water exposure pathway, and the vapor intrusion exposure pathway.

“Extractable petroleum hydrocarbons” or “EPH” means extractable aliphatic and aromatic petroleum hydrocarbons identified using the Department’s “Extractable Petroleum Hydrocarbons Methodology,” found at https://nj.gov/dep/srp/guidance/srra/eph_method.pdf. EPH includes, but is not limited to, No. 2 heating oil and diesel fuel (Category 1), and heavier petroleum products (Category 2), but excludes the lighter petroleum products including gasoline and mineral spirits.

"Ground water" means ground water as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4.

"Ground water quality criteria" means any ground water quality criteria as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4.

"Ingestion-dermal exposure pathway" means an exposure pathway involving potential human contact with contaminants through incidental ingestion of soil and through dermal contact with soil.

"Inhalation exposure pathway" means an exposure pathway involving potential human contact with contaminants through the inhalation of particulates or vapors, or a combination

of particulates and vapors, emanating from contaminated soil. This pathway is distinct from the vapor intrusion exposure pathway.

“Interim remediation standard” means a remediation standard that is established pursuant to N.J.A.C. 7:26D-6.

“Migration to ground water exposure pathway” means an exposure pathway involving the migration of contaminants in the vadose zone to ground water and subsequent potential human exposure through the ingestion of ground water.

“Nonresidential” or “NR” means used for commercial or industrial purposes.

"Person responsible for conducting the remediation" means the person responsible for conducting the remediation as defined in the Administrative Requirements for the Remediation of Contaminated Sites at N.J.A.C. 7:26C-1.3.

"Pollutant" means any substance defined as such pursuant to the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.

“Practical quantitation level” or “PQL” means a practical quantitation level or PQL as defined pursuant to Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Regional natural background level" means the concentration of a contaminant consistently present in the environment of the region of the site and which has not been influenced by localized human activities.

"Remediation" or "remediate" means remediation or remediate as defined pursuant to the Technical Requirements for Site Remediation at N.J.A.C. 7:26E-1.8.

"Remediation standard" means the combination of a numeric standard that establish a level or concentration, and a narrative standard, as appropriate, to which a contaminant

must be treated, removed, or otherwise cleaned for soil, soil leachate, ground water, surface water, or indoor air, as established by this chapter.

“Reporting limit” means a reporting limit as defined pursuant to the Technical Requirements for Site Remediation at N.J.A.C. 7:26E-1.8.

“Residential” means used for residences, private and public schools as defined at N.J.S.A. 18A:1-1, charter schools established pursuant to N.J.S.A. 18A:36A-1 et seq., and childcare centers licensed pursuant to N.J.S.A. 30:5B-1 et seq.

"Surface water" means "surface water" as defined pursuant to the Surface Water Quality Standards, N.J.A.C. 7:9B.

"Surface Water Quality Standards" has the same meaning as the definition of the term at N.J.A.C. 7:9B-1.4.

“USEPA” means the United States Environmental Protection Agency.

“Vapor intrusion exposure pathway” is an exposure pathway involving potential human contact with contaminants through the inhalation of contaminated indoor air resulting from the migration of volatile contaminants from the subsurface into buildings. This pathway is distinct from the inhalation exposure pathway.

SUBCHAPTER 2. GROUND WATER REMEDIATION STANDARDS

7:26D-2.1 Purpose

This subchapter establishes the remediation standards for ground water.

7:26D-2.2 Ground water remediation standards

(a) The remediation standards for ground water are:

1. For Class II ground water, the Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(c) and (d);

2. For Class I-A and Class I-PL, Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(a) and (b);

3. For Class III-A and Class III-B, Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(e) and (f); and

4. For all ground water, regardless of classification, each of the following narrative ground water remediation standards, as applicable:

i. The general ground water quality policies in N.J.A.C. 7:9C-1.2;

ii. The narrative ground water quality criteria in N.J.A.C. 7:9C-1.7;

iii. The ground water quality antidegradation policy in N.J.A.C. 7:9C-1.8;

iv. The remediation requirements in N.J.A.C. 7:26E-1 through 5 in order to both:

(1) Address the adverse impact of the contamination on the ground water itself; and

(2) Limit additional risks posed by the contamination to the human health and safety and to the environment;

v. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-5.1(e); and

vi. The contaminants have not migrated to the ground surface, structures, or air in concentrations in excess of a remediation standard.

SUBCHAPTER 3. SURFACE WATER REMEDIATION STANDARDS

7:26D-3.1 Purpose

This subchapter establishes the remediation standards for surface water.

7:26D-3.2 Surface water remediation standards

(a) The remediation standards for surface water are:

1. The numeric New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B-1.14(c) through (h); and

2. The following narrative surface water remediation standards:

i. The general surface water quality policies in N.J.A.C. 7:9B-1.5;

ii. The surface water quality criteria at N.J.A.C. 7:9B-1.14(a) and (b);

iii. The remediation requirements at N.J.A.C. 7:26E-1 through 5 in order to both:

(1) Address the adverse impact of the contamination on the surface water itself; and

(2) Limit additional risks posed by the contamination to the public health and safety and to the environment; and

iv. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-5.1(e).

SUBCHAPTER 4. SOIL AND SOIL LEACHATE REMEDIATION STANDARDS

7:26D-4.1. Purpose

This subchapter establishes remediation standards for soil and soil leachate.

7:26D-4.2 Soil remediation standards for the ingestion-dermal exposure pathway

(a) The soil remediation standard for the ingestion-dermal exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Tables 1 and 2, is:

1. The more stringent value of the carcinogenic or noncarcinogenic ingestion-dermal human health-based criterion; or

2. The reporting limit, if the reporting limit is greater than the value determined at (a)1 above.

(b) The ingestion-dermal human health-based criteria at N.J.A.C. 7:26D Appendix 1, Tables 1 and 2, incorporated herein by reference, are the residential and nonresidential human health-based criteria for the ingestion-dermal exposure pathway, based on the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 2, incorporated herein by reference, using the data provided at N.J.A.C. 7:26D Appendices 10 and 11, incorporated herein by reference.

(c) N.J.A.C. 7:26D Appendix 1, Table 1 shall be used for sites where the anticipated use is residential. N.J.A.C. 7:26D Appendix 1, Table 2 shall be used for sites where the anticipated use is nonresidential.

7:26D-4.3 Soil remediation standards for the inhalation exposure pathway

(a) The soil remediation standard for the inhalation exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Tables 3 and 4, is:

1. The more stringent value of the carcinogenic or noncarcinogenic inhalation human health-based criterion; or

2. The reporting limit, if the reporting limit is greater than the value determined at (a)1 above.

(b) The inhalation human health-based criteria at N.J.A.C. 7:26D Appendix 1, Tables 3 and 4, incorporated herein by reference, are the residential and nonresidential human health-based criteria for the inhalation exposure pathway, based on the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 3, incorporated herein by reference, using the data provided at N.J.A.C. 7:26D Appendices 10 and 11, incorporated herein by reference.

(c) N.J.A.C. 7:26D Appendix 1, Table 3 shall be used for sites where the anticipated use is residential. N.J.A.C. 7:26D 1, Table 4 shall be used for sites where the anticipated use is nonresidential.

7:26D-4.4 Soil and soil leachate remediation standards for the migration to ground water exposure pathway

(a) The soil remediation standard for the migration to groundwater exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Table 5 is the greater of:

1. The migration to ground water soil criterion; or

2. The reporting limit.

(b) The migration to ground water soil criteria at N.J.A.C. 7:26D Appendix 1, Table 5, incorporated herein by reference, are based on the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 4, Equations 1 through 4, incorporated herein by reference, using the data at N.J.A.C. 7:26D Appendix 10, incorporated herein by reference.

(c) The soil leachate remediation standards for the migration to ground water exposure pathway at N.J.A.C. 7:26D Appendix 1, Table 6, incorporated herein by reference, are based upon the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 4, Equation 5, incorporated herein by reference.

SUBCHAPTER 5. INDOOR AIR REMEDIATION STANDARDS

7:26D-5.1 Purpose

This subchapter establishes remediation standards for indoor air for the vapor intrusion exposure pathway.

7:26D-5.2 Indoor air remediation standards

(a) The indoor air remediation standards for the vapor intrusion exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Tables 7 and 8, incorporated herein by reference, were developed as follows:

1. The more stringent value of the carcinogenic or noncarcinogenic indoor air human health-based criterion; or

2. The reporting limit, if the reporting limit is greater than the value determined at (a)1 above.

(b) N.J.A.C. 7:26D Appendix 1, Table 7, shall be used for sites where the anticipated use is residential. N.J.A.C. 7:26D Appendix 1, Table 8, shall be used for sites where the anticipated use is nonresidential.

(c) The methodology used to develop the indoor air remediation criteria is provided at N.J.A.C. 7:26D Appendix 5, incorporated herein by reference.

SUBCHAPTER 6. INTERIM REMEDIATION STANDARDS

7:26D-6.1 Purpose

This subchapter sets forth the procedures that the Department will use to establish interim remediation standards.

7:26D-6.2 Interim remediation standards

(a) The Department may establish an interim remediation standard for:

1. Soil, soil leachate, and indoor air when a contaminant is not listed at N.J.A.C. 7:26D Appendix 1; and

2. Ground water when a contaminant is not listed in the Ground Water Quality Standards, N.J.A.C. 7:9C Appendix, Table 1.

(b) The person responsible for conducting the remediation may request that the Department develop an interim remediation standard pursuant to this subchapter and shall use only a Department-developed or approved interim remediation standard.

(c) An interim remediation standard shall be developed as follows:

1. For ground water, using the procedures set forth in the Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c);

2. For soil:

i. For the ingestion-dermal exposure pathway, using the procedures set forth at N.J.A.C. 7:26D Appendix 2, incorporated herein by reference;

ii. For the inhalation exposure pathway, using the procedures set forth at N.J.A.C. 7:26D Appendix 3, incorporated herein by reference; or

iii. For the migration to ground water exposure pathway, using procedures set forth at N.J.A.C. 7:26D Appendix 4, incorporated herein by reference; or

3. For indoor air for the vapor intrusion exposure pathway, using procedures set forth at N.J.A.C. 7:26D Appendix 5, incorporated herein by reference.

7:26D-6.3 Publication and promulgation of interim remediation standards

(a) The Department shall publish on its website a listing of all interim remediation standards developed pursuant to this chapter and the technical basis used in their derivation.

(b) Interim soil remediation standards developed pursuant to this chapter shall be replaced with duly promulgated soil remediation standards as soon as reasonably possible.

SUBCHAPTER 7. UPDATING REMEDIATION STANDARDS

7:26D-7.1 Purpose

This subchapter sets forth the procedures that the Department will use to update remediation standards.

7:26D-7.2 Procedures for updating remediation standards

(a) The Department shall update a remediation standard for soil or indoor air at N.J.A.C. 7:26D Appendix 1 when:

1. The USEPA revises toxicity information contained in the Integrated Risk Information System (IRIS) database;

2. The Department uses new or revised toxicity information developed by the New Jersey Drinking Water Quality Institute when promulgating a new or revised maximum contaminant level (MCL) for a drinking water constituent;

3. The Department uses new or revised toxicity information when promulgating a new or revised ground water quality standard; or

4. The USEPA revises or replaces its Integrated Environmental Uptake Biokinetic (IEUBK) Model and Adult Lead Model (ALM) and input parameters for lead.

(b) The Department shall update a soil and a soil leachate remediation standard for the migration to ground water exposure pathway at N.J.A.C. 7:26D Appendix 1 when a ground water quality criterion is updated pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c).

(c) When the Department develops an updated remediation standard, the Department shall post on its website at https://www.nj.gov/dep/rules/adminchg.html and publish in the New Jersey Register a notice of administrative change. The notice of administrative change shall identify the remediation standard to be updated including the relevant media and exposure pathway, the contaminant, the basis for the administrative change, and the revised criterion to be listed at N.J.A.C. 7:26D Appendix 1.

(d) An updated remediation standard shall be effective on the date the notice of administrative change is filed with the Office of Administrative Law.

(e) An updated remediation standard shall be applied to all sites except, in lieu of the updated remediation standard established pursuant to this subchapter, the person responsible for conducting the remediation may continue to use a remediation standard that is specified in a remedial action workplan or remedial action report for a site, provided that:

1. The remedial action workplan or remedial action report is submitted no later than six months after the effective date of the updated standard;

2. The remedial action workplan or remedial action report is approved by the Department or is certified by a licensed site remediation professional;

3. The remediation standard specified in the remedial action workplan or remedial action report for a given contaminant is not greater by an order of magnitude than the updated remediation standard; and

4. The remedial action shall comply with the applicable regulatory timeframes pursuant to the Technical Requirements for Site Remediation at N.J.A.C. 7:26E-5.

SUBCHAPTER 8. ALTERNATIVE REMEDIATION STANDARDS

7:26D-8.1 Purpose

(a) This subchapter sets forth the procedures for the development and approval of alternative remediation standards for:

1. Soil for the ingestion-dermal exposure pathway and inhalation exposure pathway;

2. Soil and soil leachate for the migration to ground water exposure pathway; and

3. Indoor air for the vapor intrusion exposure pathway.

7:26D-8.2 Applicability

An alternative remediation standard developed pursuant to this subchapter in lieu of a remediation standard established by N.J.A.C. 7:26D-2, 3, 4, 5, or 6, shall be used only at the site or area of concern for which it is developed and approved.

7:26D-8.3 Development of an alternative remediation standard

(a) An alternative remediation standard for a site or area of concern:

1. May be developed for soil, for the following exposure pathways:

i. Ingestion-dermal exposure pathway using the procedures at N.J.A.C. 7:26D Appendix 6, incorporated herein by reference;

ii. Inhalation exposure pathway using the procedures at N.J.A.C. 7:26D Appendix 7, incorporated herein by reference; and

iii. Migration to ground water exposure pathway using the procedures at N.J.A.C. 7:26D Appendix 8, incorporated herein by reference;

2. May be developed for indoor air, for the vapor intrusion exposure pathway, using the procedures at N.J.A.C. 7:26D Appendix 9, incorporated herein by reference.

(b) The Department may, upon its own initiative and in accordance with N.J.S.A. 58:10B-12.f(2), require the development and use of an alternative remediation standard for a particular contaminant for a particular site or area of concern that is either more or less stringent than the remediation standards established by this chapter.

(c) The person responsible for conducting the remediation who develops an alternative remediation standard that requires prior approval from the Department shall follow the approval process outlined at N.J.A.C. 7:26D-8.4.

(d) The person responsible for conducting the remediation who develops an alternative remediation standard that does not require prior approval from the Department shall follow the process outlined at N.J.A.C. 7:26D-8.5.

(e) In accordance with the Site Remediation Reform Act, at N.J.S.A. 58:10C-21, the alternative remediation standards developed pursuant to this subchapter shall be subject to the Department inspection and review process as described in the Site Remediation Reform Act at N.J.S.A. 58:10C-21a.

7:26D-8.4 Approval process for alternative remediation standards requiring prior approval from the Department

(a) Except as provided at N.J.A.C. 7:26D-8.5, the person responsible for conducting the remediation shall obtain prior approval from the Department, in accordance with (b) and (c)

below, for an alternative remediation standard developed pursuant to this subchapter before using the alternative remediation standard at a specific site or area of concern.

(b) For each proposed alternative remediation standard, the person responsible for conducting the remediation shall collect and submit to the Department, along with the appropriate form(s) found on the Department's website at www.nj.gov/dep/srp/srra/forms, the information indicated for the proposed alternative remediation standard as described at N.J.A.C. 7:26D Appendices 6 through 9, incorporated herein by reference.

(c) The Department shall review the information the person responsible for conducting the remediation submits in accordance with (b) above, and shall respond as follows:

1. If the Department determines that the submitted information is acceptable, then the Department shall provide the person responsible for conducting the remediation with a written approval for the use of the alternative soil remediation standard at the specific site or area of concern; or

2. If the Department determines that the submitted information is deficient, then the Department shall provide comments to the person responsible for conducting the remediation describing the deficiencies, in which case:

i. The person responsible for conducting the remediation may correct the deficiencies and may resubmit the information to the Department for its review pursuant to (c) above; or

ii. The person responsible for conducting the remediation may withdraw the request for approval of a proposed alternative remediation standard.

(d) The person responsible for conducting the remediation shall not use the proposed alternative remediation standard if that person does not correct a deficiency noted by the Department pursuant to N.J.A.C. 7:26D-8.4(c)2.

7:26D-8.5 Process for the development of alternative remediation standards not requiring prior approval by the Department

(a) When the person responsible for conducting the remediation is not required to obtain prior approval from the Department for the implementation of an alternative remediation standard developed pursuant to this subchapter, the person responsible shall:

1. For each proposed alternative remediation standard, collect the information indicated for each applicable exposure pathway as described at N.J.A.C. 7:26D Appendices 6, 7, 8, and 9, incorporated herein by reference; and

2. Submit to the Department the information described in (a)1 above with the applicable remedial phase report or workplan pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E.

APPENDIX 1

REMEDIATION STANDARDS TABLES

Table 1 – Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway -

Residential (mg/kg) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Residential Carcinogenic Ingestion-Dermal Human Health-based Criterion	Residential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion	Reporting Limit	Soil Remediation Standard Ingestion-Dermal Residential
Acenaphthene	83-32-9	NA	3,600	0.17	3,600
Acetone (2-Propanone)	67-64-1	NA	70,000	0.010	70,000
Acetophenone	98-86-2	NA	7,800	0.33	7,800
Aldrin	309-00-2	0.041	2.3	0.0017	0.041
Aluminum (total)	7429-90-5	NA	78,000	20	78,000
Anthracene	120-12-7	NA	18,000	0.17	18,000
Antimony (total)	7440-36-0	NA	31	1.0	31
Arsenic (total)	7440-38-2	0.43	22	0.50	19[1]
Atrazine	1912-24-9	NA	220	0.33	220
Barium (total)	7440-39-3	NA	16,000	5.0	16,000
Benzaldehyde	100-52-7	170	7,800	0.33	170
Benzene	71-43-2	3.0	310	0.0050	3.0
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	5.1	NA	0.17	5.1
Benzo(a)pyrene	50-32-8	0.51	18	0.17	0.51
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	5.1	NA	0.17	5.1
Benzo(k)fluoranthene	207-08-9	51	NA	0.17	51
Beryllium	7440-41-7	NA	160	0.50	160
1,1'-Biphenyl	92-52-4	87	39,000	0.17	87
Bis(2-chloroethoxy)methane	111-91-1	NA	190	0.17	190
Bis(2-chloroethyl)ether	111-44-4	0.63	NA	0.33	0.63
Bis(2-ethylhexyl)phthalate	117-81-7	39	1,300	0.17	39
Bromodichloromethane (Dichlorobromomethane)	75-27-4	11	1,600	0.0050	11
Bromoform	75-25-2	88	1,600	0.0050	88
Bromomethane (Methyl bromide)	74-83-9	NA	110	0.0050	110
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	47,000	0.010	47,000
Butylbenzyl phthalate	85-68-7	290	13,000	0.17	290
Cadmium	7440-43-9	NA	71	0.50	71
Caprolactam	105-60-2	NA	32,000	0.33	32,000
Carbon disulfide	75-15-0	NA	NA	0.0050	NA
Carbon tetrachloride	56-23-5	7.6	310	0.0050	7.6

Chlordane (alpha and gamma forms summed)	57-74-9	0.27	36	0.0017	0.27
4-Chloroaniline	106-47-8	2.7	250	0.17	2.7
Chlorobenzene	108-90-7	NA	510	0.0050	510
Chloroethane (Ethyl chloride)	75-00-3	NA	NA	0.0050	NA
Chloroform	67-66-3	NA	780	0.0050	780
Chloromethane (Methyl chloride)	74-87-3	NA	NA	0.0050	NA
2-Chloronaphthalene	91-58-7	NA	4,800	0.17	4,800
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA	390	0.17	390
Chrysene	218-01-9	510	NA	0.17	510
Cobalt (total)	7440-48-4	NA	23	0.50	23
Copper (total)	7440-50-8	NA	3,100	1.0	3,100
Cyanide	57-12-5	NA	47	0.50	47
Cyclohexane	110-82-7	NA	NA	0.0050	NA
4,4'-DDD (p,p'-TDE)	72-54-8	2.3	NA	0.0033	2.3
4,4'-DDE (p,p'-DDX)	72-55-9	2.0	NA	0.0033	2.0
4,4'-DDT	50-29-3	1.9	37	0.0033	1.9
Dibenz(a,h)anthracene	53-70-3	0.51	NA	0.17	0.51
Dibromochloromethane (Chlorodibromomethane)	124-48-1	8.3	1,600	0.0050	8.3
1,2-Dibromo-3-chloropropane	96-12-8	0.87	16	0.0050	0.87
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.35	700	0.0050	0.35
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	6,700	0.0050	6,700
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA	6,700	0.0050	6,700
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	780	0.0050	780
3,3'-Dichlorobenzidine	91-94-1	1.2	NA	0.33	1.2
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	16,000	0.0050	16,000
1,1-Dichloroethane	75-34-3	120	16,000	0.0050	120
1,2-Dichloroethane	107-06-2	5.8	NA	0.0050	5.8
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	11	0.0050	11
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	780	0.0050	780

1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	1,300	0.0050	1,300
2,4-Dichlorophenol	120-83-2	NA	190	0.17	190
1,2-Dichloropropane	78-87-5	19	3,100	0.0050	19
1,3-Dichloropropene (total)	542-75-6	7.0	2,300	0.0050	7.0
Dieldrin	60-57-1	0.034	3.2	0.0033	0.034
Diethylphthalate	84-66-2	NA	51,000	0.17	51,000
2,4-Dimethylphenol	105-67-9	NA	1,300	0.17	1,300
Di-n-butyl phthalate	84-74-2	NA	6,300	0.17	6,300
2,4-Dinitrophenol	51-28-5	NA	130	0.33	130
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.80	NA	0.17	0.80
Di-n-octyl phthalate	117-84-0	NA	630	0.33	630
1,4-Dioxane	123-91-1	7.0	2,300	0.067	7.0
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA	470	0.0033	470
Endrin	72-20-8	NA	19	0.0033	19
Ethylbenzene	100-41-4	NA	7,800	0.0050	7,800
Extractable Petroleum Hydrocarbons (Category 1)	various	NA	5,300[3]	80	5,300[3]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA	Sample-specific[4]	80	Sample-specific[4]
Fluoranthene	206-44-0	NA	2,400	0.33	2,400
Fluorene	86-73-7	NA	2,400	0.17	2,400
alpha-HCH (alpha-BHC)	319-84-6	0.086	510	0.0017	0.086
beta-HCH (beta-BHC)	319-85-7	0.30	NA	0.0017	0.30
Heptachlor	76-44-8	0.15	39	0.0017	0.15
Heptachlor epoxide	1024-57-3	0.076	1.0	0.0017	0.076
Hexachlorobenzene	118-74-1	0.43	63	0.17	0.43
Hexachloro-1,3-butadiene	87-68-3	8.9	78	0.17	8.9
Hexachlorocyclopentadiene	77-47-4	NA	470	0.33	470
Hexachloroethane	67-72-1	17	55	0.17	17
n-Hexane	110-54-3	NA	NA	-[7]	NA
2-Hexanone	591-78-6	NA	390	0.010	390
Indeno(1,2,3-cd)pyrene	193-39-5	5.1	NA	0.17	5.1
Isophorone	78-59-1	570	13,000	0.17	570
Isopropylbenzene	98-82-8	NA	7,800	0.0050	7,800
Lead (total)	7439-92-1	NA	NA	0.50	200[5]
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	0.57	21	0.0017	0.57
Manganese (total)	7439-96-5	NA	1,900	0.50	1,900
Mercury (total)	7439-97-6	NA	23	0.10	23

Methoxychlor	72-43-5	NA	320	0.017	320
Methyl acetate	79-20-9	NA	78,000	0.0050	78,000
Methylene chloride (Dichloromethane)	75-09-2	50	470	0.0050	50
2-Methylnaphthalene	91-57-6	NA	240	0.17	240
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	NA	0.010	NA
2-Methylphenol (o-cresol)	95-48-7	NA	320	0.33	320
4-Methylphenol (p-cresol)	106-44-5	NA	630	0.33	630
Methyl tert-butyl ether (MTBE)	1634-04-4	NA	780	0.0050	780
Naphthalene	91-20-3	NA	2,500	0.17	2,500
Nickel (total)	7440-02-0	NA	1,600	0.50	1,600
4-Nitroaniline	100-01-6	27	250	0.33	27
Nitrobenzene	98-95-3	NA	160	0.17	160
N-Nitrosodi-n-propylamine	621-64-7	0.078	NA	0.17	0.17[2]
N-Nitrosodiphenylamine	86-30-6	110	NA	0.17	110
2,2'-oxybis (1-chloropropane)	108-60-1	NA	3,100	0.33	3,100
Pentachlorophenol	87-86-5	1.0	250	0.33	1.0
Phenol	108-95-2	NA	19,000	0.33	19,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.25	NA	0.030	0.25
Pyrene	129-00-0	NA	1,800	0.17	1,800
Selenium (total)	7782-49-2	NA	390	2.5	390
Silver (total)	7440-22-4	NA	390	0.50	390
Styrene	100-42-5	NA	16,000	0.0050	16,000
Tertiary butyl alcohol (TBA)	75-65-0	NA	1,400	0.10	1,400
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	23	0.17	23
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA	0.000051	0.0000010	0.000051[6]
1,1,2,2-Tetrachloroethane	79-34-5	3.5	1,600	0.0050	3.5
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	330	470	0.0050	330
2,3,4,6-Tetrachlorophenol	58-90-2	NA	1,900	0.17	1,900
Toluene	108-88-3	NA	6,300	0.0050	6,300
Toxaphene	8001-35-2	0.49	NA	0.17	0.49
1,2,4-Trichlorobenzene	120-82-1	NA	780	0.0050	780
1,1,1-Trichloroethane	71-55-6	NA	160,000	0.0050	160,000
1,1,2-Trichloroethane	79-00-5	12	310	0.0050	12
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	15	39	0.0050	15
Trichlorofluoromethane (Freon 11)	75-69-4	NA	23,000	0.0050	23,000
2,4,5-Trichlorophenol	95-95-4	NA	6,300	0.20	6,300
2,4,6-Trichlorophenol	88-06-2	49	63	0.20	49

1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	NA	0.0050	NA
1,2,4-Trimethylbenzene	95-63-6	NA	780	0.076	780
Vanadium (total)	7440-62-2	NA	390	2.5	390
Vinyl chloride	75-01-4	0.97	230	0.0050	0.97
Xylenes (total)	1330-20-7	NA	12,000	0.0050	12,000
Zinc (total)	7440-66-6	NA	23,000	1.0	23,000

NA – Not applicable because appropriate toxicological information is not available

[1] Standard is based on natural background

[2] Standard set at reporting limit

[3] Special calculation for EPH – see at N.J.A.C. 7:26D Appendix 2

[4] Sample-specific calculation using EPH calculator – see at N.J.A.C. 7:26D Appendix 2

[5] Standard based on the Integrated Exposure Uptake Biokinetic (IEUBK) model for lead in children

[6] This standard is used for comparison to site soil data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

[7] Although n-Hexane does not have a specific reporting limit, quantification is required to be less than the applicable remediation standard

Table 2 – Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway - Nonresidential (mg/kg) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Nonresidential Carcinogenic Ingestion-Dermal Human Health-based Criterion	Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion	Reporting Limit	Soil Remediation Standard Ingestion-Dermal Nonresidential

Acenaphthene	83-32-9	NA	50,000	0.17	50,000
Acetone (2-Propanone)	67-64-1	NA	1,200,000	0.010	NA[1]
Acetophenone	98-86-2	NA	130,000	0.33	130,000
Aldrin	309-00-2	0.21	39	0.0017	0.21
Aluminum (total)	7429-90-5	NA	1,300,000	20	NA[1]
Anthracene	120-12-7	NA	250,000	0.17	250,000
Antimony (total)	7440-36-0	NA	520	1.0	520
Arsenic (total)	7440-38-2	2.1	350	0.50	19[2]
Atrazine	1912-24-9	NA	3,200	0.33	3,200
Barium (total)	7440-39-3	NA	260,000	5.0	260,000
Benzaldehyde	100-52-7	910	130,000	0.33	910
Benzene	71-43-2	16	5,200	0.0050	16
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	23	250	0.17	23
Benzo(a)pyrene	50-32-8	2.3	250	0.17	2.3
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	23	NA	0.17	23
Benzo(k)fluoranthene	207-08-9	230	NA	0.17	230
Beryllium	7440-41-7	NA	2,600	0.50	2,600
1,1'-Biphenyl	92-52-4	450	650,000	0.17	450
Bis(2-chloroethoxy)methane	111-91-1	NA	2,700	0.17	2,700
Bis(2-chloroethyl)ether	111-44-4	3.3	NA	0.33	3.3
Bis(2-ethylhexyl)phthalate	117-81-7	180	18,000	0.17	180
Bromodichloromethane (Dichlorobromomethane)	75-27-4	59	26,000	0.0050	59
Bromoform	75-25-2	460	26,000	0.0050	460
Bromomethane (Methyl bromide)	74-83-9	NA	1,800	0.0050	1,800
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	780,000	0.010	780,000
Butylbenzyl phthalate	85-68-7	1,300	180,000	0.17	1,300
Cadmium	7440-43-9	NA	1,100	0.50	1,100
Caprolactam	105-60-2	NA	460,000	0.33	460,000
Carbon disulfide	75-15-0	NA	NA	0.0050	NA
Carbon tetrachloride	56-23-5	40	5,200	0.0050	40
Chlordane (alpha and gamma forms summed)	57-74-9	1.4	550	0.0017	1.4
4-Chloroaniline	106-47-8	13	3,600	0.17	13
Chlorobenzene	108-90-7	NA	8,400	0.0050	8,400
Chloroethane (Ethyl chloride)	75-00-3	NA	NA	0.0050	NA
Chloroform	67-66-3	NA	13,000	0.0050	13,000

Chloromethane (Methyl chloride)	74-87-3	NA	NA	0.0050	NA
2-Chloronaphthalene	91-58-7	NA	67,000	0.17	67,000
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA	6,500	0.17	6,500
Chrysene	218-01-9	2,300	NA	0.17	2,300
Cobalt (total)	7440-48-4	NA	390	0.50	390
Copper (total)	7440-50-8	NA	52,000	1.0	52,000
Cyanide	57-12-5	NA	780	0.50	780
Cyclohexane	110-82-7	NA	NA	0.0050	NA
4,4'-DDD (p,p'-TDE)	72-54-8	11	NA	0.0033	11
4,4'-DDE (p,p'-DDX)	72-55-9	11	NA	0.0033	11
4,4'-DDT	50-29-3	9.5	580	0.0033	9.5
Dibenz(a,h)anthracene	53-70-3	2.3	NA	0.17	2.3
Dibromochloromethane (Chlorodibromomethane)	124-48-1	43	26,000	0.0050	43
1,2-Dibromo-3-chloropropane	96-12-8	4.5	260	0.0050	4.5
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	1.8	12,000	0.0050	1.8
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	110,000	0.0050	110,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA	110,000	0.0050	110,000
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	13,000	0.0050	13,000
3,3'-Dichlorobenzidine	91-94-1	5.7	NA	0.33	5.7
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	260,000	0.0050	260,000
1,1-Dichloroethane	75-34-3	640	260,000	0.0050	640
1,2-Dichloroethane	107-06-2	30	NA	0.0050	30
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	180	0.0050	180
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	13,000	0.0050	13,000
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	22,000	0.0050	22,000
2,4-Dichlorophenol	120-83-2	NA	2,700	0.17	2,700
1,2-Dichloropropane	78-87-5	98	52,000	0.0050	98
1,3-Dichloropropene (total)	542-75-6	36	39,000	0.0050	36
Dieldrin	60-57-1	0.16	46	0.0033	0.16
Diethylphthalate	84-66-2	NA	730,000	0.17	730,000
2,4-Dimethylphenol	105-67-9	NA	18,000	0.17	18,000
Di-n-butyl phthalate	84-74-2	NA	91,000	0.17	91,000

2,4-Dinitrophenol	51-28-5	NA	1,800	0.33	1,800
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	3.8	NA	0.17	3.8
Di-n-octyl phthalate	117-84-0	NA	9,100	0.33	9,100
1,4-Dioxane	123-91-1	36	39,000	0.067	36
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA	7,800	0.0033	7,800
Endrin	72-20-8	NA	270	0.0033	270
Ethylbenzene	100-41-4	NA	130,000	0.0050	130,000
Extractable Petroleum Hydrocarbons (Category 1)	various	NA	75,000[3]	80	75,000[3]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA	Sample-specific[4]	80	Sample-specific[4]
Fluoranthene	206-44-0	NA	33,000	0.33	33,000
Fluorene	86-73-7	NA	33,000	0.17	33,000
alpha-HCH (alpha-BHC)	319-84-6	0.41	7,300	0.0017	0.41
beta-HCH (beta-BHC)	319-85-7	1.4	NA	0.0017	1.4
Heptachlor	76-44-8	0.81	650	0.0017	0.81
Heptachlor epoxide	1024-57-3	0.40	17	0.0017	0.40
Hexachlorobenzene	118-74-1	2.3	1,000	0.17	2.3
Hexachloro-1,3-butadiene	87-68-3	47	1,300	0.17	47
Hexachlorocyclopentadiene	77-47-4	NA	7,800	0.33	7,800
Hexachloroethane	67-72-1	91	910	0.17	91
n-Hexane	110-54-3	NA	NA	-[7]	NA
2-Hexanone	591-78-6	NA	6,500	0.010	6,500
Indeno(1,2,3-cd)pyrene	193-39-5	23	NA	0.17	23
Isophorone	78-59-1	2,700	180,000	0.17	2,700
Isopropylbenzene	98-82-8	NA	130,000	0.0050	130,000
Lead (total)	7439-92-1	NA	NA	0.5	800[5]
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	2.8	330	0.0017	2.8
Manganese (total)	7439-96-5	NA	31,000	0.50	31,000
Mercury (total)	7439-97-6	NA	390	0.10	390
Methoxychlor	72-43-5	NA	4,600	0.017	4,600
Methyl acetate	79-20-9	NA	1,300,000	0.0050	NA[1]
Methylene chloride (Dichloromethane)	75-09-2	260	7,800	0.0050	260
2-Methylnaphthalene	91-57-6	NA	3,300	0.17	3,300
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	NA	0.010	NA
2-Methylphenol (o-cresol)	95-48-7	NA	4,600	0.33	4,600
4-Methylphenol (p-cresol)	106-44-5	NA	9,100	0.33	9,100
Methyl tert-butyl ether (MTBE)	1634-04-4	NA	13,000	0.0050	13,000

Naphthalene	91-20-3	NA	34,000	0.17	34,000
Nickel (total)	7440-02-0	NA	26,000	0.50	26,000
4-Nitroaniline	100-01-6	130	3,600	0.33	130
Nitrobenzene	98-95-3	NA	2,600	0.17	2,600
N-Nitrosodi-n-propylamine	621-64-7	0.36	NA	0.17	0.36
N-Nitrosodiphenylamine	86-30-6	520	NA	0.17	520
2,2'-oxybis(1-chloropropane)	108-60-1	NA	52,000	0.33	52,000
Pentachlorophenol	87-86-5	4.4	3,200	0.33	4.4
Phenol	108-95-2	NA	270,000	0.33	270,000
Polychlorinated biphenyls (PCBs)	1336-36-3	1.1	NA	0.030	1.1
Pyrene	129-00-0	NA	25,000	0.17	25,000
Selenium (total)	7782-49-2	NA	6,500	2.5	6,500
Silver (total)	7440-22-4	NA	6,500	0.50	6,500
Styrene	100-42-5	NA	260,000	0.0050	260,000
Tertiary butyl alcohol (TBA)	75-65-0	NA	23,000	0.10	23,000
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	390	0.17	390
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA	0.00081	0.0000010	0.00081[6]
1,1,2,2-Tetrachloroethane	79-34-5	18	26,000	0.0050	18
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1,700	7,800	0.0050	1,700
2,3,4,6-Tetrachlorophenol	58-90-2	NA	27,000	0.17	27,000
Toluene	108-88-3	NA	100,000	0.0050	100,000
Toxaphene	8001-35-2	2.3	NA	0.17	2.3
1,2,4-Trichlorobenzene	120-82-1	NA	13,000	0.0050	13,000
1,1,1-Trichloroethane	71-55-6	NA	2,600,000	0.0050	NA[1]
1,1,2-Trichloroethane	79-00-5	64	5,200	0.0050	64
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	79	650	0.0050	79
Trichlorofluoromethane (Freon 11)	75-69-4	NA	390,000	0.0050	390,000
2,4,5-Trichlorophenol	95-95-4	NA	91,000	0.20	91,000
2,4,6-Trichlorophenol	88-06-2	230	910	0.20	230
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	NA	0.0050	NA
1,2,4-Trimethylbenzene	95-63-6	NA	13,000	0.076	13,000
Vanadium (total)	7440-62-2	NA	6,500	2.5	6,500
Vinyl chloride	75-01-4	5.0	3,900	0.0050	5.0
Xylenes (total)	1330-20-7	NA	190,000	0.0050	190,000
Zinc (total)	7440-66-6	NA	390,000	1.0	390,000

NA – Not applicable because appropriate toxicological information is not available

[1] Standard not applicable because calculated health-based criterion exceeds one million mg/kg

[2] Standard is based on natural background

[3] Special calculation for EPH– see N.J.A.C. 7:26D Appendix 2

[4] Sample-specific calculation using EPH calculator – see N.J.A.C. 7:26D Appendix 2

[5] Standard based on the Adult Lead Model (ALM)

[6] This standard is used for comparison to site soil data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

[7] Although n-Hexane does not have a specific reporting limit, quantification is required to be less than the applicable remediation standard

Table 3 – Soil Remediation Standards for the Inhalation Exposure Pathway – Residential (mg/kg) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Inhalation Human Health-based Criterion	Noncarcinogenic Inhalation Human Health-based Criterion	Soil Saturation Limit	Reporting Limit	Soil Remediation Standard Inhalation Residential
Acenaphthene	83-32-9	NA[1]	NA[1]	40	0.17	NA[1]
Acetone (2-Propanone)	67-64-1	NA[1]	NA[1]	160,000	0.010	NA[1]
Acetophenone	98-86-2	NA[1]	NA[1]	1,600	0.33	NA[1]
Aldrin	309-00-2	NA[1]	NA[1]	2.8	0.0017	NA[1]
Aluminum (total)	7429-90-5	NA[1]	NA[2]	NA	20	NA[2]
Anthracene	120-12-7	NA[1]	NA[1]	1.4	0.17	NA[1]
Antimony (total)	7440-36-0	NA[1]	NA[1]	NA	1.0	NA[1]
Arsenic (total)	7440-38-2	1,100	NA[1]	NA	0.50	1,100
Atrazine	1912-24-9	NA[1]	NA[1]	21	0.33	NA[1]
Barium (total)	7440-39-3	NA[1]	870,000	NA	5.0	870,000

Benzaldehyde	100-52-7	NA[1]	NA[1]	1,200	0.33	NA[1]
Benzene	71-43-2	2.2	190	850	0.0050	2.2
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	78,000[4]	NA[1]	3.3	0.17	78,000[4]
Benzo(a)pyrene	50-32-8	7,800[4]	3,500[4]	1.9	0.17	3,500[4]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	78,000[4]	NA[1]	1.8	0.17	78,000[4]
Benzo(k)fluoranthene	207-08-9	780,000[4]	NA[1]	0.94	0.17	780,000[4]
Beryllium	7440-41-7	2,000	35,000	NA	0.50	2,000
1,1'-Biphenyl	92-52-4	NA[1]	NA[1]	78	0.17	NA[1]
Bis(2-chloroethoxy)methane	111-91-1	NA[1]	NA[1]	1,400	0.17	NA[1]
Bis(2-chloroethyl)ether	111-44-4	NA[1]	NA[1]	3,700	0.33	NA[1]
Bis(2-ethylhexyl)phthalate	117-81-7	NA[1]	NA[1]	65	0.17	NA[1]
Bromodichloromethane (Dichlorobromomethane)	75-27-4	NA[1]	NA[1]	690	0.0050	NA[1]
Bromoform	75-25-2	NA[1]	NA[1]	680	0.0050	NA[1]
Bromomethane (Methyl bromide)	74-83-9	NA[1]	18	3,300	0.0050	18
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA[1]	NA[2,3]	36,000	0.010	NA[2,3]
Butylbenzyl phthalate	85-68-7	NA[1]	NA[1]	39	0.17	NA[1]
Cadmium	7440-43-9	2,600	17,000	NA	0.50	2,600
Caprolactam	105-60-2	NA[1]	290	160,000	0.33	290
Carbon disulfide	75-15-0	NA[1]	NA[2,3]	580	0.0050	NA[2,3]
Carbon tetrachloride	56-23-5	1.4	NA[2,3]	300	0.0050	1.4
Chlordane (alpha and gamma forms summed)	57-74-9	NA[1]	NA[2,3]	7.6	0.0017	NA[2,3]
4-Chloroaniline	106-47-8	NA[1]	NA[1]	1,500	0.17	NA[1]
Chlorobenzene	108-90-7	NA[1]	NA[2,3]	320	0.0050	NA[2,3]
Chloroethane (Ethyl chloride)	75-00-3	NA[1]	NA[2,3]	1,700	0.0050	NA[2,3]
Chloroform	67-66-3	NA[1]	590	1,900	0.0050	590
Chloromethane (Methyl chloride)	74-87-3	NA[1]	270	1,200	0.0050	270
2-Chloronaphthalene	91-58-7	NA[1]	NA[1]	60	0.17	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA[1]	NA[1]	11,000	0.17	NA[1]
Chrysene	218-01-9	NA[2,3]	NA[1]	0.72	0.17	NA[2,3]
Cobalt (total)	7440-48-4	520	10,000	NA	0.50	520
Copper (total)	7440-50-8	NA[1]	NA[1]	NA	1.0	NA[1]
Cyanide	57-12-5	NA[1]	NA[2]	NA	0.50	NA[2]
Cyclohexane	110-82-7	NA[1]	NA[2,3]	65	0.0050	NA[2,3]
4,4'-DDD (p,p'-TDE)	72-54-8	NA[1]	NA[1]	21	0.0033	NA[1]
4,4'-DDE (p,p'-DDX)	72-55-9	NA[1]	NA[1]	9.4	0.0033	NA[1]
4,4'-DDT	50-29-3	NA[1]	NA[1]	1.9	0.0033	NA[1]

Dibenz(a,h)anthracene	53-70-3	7,800[4]	NA[1]	9.5	0.17	7,800[4]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	NA[1]	NA[1]	600	0.0050	NA[1]
1,2-Dibromo-3-chloropropane	96-12-8	0.026	11	470	0.0050	0.026
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.085	170	920	0.0050	0.085
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA[1]	NA[2,3]	140	0.0050	NA[2,3]
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA[1]	NA[1]	110	0.0050	NA[1]
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA[1]	NA[2,3]	74	0.0050	NA[2,3]
3,3'-Dichlorobenzidine	91-94-1	NA[1]	NA[1]	20	0.33	NA[1]
Dichlorodifluoromethane (Freon 12)	75-71-8	NA[1]	NA[1]	540	0.0050	NA[1]
1,1-Dichloroethane	75-34-3	NA[1]	NA[1]	1,200	0.0050	NA[1]
1,2-Dichloroethane	107-06-2	NA[1]	71	2,000	0.0050	71
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA[1]	52	830	0.0050	52
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA[1]	NA[1]	1,600	0.0050	NA[1]
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA[1]	NA[1]	1,300	0.0050	NA[1]
2,4-Dichlorophenol	120-83-2	NA[1]	NA[1]	2,600	0.17	NA[1]
1,2-Dichloropropane	78-87-5	5.7	31	810	0.0050	5.7
1,3-Dichloropropene (total)	542-75-6	4.8	140	880	0.0050	4.8
Dieldrin	60-57-1	NA[1]	NA[1]	7.9	0.0033	NA[1]
Diethylphthalate	84-66-2	NA[1]	NA[1]	390	0.17	NA[1]
2,4-Dimethylphenol	105-67-9	NA[1]	NA[1]	8,900	0.17	NA[1]
Di-n-butyl phthalate	84-74-2	NA[1]	NA[1]	28	0.17	NA[1]
2,4-Dinitrophenol	51-28-5	NA[1]	NA[1]	430	0.33	NA[1]
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	NA[1]	NA[1]	360	0.17	NA[1]
Di-n-octyl phthalate	117-84-0	NA[1]	NA[1]	6.2	0.33	NA[1]
1,4-Dioxane	123-91-1	45	2,500	160,000	0.067	45
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA[1]	NA[1]	4.4	0.0033	NA[1]
Endrin	72-20-8	NA[1]	NA[1]	10	0.0033	NA[1]
Ethylbenzene	100-41-4	10	NA[2,3]	180	0.0050	10
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[1]	NA[1]	NA	80	NA[1]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[1]	NA[1]	NA	80	NA[1]
Fluoranthene	206-44-0	NA[1]	NA[1]	29	0.33	NA[1]
Fluorene	86-73-7	NA[1]	NA[1]	31	0.17	NA

alpha-HCH (alpha-BHC)	319-84-6	NA[1]	NA[1]	12	0.0017	NA[1]
beta-HCH (beta-BHC)	319-85-7	NA[1]	NA[1]	1.4	0.0017	NA[1]
Heptachlor	76-44-8	NA[1]	NA[1]	15	0.0017	NA[1]
Heptachlor epoxide	1024-57-3	NA[1]	NA[1]	4.1	0.0017	NA[1]
Hexachlorobenzene	118-74-1	NA[1]	NA[1]	0.078	0.17	NA[1]
Hexachloro-1,3-butadiene	87-68-3	NA[1]	NA[1]	6.1	0.17	NA[1]
Hexachlorocyclopentadiene	77-47-4	NA[1]	2.7	5.6	0.33	2.7
Hexachloroethane	67-72-1	NA[1]	NA[2,3]	28	0.17	NA[2,3]
n-Hexane	110-54-3	NA[1]	NA[2,3]	88	NA	NA[2,3]
2-Hexanone	591-78-6	NA[1]	1,000	3,200	0.010	1,000
Indeno(1,2,3-cd)pyrene	193-39-5	78,000[4]	NA[1]	0.74	0.17	78,000[4]
Isophorone	78-59-1	NA[1]	NA[2,3]	3,400	0.17	NA[2,3]
Isopropylbenzene	98-82-8	NA[1]	NA[2,3]	98	0.0050	NA[2,3]
Lead (total)	7439-92-1	NA[1]	NA[1]	NA	0.50	NA[1]
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	NA[1]	NA[1]	42	0.0017	NA[1]
Manganese (total)	7439-96-5	NA[1]	87,000	NA	0.50	87,000
Mercury (total)	7439-97-6	NA[1]	520,000[4]	3.1[5]	0.10	520,000[4]
Methoxychlor	72-43-5	NA[1]	NA[1]	5.4	0.017	NA[1]
Methyl acetate	79-20-9	NA[1]	NA[1]	39,000	0.0050	NA[1]
Methylene chloride (Dichloromethane)	75-09-2	1,400	NA[2,3]	2,800	0.0050	1,400
2-Methylnaphthalene	91-57-6	NA[1]	NA[1]	130	0.17	NA[1]
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[1]	NA[2,3]	3,400	0.010	NA[2,3]
2-Methylphenol (o-cresol)	95-48-7	NA[1]	NA[1]	20,000	0.33	NA[1]
4-Methylphenol (p-cresol)	106-44-5	NA[1]	NA[1]	16,000	0.33	NA[1]
Methyl tert-butyl ether (MTBE)	1634-04-4	140	NA[2,3]	9,100	0.0050	140
Naphthalene	91-20-3	5.7	NA[2,3]	100	0.17	5.7
Nickel (total)	7440-02-0	20,000	24,000	NA	0.50	20,000
4-Nitroaniline	100-01-6	NA[1]	NA[2,3]	270	0.33	NA[2,3]
Nitrobenzene	98-95-3	7.5	1,000	1,300	0.17	7.5
N-Nitrosodi-n-propylamine	621-64-7	NA[1]	NA[1]	9,200	0.17	NA[1]
N-Nitrosodiphenylamine	86-30-6	NA[1]	NA[1]	190	0.17	NA[1]
2,2'-oxybis(1-chloropropane)	108-60-1	NA[1]	NA[1]	540	0.33	NA[1]
Pentachlorophenol	87-86-5	NA[1]	NA[1]	140	0.33	NA[1]
Phenol	108-95-2	NA[1]	39,000	44,000	0.33	39,000
Polychlorinated biphenyls (PCBs)	1336-36-3	NA[1]	NA[1]	110	0.030	NA[1]
Pyrene	129-00-0	NA[1]	NA[1]	15	0.17	NA[1]
Selenium (total)	7782-49-2	NA[1]	NA[1]	NA	2.5	NA[1]
Silver (total)	7440-22-4	NA[1]	NA[1]	NA	0.50	NA[1]

Styrene	100-42-5	NA[1]	NA[2,3]	330	0.0050	NA[2,3]
Tertiary butyl alcohol (TBA)	75-65-0	NA[1]	NA[1]	160,000	0.10	NA[1]
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[1]	NA[1]	2.7	0.17	NA[1]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA[1]	NA[1]	0.10	0.0000010	NA[1]
1,1,2,2-Tetrachloroethane	79-34-5	NA[1]	NA[1]	980	0.0050	NA[1]
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	47	NA[2,3]	89	0.0050	47
2,3,4,6-Tetrachlorophenol	58-90-2	NA[1]	NA[1]	150	0.17	NA[1]
Toluene	108-88-3	NA[1]	NA[2,3]	340	0.0050	NA[2,3]
Toxaphene	8001-35-2	NA[1]	NA[1]	85	0.17	NA[1]
1,2,4-Trichlorobenzene	120-82-1	NA[1]	94	140	0.0050	94
1,1,1-Trichloroethane	71-55-6	NA[1]	NA[2,3]	420	0.0050	NA[2,3]
1,1,2-Trichloroethane	79-00-5	NA[1]	NA[1]	1,300	0.0050	NA[1]
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	3.0	9.1	410	0.0050	3.0
Trichlorofluoromethane (Freon 11)	75-69-4	NA[1]	NA[1]	790	0.0050	NA[1]
2,4,5-Trichlorophenol	95-95-4	NA[1]	NA[1]	5,800	0.20	NA[1]
2,4,6-Trichlorophenol	88-06-2	NA[1]	NA[1]	1,700	0.20	NA[1]
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA[1]	NA[2,3]	530	0.0050	NA[2,3]
1,2,4-Trimethylbenzene	95-63-6	NA[1]	NA[2,3]	80	0.076	NA[2,3]
Vanadium (total)	7440-62-2	NA[1]	170,000	NA	2.5	170,000
Vinyl chloride	75-01-4	1.4	220	2,900	0.0050	1.4
Xylenes (total)	1330-20-7	NA[1]	NA[2,3]	100	0.0050	NA[2,3]
Zinc (total)	7440-66-6	NA[1]	NA[1]	NA	1.0	NA[1]

NA – Not applicable because soil saturation limit does not apply to this contaminant

NA[1] – Not applicable because appropriate toxicological information is not available

NA[2] – Standard not applicable because the calculated health-based criterion exceeds one million mg/kg

NA[3] – Standard not applicable because the calculated health-based criterion exceeds the soil saturation limit

[4] Exceeds soil saturation limit; however, health-based criterion based on particulate portion of the equation

[5] Value is for elemental mercury

Table 4 – Soil Remediation Standards for the Inhalation Exposure Pathway – Nonresidential

(mg/kg) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Inhalation Human Health-based Criterion	Noncarcinogenic Inhalation Human Health-based Criterion	Soil Saturation Concentration	Reporting Limit	Soil Remediation Standard Inhalation Nonresidential
Acenaphthene	83-32-9	NA[1]	NA[1]	40	0.17	NA[1]
Acetone (2-Propanone)	67-64-1	NA[1]	NA[1]	160,000	0.010	NA[1]
Acetophenone	98-86-2	NA[1]	NA[1]	1,600	0.33	NA[1]
Aldrin	309-00-2	NA[1]	NA[1]	2.8	0.0017	NA[1]
Aluminum (total)	7429-90-5	NA[1]	NA[2]	NA	20	NA[2]
Anthracene	120-12-7	NA[1]	NA[1]	1.4	0.17	NA[1]
Antimony (total)	7440-36-0	NA[1]	NA[1]	NA	1.0	NA[1]
Arsenic (total)	7440-38-2	5,200	NA[1]	NA	0.50	5,200
Atrazine	1912-24-9	NA[1]	NA[1]	21	0.33	NA[1]
Barium (total)	7440-39-3	NA[1]	NA[2]	NA	5.0	NA[2]
Benzaldehyde	100-52-7	NA[1]	NA[1]	1,200	0.33	NA[1]
Benzene	71-43-2	11	NA[2,3]	850	0.0050	11
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	370,000[4]	NA[1]	3.3	0.17	370,000[4]
Benzo(a)pyrene	50-32-8	37,000[4]	16,000[4]	1.9	0.17	16,000[4]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	370,000[4]	NA[1]	1.8	0.17	370,000[4]
Benzo(k)fluoranthene	207-08-9	NA[2,3]	NA[1]	0.94	0.17	NA[2,3]
Beryllium	7440-41-7	9,300	160,000	NA	0.50	9,300
1,1'-Biphenyl	92-52-4	NA[1]	NA[1]	78	0.17	NA[1]
Bis(2-chloroethoxy)methane	111-91-1	NA[1]	NA[1]	1,400	0.17	NA[1]
Bis(2-chloroethyl)ether	111-44-4	NA[1]	NA[1]	3,700	0.33	NA[1]
Bis(2-ethylhexyl)phthalate	117-81-7	NA[1]	NA[1]	65	0.17	NA[1]
Bromodichloromethane (Dichlorobromomethane)	75-27-4	NA[1]	NA[1]	690	0.0050	NA[1]
Bromoform	75-25-2	NA[1]	NA[1]	680	0.0050	NA[1]
Bromomethane (Methyl bromide)	74-83-9	NA[1]	82	3,300	0.0050	82
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA[1]	NA[2,3]	36,000	0.010	NA[2,3]
Butylbenzyl phthalate	85-68-7	NA[1]	NA[1]	39	0.17	NA[1]
Cadmium	7440-43-9	12,000	80,000	NA	0.50	12,000
Caprolactam	105-60-2	NA[1]	1,300	160,000	0.33	1,300

Carbon disulfide	75-15-0	NA[1]	NA[2,3]	580	0.0050	NA[2,3]
Carbon tetrachloride	56-23-5	6.9	NA[2,3]	300	0.0050	6.9
Chlordane (alpha and gamma forms summed)	57-74-9	NA[1]	NA[2,3]	7.6	0.0017	NA[2,3]
4-Chloroaniline	106-47-8	NA[1]	NA[1]	1,500	0.17	NA[1]
Chlorobenzene	108-90-7	NA[1]	NA[2,3]	320	0.0050	NA[2,3]
Chloroethane (Ethyl chloride)	75-00-3	NA[1]	NA[2,3]	1,700	0.0050	NA[2,3]
Chloroform	67-66-3	NA[1]	NA[2,3]	1,900	0.0050	NA[2,3]
Chloromethane (Methyl chloride)	74-87-3	NA[1]	1,200	1,200	0.0050	1,200
2-Chloronaphthalene	91-58-7	NA[1]	NA[1]	60	0.17	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA[1]	NA[1]	11,000	0.17	NA[1]
Chrysene	218-01-9	NA[2,3]	NA[1]	0.72	0.17	NA[2,3]
Cobalt (total)	7440-48-4	2,500	48,000	NA	0.50	2,500
Copper (total)	7440-50-8	NA[1]	NA[1]	NA	1.0	NA[1]
Cyanide	57-12-5	NA[1]	NA[2]	NA	0.50	NA[2]
Cyclohexane	110-82-7	NA[1]	NA[2,3]	65	0.0050	NA[2,3]
4,4'-DDD (p,p'-TDE)	72-54-8	NA[1]	NA[1]	21	0.0033	NA[1]
4,4'-DDE (p,p'-DDX)	72-55-9	NA[1]	NA[1]	9.4	0.0033	NA[1]
4,4'-DDT	50-29-3	NA[1]	NA[1]	1.9	0.0033	NA[1]
Dibenz(a,h)anthracene	53-70-3	37,000[4]	NA[1]	9.5	0.17	37,000[4]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	NA[1]	NA[1]	600	0.0050	NA[1]
1,2-Dibromo-3-chloropropane	96-12-8	0.12	52	470	0.0050	0.12
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.41	780	920	0.0050	0.41
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA[1]	NA[2,3]	140	0.0050	NA[2,3]
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA[1]	NA[1]	110	0.0050	NA[1]
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA[1]	NA[2,3]	74	0.0050	NA[2,3]
3,3'-Dichlorobenzidine	91-94-1	NA[1]	NA[1]	20	0.33	NA[1]
Dichlorodifluoromethane (Freon 12)	75-71-8	NA[1]	NA[1]	540	0.0050	NA[1]
1,1-Dichloroethane	75-34-3	NA[1]	NA[1]	1,200	0.0050	NA[1]
1,2-Dichloroethane	107-06-2	NA[1]	320	2,000	0.0050	320
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA[1]	240	830	0.0050	240
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA[1]	NA[1]	1,600	0.0050	NA[1]
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA[1]	NA[1]	1,300	0.0050	NA[1]

2,4-Dichlorophenol	120-83-2	NA[1]	NA[1]	2,600	0.17	NA[1]
1,2-Dichloropropane	78-87-5	27	140	810	0.0050	27
1,3-Dichloropropene (total)	542-75-6	23	650	880	0.0050	23
Dieldrin	60-57-1	NA[1]	NA[1]	7.9	0.0033	NA[1]
Diethylphthalate	84-66-2	NA[1]	NA[1]	390	0.17	NA[1]
2,4-Dimethylphenol	105-67-9	NA[1]	NA[1]	8,900	0.17	NA[1]
Di-n-butyl phthalate	84-74-2	NA[1]	NA[1]	28	0.17	NA[1]
2,4-Dinitrophenol	51-28-5	NA[1]	NA[1]	430	0.33	NA[1]
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	NA[1]	NA[1]	360	0.17	NA[1]
Di-n-octyl phthalate	117-84-0	NA[1]	NA[1]	6.2	0.33	NA[1]
1,4-Dioxane	123-91-1	210	11,000	160,000	0.067	210
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA[1]	NA[1]	4.4	0.0033	NA[1]
Endrin	72-20-8	NA[1]	NA[1]	10	0.0033	NA[1]
Ethylbenzene	100-41-4	48	NA[2,3]	180	0.0050	48
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[1]	NA[1]	NA	80	NA[1]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[1]	NA[1]	NA	80	NA[1]
Fluoranthene	206-44-0	NA[1]	NA[1]	29	0.33	NA[1]
Fluorene	86-73-7	NA[1]	NA[1]	31	0.17	NA[1]
alpha-HCH (alpha-BHC)	319-84-6	NA[1]	NA[1]	12	0.0017	NA[1]
beta-HCH (beta-BHC)	319-85-7	NA[1]	NA[1]	1.4	0.0017	NA[1]
Heptachlor	76-44-8	NA[1]	NA[1]	15	0.0017	NA[1]
Heptachlor epoxide	1024-57-3	NA[1]	NA[1]	4.1	0.0017	NA[1]
Hexachlorobenzene	118-74-1	NA[1]	NA[1]	0.078	0.17	NA[1]
Hexachloro-1,3-butadiene	87-68-3	NA[1]	NA[1]	6.1	0.17	NA[1]
Hexachlorocyclopentadiene	77-47-4	NA[1]	NA[2,3]	5.6	0.33	NA[2,3]
Hexachloroethane	67-72-1	NA[1]	NA[2,3]	28	0.17	NA[2,3]
n-Hexane	110-54-3	NA[1]	NA[2,3]	88	NA	NA[2,3]
2-Hexanone	591-78-6	NA[1]	NA[2,3]	3,200	0.010	NA[2,3]
Indeno(1,2,3-cd)pyrene	193-39-5	370,000[4]	NA[1]	0.74	0.17	370,000[4]
Isophorone	78-59-1	NA[1]	NA[2,3]	3,400	0.17	NA[2,3]
Isopropylbenzene	98-82-8	NA[1]	NA[2,3]	98	0.0050	NA[2,3]
Lead (total)	7439-92-1	NA[1]	NA[1]	NA	0.50	NA[1]
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	NA[1]	NA[1]	42	0.0017	NA[1]
Manganese (total)	7439-96-5	NA[1]	400,000	NA	0.50	400,000
Mercury (total)	7439-97-6	NA[1]	NA[2,3]	3.1[5]	0.10	NA[2,3]
Methoxychlor	72-43-5	NA[1]	NA[1]	5.4	0.017	NA[1]
Methyl acetate	79-20-9	NA[1]	NA[1]	39,000	0.0050	NA[1]

Methylene chloride (Dichloromethane)	75-09-2	NA[2,3]	NA[2,3]	2,800	0.0050	NA[2,3]
2-Methylnaphthalene	91-57-6	NA[1]	NA[1]	130	0.17	NA[1]
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[1]	NA[2,3]	3,400	0.010	NA[2,3]
2-Methylphenol (o-cresol)	95-48-7	NA[1]	NA[1]	20,000	0.33	NA[1]
4-Methylphenol (p-cresol)	106-44-5	NA[1]	NA[1]	16,000	0.33	NA[1]
Methyl tert-butyl ether (MTBE)	1634-04-4	650	NA[2,3]	9,100	0.0050	650
Naphthalene	91-20-3	27	NA[2,3]	100	0.17	27
Nickel (total)	7440-02-0	93,000	110,000	NA	0.50	93,000
4-Nitroaniline	100-01-6	NA[1]	NA[2,3]	270	0.33	NA[2,3]
Nitrobenzene	98-95-3	36	NA[2,3]	1,300	0.17	36
N-Nitrosodi-n-propylamine	621-64-7	NA[1]	NA[1]	9,200	0.17	NA[1]
N-Nitrosodiphenylamine	86-30-6	NA[1]	NA[1]	190	0.17	NA[1]
2,2'-oxybis(1-chloropropane)	108-60-1	NA[1]	NA[1]	540	0.33	NA[1]
Pentachlorophenol	87-86-5	NA[1]	NA[1]	140	0.33	NA[1]
Phenol	108-95-2	NA[1]	NA[2,3]	44,000	0.33	NA[2,3]
Polychlorinated biphenyls (PCBs)	1336-36-3	NA[1]	NA[1]	110	0.030	NA[1]
Pyrene	129-00-0	NA[1]	NA[1]	15	0.17	NA[1]
Selenium (total)	7782-49-2	NA[1]	NA[1]	NA	2.5	NA[1]
Silver (total)	7440-22-4	NA[1]	NA[1]	NA	0.50	NA[1]
Styrene	100-42-5	NA[1]	NA[2,3]	330	0.0050	NA[2,3]
Tertiary butyl alcohol (TBA)	75-65-0	NA[1]	NA[1]	160,000	0.10	NA[1]
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[1]	NA[1]	2.7	0.17	NA[1]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA[1]	NA[1]	0.10	0.0000010	NA[1]
1,1,2,2-Tetrachloroethane	79-34-5	NA[1]	NA[1]	980	0.0050	NA[1]
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	NA[2,3]	NA[2,3]	89	0.0050	NA[2,3]
2,3,4,6-Tetrachlorophenol	58-90-2	NA[1]	NA[1]	150	0.17	NA[1]
Toluene	108-88-3	NA[1]	NA[2,3]	340	0.0050	NA[2,3]
Toxaphene	8001-35-2	NA[1]	NA[1]	85	0.17	NA[1]
1,2,4-Trichlorobenzene	120-82-1	NA[1]	NA[2,3]	140	0.0050	NA[2,3]
1,1,1-Trichloroethane	71-55-6	NA[1]	NA[2,3]	420	0.0050	NA[2,3]
1,1,2-Trichloroethane	79-00-5	NA[1]	NA[1]	1,300	0.0050	NA[1]
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	14	42	410	0.0050	14
Trichlorofluoromethane (Freon 11)	75-69-4	NA[1]	NA[1]	790	0.0050	NA[1]
2,4,5-Trichlorophenol	95-95-4	NA[1]	NA[1]	5,800	0.20	NA[1]
2,4,6-Trichlorophenol	88-06-2	NA[1]	NA[1]	1,700	0.20	NA[1]
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA[1]	NA[2,3]	530	0.0050	NA[2,3]

1,2,4-Trimethylbenzene	95-63-6	NA[1]	NA[2,3]	80	0.076	NA[2,3]
Vanadium (total)	7440-62-2	NA[1]	800,000	NA	2.5	800,000
Vinyl chloride	75-01-4	6.4	1,000	2,900	0.0050	6.4
Xylenes (total)	1330-20-7	NA[1]	NA[2,3]	100	0.0050	NA[2,3]
Zinc (total)	7440-66-6	NA[1]	NA[1]	NA	1.0	NA[1]

NA – Not applicable because soil saturation limit does not apply to this contaminant

NA[1] Not applicable because appropriate toxicological information is not available

NA[2] Standard not applicable because the calculated health-based criterion exceeds one million mg/kg

NA[3] Standard not applicable because the calculated health-based criterion exceeds the soil saturation limit

[4] Exceeds soil saturation limit; however, health-based criterion based on particulate portion of the equation

[5] Value is for elemental mercury

Table 5 – Soil Remediation Standards for the Migration to Ground Water Exposure Pathway (mg/kg) (All ground water remediation standards are rounded to one significant figure[A]; all other numeric values are rounded to two significant figures)

Contaminant	CAS No.	Ground Water Remediation Standard (µg/L)	Migration to Ground Water Soil Criterion (mg/kg)	Soil Saturation Limit (mg/kg)	Reporting Limit (mg/kg)	Soil Remediation Standard Migration to Ground Water (mg/kg)
Acenaphthene	83-32-9	400	82	40	0.17	NA[1]
Acetone (2-Propanone)	67-64-1	6,000	19	160,000	0.010	19
Acetophenone	98-86-2	700	3.6	1,600	0.33	3.6
Aldrin	309-00-2	0.04	0.13	2.8	0.0017	0.13
Aluminum (total)	7429-90-5	NA[2]	NA[2]	NA[3]	20	NA[2]
Anthracene	120-12-7	2,000	1,300	1.4	0.17	NA[1]

Antimony (total)	7440-36-0	6	5.4	NA[3]	1.0	5.4
Arsenic (total)	7440-38-2	3	1.6	NA[3]	0.50	19[4]
Atrazine	1912-24-9	3	0.036	21	0.33	0.33[5]
Barium (total)	7440-39-3	6,000	2,100	NA[3]	5.0	2,100
Benzaldehyde	100-52-7	NA[6]	NA[6]	1,200	0.33	NA[6]
Benzene	71-43-2	1	0.0094	850	0.0050	0.0094
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.1	0.71	3.3	0.17	0.71
Benzo(a)pyrene	50-32-8	0.1	2.3	1.9	0.17	NA[1]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.2	4.8	1.8	0.17	NA[1]
Benzo(k)fluoranthene	207-08-9	0.5	12	0.94	0.17	NA[1]
Beryllium	7440-41-7	1	0.70	NA[3]	0.50	0.70
1,1'-Biphenyl	92-52-4	400	83	78	0.17	NA[1]
Bis(2-chloroethoxy)methane	111-91-1	NA[6]	NA[6]	1,400	0.17	NA[6]
Bis(2-chloroethyl)ether	111-44-4	7	0.030	3,700	0.33	0.33[5]
Bis(2-ethylhexyl)phthalate	117-81-7	3	14	65	0.17	14
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1	0.0045	690	0.0050	0.0050[5]
Bromoform	75-25-2	4	0.018	680	0.0050	0.018
Bromomethane (Methyl bromide)	74-83-9	10	0.043	3,300	0.0050	0.043
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	300	0.98	36,000	0.010	0.98
Butylbenzyl phthalate	85-68-7	100	29	39	0.17	29
Cadmium	7440-43-9	4	1.9	NA[3]	0.50	1.9
Caprolactam	105-60-2	4,000	16	160,000	0.33	16
Carbon disulfide	75-15-0	700	3.7	580	0.0050	3.7
Carbon tetrachloride	56-23-5	1	0.0075	300	0.0050	0.0075
Chlordane (alpha and gamma forms summed)	57-74-9	0.5	1.4	7.6	0.0017	1.4
4-Chloroaniline	106-47-8	30	0.23	1,500	0.17	0.23
Chlorobenzene	108-90-7	50	0.64	320	0.0050	0.64
Chloroethane (Ethyl chloride)	75-00-3	NA[6]	NA[6]	1,700	0.0050	NA[6]
Chloroform	67-66-3	70	0.33	1,900	0.0050	0.33
Chloromethane (Methyl chloride)	74-87-3	NA[6]	NA[6]	1,200	0.0050	NA[6]
2-Chloronaphthalene	91-58-7	600	61	60	0.17	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	40	0.76	11,000	0.17	0.76
Chrysene	218-01-9	5	36	0.72	0.17	NA[1]
Cobalt (total)	7440-48-4	100	90	NA[3]	0.50	90

Copper (total)	7440-50-8	1,300	910	NA[3]	1.0	910
Cyanide	57-12-5	100	20	NA[3]	0.50	20
Cyclohexane	110-82-7	NA[6]	NA[6]	65	0.0050	NA[6]
4,4'-DDD (p,p'-TDE)	72-54-8	0.1	0.47	21	0.0033	0.47
4,4'-DDE (p,p'-DDX)	72-55-9	0.1	0.47	9.4	0.0033	0.47
4,4'-DDT	50-29-3	0.1	0.67	1.9	0.0033	0.67
Dibenz(a,h)anthracene	53-70-3	0.3	23	9.5	0.17	NA[1]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	1	0.0044	600	0.0050	0.0050[5]
1,2-Dibromo-3-chloropropane	96-12-8	0.02	0.00015	470	0.0050	0.0050[5]
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.03	0.00014	920	0.0050	0.0050[5]
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	600	11	140	0.0050	11
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	600	11	110	0.0050	11
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	75	1.4	74	0.0050	1.4
3,3'-Dichlorobenzidine	91-94-1	30	3.9	20	0.33	3.9
Dichlorodifluoromethane (Freon 12)	75-71-8	1,000	38	540	0.0050	38
1,1-Dichloroethane	75-34-3	50	0.24	1,200	0.0050	0.24
1,2-Dichloroethane	107-06-2	2	0.0095	2,000	0.0050	0.0095
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	1	0.0069	830	0.0050	0.0069
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	70	0.35	1,600	0.0050	0.35
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	100	0.56	1,300	0.0050	0.56
2,4-Dichlorophenol	120-83-2	20	0.19	2,600	0.17	0.19
1,2-Dichloropropane	78-87-5	1	0.0058	810	0.0050	0.0058
1,3-Dichloropropene (total)	542-75-6	1	0.0063	880	0.0050	0.0063
Dieldrin	60-57-1	0.03	0.024	7.9	0.0033	0.024
Diethylphthalate	84-66-2	6,000	44	390	0.17	44
2,4-Dimethylphenol	105-67-9	100	2.3	8,900	0.17	2.3
Di-n-butyl phthalate	84-74-2	700	35	28	0.17	NA[1]
2,4-Dinitrophenol	51-28-5	40	0.12	430	0.33	0.33[5]
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	10	0.27	360	0.17	0.27
Di-n-octyl phthalate	117-84-0	100	560	6.2	0.33	NA[1]
1,4-Dioxane	123-91-1	0.4	0.0013	160,000	0.067	0.067[5]

Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	40	11	4.4	0.0033	NA[1]
Endrin	72-20-8	2	1.6	10	0.0033	1.6
Ethylbenzene	100-41-4	700	15	180	0.0050	15
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[6]	NA[6]	NA[3]	80	NA[6]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[6]	NA[6]	NA[3]	80	NA[6]
Fluoranthene	206-44-0	300	670	29	0.33	NA[1]
Fluorene	86-73-7	300	110	31	0.17	NA[1]
alpha-HCH (alpha-BHC)	319-84-6	0.02	0.0023	12	0.0017	0.0023
beta-HCH (beta-BHC)	319-85-7	0.04	0.0046	1.4	0.0017	0.0046
Heptachlor	76-44-8	0.05	0.083	15	0.0017	0.083
Heptachlor epoxide	1024-57-3	0.2	0.081	4.1	0.0017	0.081
Hexachlorobenzene	118-74-1	0.02	0.0050	0.078	0.17	0.17[5]
Hexachloro-1,3-butadiene	87-68-3	1	0.038	6.1	0.17	0.17[5]
Hexachlorocyclopentadiene	77-47-4	40	2.5	5.6	0.33	2.5
Hexachloroethane	67-72-1	7	0.079	28	0.17	0.17[5]
n-Hexane	110-54-3	30	5.5	88	-	5.5
2-Hexanone	591-78-6	40	0.15	3,200	0.010	0.15
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	16	0.74	0.17	NA[1]
Isophorone	78-59-1	40	0.23	3,400	0.17	0.23
Isopropylbenzene	98-82-8	700	22	98	0.0050	22
Lead (total)	7439-92-1	5	90	NA[3]	0.50	90
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.03	0.0035	42	0.0017	0.0035
Manganese (total)	7439-96-5	NA[2]	NA[2]	NA[3]	0.50	NA[2]
Mercury (total)	7439-97-6	2	0.014	NA[3]	0.10	0.10[5]
Methoxychlor	72-43-5	40	43	5.4	0.017	NA[1]
Methyl acetate	79-20-9	7,000	22	39,000	0.0050	22
Methylene chloride (Dichloromethane)	75-09-2	3	0.013	2,800	0.0050	0.013
2-Methylnaphthalene	91-57-6	30	3.1	130	0.17	3.1
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[6]	NA[6]	3,400	0.010	NA[6]
2-Methylphenol (o-cresol)	95-48-7	50	0.77	20,000	0.33	0.77
4-Methylphenol (p-cresol)	106-44-5	50	0.75	16,000	0.33	0.75
Methyl tert-butyl ether (MTBE)	1634-04-4	70	0.25	9,100	0.0050	0.25
Naphthalene	91-20-3	300	19	100	0.17	19
Nickel (total)	7440-02-0	100	48	NA[3]	0.50	48
4-Nitroaniline	100-01-6	NA[6]	NA[6]	270	0.33	NA[6]

Nitrobenzene	98-95-3	6	0.073	1,300	0.17	0.17[5]
N-Nitrosodi-n-propylamine	621-64-7	10	0.14	9,200	0.17	0.17[5]
N-Nitrosodiphenylamine	86-30-6	10	1.1	190	0.17	1.1
2,2'-oxybis(1-chloropropane)	108-60-1	300	1.9	540	0.33	1.9
Pentachlorophenol	87-86-5	0.3	0.062	140	0.33	0.33[5]
Phenol	108-95-2	2,000	21	44,000	0.33	21
Polychlorinated biphenyls (PCBs)	1336-36-3	0.5	1.6	110	0.030	1.6
Pyrene	129-00-0	200	440	15	0.17	NA[1]
Selenium (total)	7782-49-2	40	11	NA[3]	2.5	11
Silver (total)	7440-22-4	40	0.33	NA[3]	0.50	0.50[5]
Styrene	100-42-5	100	2.1	330	0.0050	2.1
Tertiary butyl alcohol (TBA)	75-65-0	100	0.32	160,000	0.10	0.32
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[6]	NA[6]	2.7	0.17	NA[6]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.00001	0.00010	0.10	0.0000010	0.00010[7]
1,1,2,2-Tetrachloroethane	79-34-5	1	0.0069	980	0.0050	0.0069
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1	0.0086	89	0.0050	0.0086
2,3,4,6-Tetrachlorophenol	58-90-2	200	26	150	0.17	26
Toluene	108-88-3	600	7.8	340	0.0050	7.8
Toxaphene	8001-35-2	2	6.2	85	0.17	6.2
1,2,4-Trichlorobenzene	120-82-1	9	0.52	140	0.0050	0.52
1,1,1-Trichloroethane	71-55-6	30	0.20	420	0.0050	0.20
1,1,2-Trichloroethane	79-00-5	3	0.017	1,300	0.0050	0.017
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1	0.0065	410	0.0050	0.0065
Trichlorofluoromethane (Freon 11)	75-69-4	2,000	29	790	0.0050	29
2,4,5-Trichlorophenol	95-95-4	700	68	5,800	0.20	68
2,4,6-Trichlorophenol	88-06-2	20	0.86	1,700	0.20	0.86
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	20,000	1,300	530	0.0050	NA[1]
1,2,4-Trimethylbenzene	95-63-6	NA[6]	NA[6]	80	0.076	NA[6]
Vanadium (total)	7440-62-2	NA[6]	NA[6]	NA[3]	2.5	NA[6]
Vinyl chloride	75-01-4	1	0.0067	2,900	0.0050	0.0067
Xylenes (total)	1330-20-7	1,000	19	100	0.0050	19
Zinc (total)	7440-66-6	2,000	930	NA[3]	1.0	930

[A] The ground water remediation standards are listed using one significant figure to be consistent with the Ground Water Quality Standards, N.J.A.C. 7:9C

NA – Not applicable

[1] Standard not applicable because the calculated health-based criterion exceeds the soil saturation limit

[2] Standard not applicable because ground water remediation standard is a secondary standard

[3] Not applicable because soil saturation limit does not apply to this contaminant

[4] Standard is based on natural background

[5] Standard set to reporting limit

[6] Standard not applicable because a ground water remediation standard does not exist

[7] This standard is used for comparison to site soil data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

Table 6 – Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway (µg/L) (All ground water remediation standards are rounded to one significant figure[A]; all other numeric values are rounded to two significant figures)

Contaminant	CAS No.	Ground Water Remediation Standard	Soil Leachate Remediation Standard - Migration to Ground Water
Acenaphthene	83-32-9	400	NA[1]
Acetone (2-Propanone)	67-64-1	6,000	120,000
Acetophenone	98-86-2	700	14,000
Aldrin	309-00-2	0.04	0.80
Aluminum (total)	7429-90-5	NA[2]	NA[2]
Anthracene	120-12-7	2,000	NA[1]
Antimony (total)	7440-36-0	6	120
Arsenic (total)	7440-38-2	3	60
Atrazine	1912-24-9	3	60
Barium (total)	7440-39-3	6,000	120,000

Benzaldehyde	100-52-7	NA[3]	NA[3]
Benzene	71-43-2	1	20
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.1	2.0
Benzo(a)pyrene	50-32-8	0.1	NA[1]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.2	NA[1]
Benzo(k)fluoranthene	207-08-9	0.5	NA[1]
Beryllium	7440-41-7	1	20
1,1'-Biphenyl	92-52-4	400	NA[1]
Bis(2-chloroethoxy)methane	111-91-1	NA[3]	NA[3]
Bis(2-chloroethyl)ether	111-44-4	7	140
Bis(2-ethylhexyl)phthalate	117-81-7	3	60
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1	20
Bromoform	75-25-2	4	80
Bromomethane (Methyl bromide)	74-83-9	10	200
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	300	6,000
Butylbenzyl phthalate	85-68-7	100	2,000
Cadmium	7440-43-9	4	80
Caprolactam	105-60-2	4,000	80,000
Carbon disulfide	75-15-0	700	14,000
Carbon tetrachloride	56-23-5	1	20
Chlordane (alpha and gamma forms summed)	57-74-9	0.5	10
4-Chloroaniline	106-47-8	30	600
Chlorobenzene	108-90-7	50	1,000
Chloroethane (Ethyl chloride)	75-00-3	NA[3]	NA[3]
Chloroform	67-66-3	70	1,400
Chloromethane (Methyl chloride)	74-87-3	NA[3]	NA[3]
2-Chloronaphthalene	91-58-7	600	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	40	800
Chrysene	218-01-9	5	NA[1]
Cobalt (total)	7440-48-4	100	2,000
Copper (total)	7440-50-8	1,300	26,000
Cyanide	57-12-5	100	2,000
Cyclohexane	110-82-7	NA[3]	NA[3]
4,4'-DDD (p,p'-TDE)	72-54-8	0.1	2.0
4,4'-DDE (p,p'-DDX)	72-55-9	0.1	2.0
4,4'-DDT	50-29-3	0.1	2.0
Dibenz(a,h)anthracene	53-70-3	0.3	NA[1]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	1	20

1,2-Dibromo-3-chloropropane	96-12-8	0.02	0.40
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.03	0.60
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	600	12,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	600	12,000
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	75	1,500
3,3'-Dichlorobenzidine	91-94-1	30	600
Dichlorodifluoromethane (Freon 12)	75-71-8	1,000	20,000
1,1-Dichloroethane	75-34-3	50	1,000
1,2-Dichloroethane	107-06-2	2	40
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	1	20
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	70	1,400
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	100	2,000
2,4-Dichlorophenol	120-83-2	20	400
1,2-Dichloropropane	78-87-5	1	20
1,3-Dichloropropene (total)	542-75-6	1	20
Dieldrin	60-57-1	0.03	0.60
Diethylphthalate	84-66-2	6,000	120,000
2,4-Dimethylphenol	105-67-9	100	2,000
Di-n-butyl phthalate	84-74-2	700	NA[1]
2,4-Dinitrophenol	51-28-5	40	800
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	10	200
Di-n-octyl phthalate	117-84-0	100	NA[1]
1,4-Dioxane	123-91-1	0.4	8.0
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	40	NA[1]
Endrin	72-20-8	2	40
Ethylbenzene	100-41-4	700	14,000
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[3]	NA[3]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[3]	NA[3]
Fluoranthene	206-44-0	300	NA[1]
Fluorene	86-73-7	300	NA[1]
alpha-HCH (alpha-BHC)	319-84-6	0.02	0.40
beta-HCH (beta-BHC)	319-85-7	0.04	0.80
Heptachlor	76-44-8	0.05	1.0
Heptachlor epoxide	1024-57-3	0.2	4.0
Hexachlorobenzene	118-74-1	0.02	0.40
Hexachloro-1,3-butadiene	87-68-3	1	20

Hexachlorocyclopentadiene	77-47-4	40	800
Hexachloroethane	67-72-1	7	140
n-Hexane	110-54-3	30	600
2-Hexanone	591-78-6	40	800
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	NA[1]
Isophorone	78-59-1	40	800
Isopropylbenzene	98-82-8	700	14,000
Lead (total)	7439-92-1	5	100
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	0.03	0.60
Manganese (total)	7439-96-5	NA[2]	NA[2]
Mercury (total)	7439-97-6	2	40
Methoxychlor	72-43-5	40	NA[1]
Methyl acetate	79-20-9	7,000	140,000
Methylene chloride (Dichloromethane)	75-09-2	3	60
2-Methylnaphthalene	91-57-6	30	600
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[3]	NA[3]
2-Methylphenol (o-cresol)	95-48-7	50	1,000
4-Methylphenol (p-cresol)	106-44-5	50	1,000
Methyl tert-butyl ether (MTBE)	1634-04-4	70	1,400
Naphthalene	91-20-3	300	6,000
Nickel (total)	7440-02-0	100	2,000
4-Nitroaniline	100-01-6	NA[3]	NA[3]
Nitrobenzene	98-95-3	6	120
N-Nitrosodi-n-propylamine	621-64-7	10	200
N-Nitrosodiphenylamine	86-30-6	10	200
2,2'-oxybis(1-chloropropane)	108-60-1	300	6,000
Pentachlorophenol	87-86-5	0.3	6.0
Phenol	108-95-2	2,000	40,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.5	10
Pyrene	129-00-0	200	NA[1]
Selenium (total)	7782-49-2	40	800
Silver (total)	7440-22-4	40	800
Styrene	100-42-5	100	2,000
Tertiary butyl alcohol (TBA)	75-65-0	100	2,000
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[3]	NA[3]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.00001	0.00020[4]
1,1,2,2-Tetrachloroethane	79-34-5	1	20
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1	20
2,3,4,6-Tetrachlorophenol	58-90-2	200	4,000
Toluene	108-88-3	600	12,000
Toxaphene	8001-35-2	2	40

1,2,4-Trichlorobenzene	120-82-1	9	180
1,1,1-Trichloroethane	71-55-6	30	600
1,1,2-Trichloroethane	79-00-5	3	60
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1	20
Trichlorofluoromethane (Freon 11)	75-69-4	2,000	40,000
2,4,5-Trichlorophenol	95-95-4	700	14,000
2,4,6-Trichlorophenol	88-06-2	20	400
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	20,000	NA[1]
1,2,4-Trimethylbenzene	95-63-6	NA[3]	NA[3]
Vanadium (total)	7440-62-2	NA[3]	NA[3]
Vinyl chloride	75-01-4	1	20
Xylenes (total)	1330-20-7	1,000	20,000
Zinc (total)	7440-66-6	2,000	40,000

[A] The ground water remediation standards are listed using one significant figure to be consistent with the Ground Water Quality Standards, N.J.A.C. 7:9C

NA – Not applicable

[1] Standard not applicable because the calculated health-based soil criterion exceeds the soil saturation limit

[2] Not applicable because ground water remediation standard is a secondary standard

[3] Not applicable because a ground water remediation standard does not exist

[4] This standard is used for comparison to site soil leachate data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

Table 7 – Indoor Air Remediation Standards for the Vapor Intrusion Exposure Pathway -

Residential (µg/m^3) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Indoor Air Human Health-based Criterion	Noncarcinogenic Indoor Air Human Health-based Criterion	Reporting Limit	Indoor Air Remediation Standard Residential
Acetone	67-64-1	NA	NA	12	NA
Benzene	71-43-2	0.36	31	0.64	0.64[1]
Bromodichloromethane	75-27-4	NA	NA	1.3	NA
Bromoform	75-25-2	NA	NA	2.1	NA
Bromomethane (Methyl bromide)	74-83-9	NA	5.2	0.78	5.2
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	5,200	1.5	5,200
Carbon disulfide	75-15-0	NA	730	1.6	730
Carbon tetrachloride	56-23-5	0.47	100	1.3	1.3[1]
Chlorobenzene	108-90-7	NA	52	0.92	52
Chloroethane (Ethyl chloride)	75-00-3	NA	10,000	1.3	10,000
Chloroform	67-66-3	NA	100	0.98	100
Chloromethane (Methyl chloride)	74-87-3	NA	94	1.0	94
Cyclohexane	110-82-7	NA	6,300	0.69	6,300
Dibromochloromethane	124-48-1	NA	NA	1.7	NA
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.0047	9.4	1.5	1.5[1]
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	210	1.2	210
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	830	1.2	830
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	NA	2.5	NA
1,1-Dichloroethane	75-34-3	NA	NA	0.81	NA
1,2-Dichloroethane	107-06-2	NA	7.3	0.81	7.3
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	21	0.79	21
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	NA	0.79	NA
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	NA	0.79	NA
1,2-Dichloropropane	78-87-5	0.76	4.2	0.92	0.92[1]
1,3-Dichloropropene (total)	542-75-6	0.70	21	0.91	0.91[1]
1,4-Dioxane	123-91-1	0.56	31	0.72	0.72[1]
Ethylbenzene	100-41-4	1.1	1,000	0.87	1.1

Hexachlorobutadiene	87-68-3	NA	NA	2.1	NA
n-Hexane	110-54-3	NA	730	0.70	730
Mercury (elemental)	7439-97-6	NA	0.31	1.0	1.0[1]
Methylene chloride (Dichloromethane)	75-09-2	280	630	1.7	280
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	3,100	2.0	3,100
Methyl tert-butyl ether (MTBE)	1634-04-4	11	3,100	0.72	11
Naphthalene	91-20-3	0.083	3.1	2.6	2.6[1]
Styrene	100-42-5	NA	1,000	0.85	1,000
1,1,2,2-Tetrachloroethane	79-34-5	NA	NA	1.4	NA
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	11	42	1.4	11
Toluene	108-88-3	NA	5,200	0.75	5,200
1,2,4-Trichlorobenzene	120-82-1	NA	2.1	3.7	3.7[1]
1,1,1-Trichloroethane	71-55-6	NA	5,200	1.1	5,200
1,1,2-Trichloroethane	79-00-5	NA	NA	1.1	NA
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	0.68	2.1	1.1	1.1[1]
Trichlorofluoromethane	75-69-4	NA	NA	1.1	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	5,200	1.5	5,200
1,2,4-Trimethylbenzene	95-63-6	NA	63	0.98	63
Vinyl chloride	75-01-4	0.64	100	0.51	0.64
Xylenes (total)	1330-20-7	NA	100	0.87	100

NA – Not applicable because appropriate toxicological information is not available

[1] Standard set at reporting limit

Table 8 – Indoor Air Remediation Standards for the Vapor Intrusion Exposure Pathway - Nonresidential (µg/m^3) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Indoor Air Human Health-based Criterion	Noncarcinogenic Indoor Air Human Health-based Criterion	Reporting Limit	Indoor Air Remediation Standard Nonresidential
Acetone	67-64-1	NA	NA	12	NA
Benzene	71-43-2	1.6	130	0.64	1.6
Bromodichloromethane	75-27-4	NA	NA	1.3	NA

Bromoform	75-25-2	NA	NA	2.1	NA
Bromomethane (Methyl bromide)	74-83-9	NA	22	0.78	22
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	22,000	1.5	22,000
Carbon disulfide	75-15-0	NA	3,100	1.6	3,100
Carbon tetrachloride	56-23-5	2.0	440	1.3	2.0
Chlorobenzene	108-90-7	NA	220	0.92	220
Chloroethane (Ethyl chloride)	75-00-3	NA	44,000	1.3	44,000
Chloroform	67-66-3	NA	430	0.98	430
Chloromethane (Methyl chloride)	74-87-3	NA	390	1.0	390
Cyclohexane	110-82-7	NA	26,000	0.69	26,000
Dibromochloromethane	124-48-1	NA	NA	1.7	NA
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.020	39	1.5	1.5[1]
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	880	1.2	880
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	3,500	1.2	3,500
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	NA	2.5	NA
1,1-Dichloroethane	75-34-3	NA	NA	0.81	NA
1,2-Dichloroethane	107-06-2	NA	31	0.81	31
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	88	0.79	88
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	NA	0.79	NA
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	NA	0.79	NA
1,2-Dichloropropane	78-87-5	3.3	18	0.92	3.3
1,3-Dichloropropene (total)	542-75-6	3.1	88	0.91	3.1
1,4-Dioxane	123-91-1	2.5	130	0.72	2.5
Ethylbenzene	100-41-4	4.9	4,400	0.87	4.9
Hexachlorobutadiene	87-68-3	NA	NA	2.1	NA
n-Hexane	110-54-3	NA	3,100	0.70	3,100
Mercury (elemental)	7439-97-6	NA	1.3	1.0	1.3
Methylene chloride (Dichloromethane)	75-09-2	1,200	2,600	1.7	1,200
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	13,000	2.0	13,000
Methyl tert-butyl ether (MTBE)	1634-04-4	47	13,000	0.72	47
Naphthalene	91-20-3	0.36	13	2.6	2.6[1]

Styrene	100-42-5	NA	4,400	0.85	4,400
1,1,2,2-Tetrachloroethane	79-34-5	NA	NA	1.4	NA
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	47	180	1.4	47
Toluene	108-88-3	NA	22,000	0.75	22,000
1,2,4-Trichlorobenzene	120-82-1	NA	8.8	3.7	8.8
1,1,1-Trichloroethane	71-55-6	NA	22,000	1.1	22,000
1,1,2-Trichloroethane	79-00-5	NA	NA	1.1	NA
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	3.0	8.8	1.1	3.0
Trichlorofluoromethane	75-69-4	NA	NA	1.1	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	22,000	1.5	22,000
1,2,4-Trimethylbenzene	95-63-6	NA	260	0.98	260
Vinyl chloride	75-01-4	2.8	440	0.51	2.8
Xylenes (total)	1330-20-7	NA	440	0.87	440

NA – Not applicable because appropriate toxicological information is not available

[1] Standard set at reporting limit

APPENDIX 2

DEVELOPMENT OF SOIL REMEDIATION STANDARDS FOR THE INGESTION-DERMAL EXPOSURE PATHWAY

This appendix describes the procedures and equations used by the Department to develop the soil remediation standards for the ingestion-dermal exposure pathway as contained in N.J.A.C. 7:26D Appendix 1 Tables 1 and 2. This appendix is also used to develop interim soil remediation standards for the ingestion-dermal exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating soil remediation standards for the ingestion-dermal exposure pathway pursuant to N.J.A.C. 7:26D-7.

If the calculated soil criterion for a contaminant for the ingestion-dermal exposure pathway is greater than one million mg/kg, a soil remediation standard for the ingestion-dermal exposure pathway for that contaminant does not apply.

If the calculated soil criterion for a contaminant for the ingestion-dermal exposure pathway is less than the reporting limit for that contaminant, the soil remediation standard for the ingestion-dermal exposure pathway for that contaminant defaults to the soil reporting limit.

Equations 1 through 4 below are derived from the USEPA, Regional Screening Levels (RSLs) – Equations (November 2018). A detailed explanation of the derivation of Equations 1 through 4 is contained at N.J.A.C. 7:26D Appendix 12.

Equation 1 – Residential Carcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_c = \frac{TR * AT * LT}{(10^{-6} kg/mg) * [(CSF_O * IFS_{adj}) + (CSF_D * DFS_{adj} * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_c	Carcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	days/year	365

LT	Lifetime	years	70
CSF_o	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
IFS_{adj}	Age-adjusted soil ingestion rate	mg/kg	36,750
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
DFS_{adj}	Age-adjusted soil dermal contact factor	mg/kg	103,390
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$IFS_{adj} = \frac{EF_c * ED_c * IR_c}{BW_c} + \frac{EF_a * ED_a * IR_a}{BW_a}$$

Parameter	Definition	Units	Default
IFS_{adj}	Age-adjusted soil ingestion rate	mg/kg	36,750
EF_c	Exposure frequency – child	days/year	350
EF_a	Exposure frequency – adult	days/year	350
ED_c	Exposure duration – child	years	6
ED_a	Exposure duration – adult	years	20
IR_c	Soil ingestion rate – child	mg/day	200
IR_a	Soil ingestion rate – adult	mg/day	100
BW_c	Body weight – child	kg	15
BW_a	Body weight – adult	kg	80

Where:

$$DFS_{adj} = \frac{EF_c * ED_c * SA_c * AF_c}{BW_c} + \frac{EF_a * ED_a * SA_a * AF_a}{BW_a}$$

Parameter	Definition	Units	Default
DFS_{adj}	Age-adjusted soil dermal contact factor	mg/kg	103,390
EF_c	Exposure frequency – child	days/year	350
EF_a	Exposure frequency – adult	days/year	350
ED_c	Exposure duration – child	years	6
ED_a	Exposure duration – adult	years	20
SA_c	Skin surface area – child	cm^2/day	2,373
SA_a	Skin surface area – adult	cm^2/day	6,032
AF_c	Soil adherence factor – child	mg/cm^2	0.2
AF_a	Soil adherence factor – adult	mg/cm^2	0.07
BW_c	Body weight – child	kg	15
BW_a	Body weight – adult	kg	80

Where:

$$CSF_D = \frac{CSF_O}{GIABS}$$

Parameter	Definition	Units	Default
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific

CSF_O	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
GIABS	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 2 – Residential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6} kg/mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_{nc}	Noncarcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
ED	Exposure duration	years	6
BW	Body weight-child	kg	15
EF	Exposure frequency	days/year	350
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
IR	Soil ingestion rate-child	mg/day	200
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
SA	Skin surface area -child	cm^2/day	2,373
AF	Soil adherence factor-child	mg/cm^2	0.2
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$RfD_D = RfD_O * GIABS$$

Parameter	Definition	Units	Default
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
GIABS	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 3 – Nonresidential Carcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_c = \frac{TR * AT * LT * BW}{EF * ED * 10^{-6} kg/mg * [(CSF_O * IR) + (CSF_D * SA * AF * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_c	Carcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
BW	Body weight - adult	kg	80

EF	Exposure frequency-outdoor worker	days/year	225
ED	Exposure duration	years	25
CSF_o	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
IR	Soil ingestion rate -outdoor worker	mg/day	100
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
SA	Skin surface area - worker	cm^2/day	3,527
AF	Soil adherence factor-worker	mg/cm^2	0.12
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$CSF_D = \frac{CSF_O}{GIABS}$$

Parameter	Definition	Units	Default
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
CSF_O	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
GIABS	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 4 – Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6} kg/mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_{nc}	Noncarcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
ED	Exposure duration	years	25
BW	Body weight-adult	kg	80
EF	Exposure frequency- outdoor worker	days/year	225
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
IR	Soil ingestion rate- outdoor worker	mg/day	100
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
SA	Skin surface area - worker	cm^2/day	3,527
AF	Soil adherence factor-worker	mg/cm^2	0.12
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$RfD_D = RfD_O * GIABS$$

Parameter	Definition	Units	Default
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
GIABS	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 5 – Residential and Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria for EPH

$$ID_{nc} = \frac{THQ}{\frac{f_{(1)}}{ECFV_{(1)}} + \frac{f_{(2)}}{ECFV_{(2)}} + \frac{f_{(3)}}{ECFV_{(3)}} + \frac{f_{(4)}}{ECFV_{(4)}} + \frac{f_{(5)}}{ECFV_{(5)}} + \frac{f_{(6)}}{ECFV_{(6)}} + \frac{f_{(7)}}{ECFV_{(7)}} + \frac{f_{(8)}}{ECFV_{(8)}}}$$

Parameter	Definition	Units	Default
ID_{nc}	Noncarcinogenic soil criterion for the ingestion-dermal exposure pathway	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
f	Equivalent carbon weight fraction	unitless	Chemical specific
ECFV	Equivalent carbon fraction value	mg/kg	Chemical specific

ID_{nc} is the noncarcinogenic soil criterion for the ingestion-dermal exposure pathway for total EPH for the EPH composition established by the eight equivalent carbon (EC) range fractions. This equation was used to calculate a single numeric total EPH soil criterion for EPH (Category 1). This equation will be used to calculate a sample-specific total EPH soil criterion for all EPH (Category 2) using the Department's online EPH Calculator.

The equivalent carbon fraction value (ECFV) equation and default input variables are the same as used to calculate the noncarcinogenic soil criteria for the specific individual contaminants for the ingestion-dermal absorption exposure pathway shown in Equations 2 and 4. That is, each EC range is treated as if it is a single contaminant.

APPENDIX 3

DEVELOPMENT OF SOIL REMEDIATION STANDARDS FOR THE INHALATION EXPOSURE PATHWAY

This appendix describes the procedures and equations used by the Department to develop the soil remediation standards for the inhalation exposure pathway as contained in N.J.A.C. 7:26D Appendix 1, Tables 3 and 4. This appendix is also used to develop interim soil remediation standards for the inhalation exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating soil remediation standards for the inhalation exposure pathway pursuant to N.J.A.C. 7:26D-7.
If a calculated soil criterion for a contaminant for the inhalation exposure pathway is greater than its soil saturation limit for the volatile portion of the equation, the volatile component of the equation is not applicable in the development of the soil criterion for the inhalation exposure pathway.

If the calculated soil criterion for a contaminant for the inhalation exposure pathway is greater than one million parts per million, a soil remediation standard for that contaminant for the inhalation exposure pathway does not apply.

If the calculated soil criterion for a contaminant for the inhalation exposure pathway is less than the soil reporting limit for that contaminant, the soil remediation standard for that contaminant for the inhalation exposure pathway defaults to the soil reporting limit.

Equations 1 through 7 below are derived from the USEPA, Regional Screening Levels (RSLs) – Equations (November 2018). A detailed explanation of the derivation of Equations 1 and 2 is contained in N.J.A.C. 7:26D Appendix 12.

Equation 1 – Carcinogenic Inhalation Human Health-Based Criteria

$$Inh_c = \frac{TR * AT * LT}{IUR * 1000\,{}^{\mu g}/_{mg} * EF * \left(\frac{1}{VF} + \frac{1}{PEF}\right) * ED * ET * \frac{1day}{24hours}}$$

Parameter	Definition	Units	Default
Inh_c	Carcinogenic inhalation human health-based criterion	mg/kg	Chemical specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
IUR	Inhalation unit risk factor	$(\mu g/m^3)^{-1}$	Chemical specific
EF	Exposure frequency	days/year	350 (Residential) 225 (Nonresidential)
VF	Soil-to-air volatilization factor	m^3/kg	Chemical specific

PEF	Particulate emission factor	m^3/kg	1.67×10^9 (Residential) 1.64×10^9 (Nonresidential)
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)

Equation 2 – Noncarcinogenic Inhalation Human Health-Based Criteria

$$Inh_{nc} = \frac{THQ * AT * ED}{EF * ED * ET * \frac{1day}{24hours} * \frac{1}{RfC} * \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Parameter	Definition	Units	Default
Inh_{nc}	Noncarcinogenic inhalation human health-based criterion	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
EF	Exposure frequency	days/year	350 (Residential) 225 (Nonresidential)
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)
RfC	Reference concentration	mg/m^3	Chemical specific

VF	Soil-to-air volatilization factor	m^3/kg	Chemical specific
PEF	Particulate emission factor	m^3/kg	1.67×10^9 (Residential) 1.64×10^9 (Nonresidential)

Equation 3 – Volatilization Factor (VF)

$$VF = Q/C * \frac{(3.14 * D_A * T)^{1/2}}{(2 * \rho_b * D_A)} * 10^{-4} \, m^2/cm^2$$

Parameter	Definition	Units	Default
VF	Soil-to-air volatilization factor	m^3/kg	Chemical specific
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	86.6 (Residential) 85 (Nonresidential)
D_A	Apparent diffusivity	cm^2/s	Chemical specific
T	Exposure interval	seconds	8.20×10^8
ρ_b	Dry soil bulk density	g/cm^3	1.5

Equation 4 – Apparent Diffusivity (D_A)

$$D_A = \frac{\left[\left(\theta_a^{10/3} * D_i * H'\right) + \left(\theta_w^{10/3} * D_w\right)\right] / n^2}{\left(\rho_b * K_d\right) + \theta_w + \left(\theta_a * H'\right)}$$

Parameter	Definition	Units	Default
D_A	Apparent diffusivity	cm^2/s	Chemical

			specific
Θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
D_i	Diffusivity in air	cm^2/s	Chemical specific
H'	Henry's law constant	unitless	Chemical specific
Θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
D_w	Diffusivity in water	cm^2/s	Chemical specific
n	Total soil porosity	L_{pore}/L_{soil}	0.41
ρ_b	Dry soil bulk density	g/cm^3	1.5
K_d	Soil-water partition coefficient	cm^3/g	Chemical specific

Equation 5 – Soil-Water Partition Coefficient (K_d)

$$K_d = K_{oc} * f_{oc}$$

Parameter	Definition	Units	Default
K_d	Soil-water partition coefficient	cm^3/g	Chemical specific
K_{oc}	Soil organic carbon-water partition coefficient	cm^3/g	Chemical specific
f_{oc}	Organic carbon content of soil	g/g	0.002

Equation 6 – Particulate Emission Factor (PEF)

$$PEF = Q/C * \left[\frac{3{,}600\ sec/hr}{0.036 * (1 - v) * \left(\frac{U_m}{U_t}\right)^3 * F(x)} \right]$$

Parameter	Definition	Units	Default
PEF	Particulate emission factor	m^3/kg	1.67×10^9 (Residential) 1.64×10^9 (Nonresidential)
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	86.6 (Residential) 85 (Nonresidential)
v	Percent vegetative cover	percent	50
Um	Mean annual wind speed	m/s	4.56
Ut	Equivalent threshold value of wind speed at 7 m	m/s	11.32
F(x)	Function dependent on Um/Ut derived using Cowherd et al. (1985)	unitless	0.159

Equation 7–Soil Saturation Limit (C_{sat})

$$C_{sat} = \frac{S}{\rho_b} * \left[\left(K_d * \rho_b\right) + \theta_w + \left(H' * \theta_a\right) \right]$$

Parameter	Definition	Units	Default
C_{sat}	Soil saturation limit	mg/kg	Chemical specific
S	Water solubility	mg/L_{water}	Chemical

			specific
ρ_b	Dry soil bulk density	g/cm^3	1.5
K_d	Soil-water partition coefficient	cm^3/g	Chemical specific
Θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
H'	Henry's law constant	unitless	Chemical specific
Θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18

APPENDIX 4

DEVELOPMENT OF THE SOIL AND SOIL LEACHATE REMEDIATION STANDARDS FOR THE MIGRATION TO GROUND WATER EXPOSURE PATHWAY

This appendix describes the procedures used by the Department to develop the soil and soil leachate remediation standards for the migration to ground water exposure pathway as contained at N.J.A.C. 7:26D Appendix 1, Tables 5 and 6. This appendix is also used to develop interim soil and soil leachate remediation standards for the migration to ground water exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating soil and soil leachate remediation standards for the migration to ground water exposure pathway pursuant to N.J.A.C. 7:26D-7.

If a calculated soil criterion for a contaminant for the migration to ground water exposure pathway is greater than its soil saturation limit, a soil remediation standard for the migration to ground water exposure pathway does not apply.

If a calculated soil criterion for a contaminant for migration to ground water exposure pathway is less than the soil reporting limit for that contaminant, the soil remediation standard for the migration to ground water remediation exposure pathway defaults to the soil reporting limit.

Equation 1a – Migration to Ground Water Soil-Water Partitioning Criteria for Inorganic Contaminants

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 22)

$$MGW_c = GWRS * \frac{mg}{1000\,\mu g} * \left\{ K_d + \frac{\theta_w + (\theta_a * H')}{\rho_b} \right\} * DAF$$

Parameter	Definition	Units	Default
MGW_c	Migration to ground water soil-water partitioning criterion	mg/kg	Chemical specific
GWRS	Ground water remediation standard	µg/L	Chemical specific
K_d	Soil-water partition coefficient	L/kg	Chemical specific
ϑ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
ϑ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
H'	Henry's law constant	unitless	Chemical specific

ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution-attenuation factor	unitless	20

Equation 1b– Migration to Ground Water Soil-Water Partitioning Criteria for Organic Contaminants

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 24)

$$MGW_c = GWRS * \frac{mg}{1000\,\mu g} * \left\{ (K_{oc} * f_{oc}) + \frac{\theta_w + (\theta_a * H')}{\rho_b} \right\} * DAF$$

Parameter	Definition	Units	Default
MGW_c	Migration to ground water soil-water partitioning criterion	mg/kg	Chemical specific
GWRS	Ground water remediation standard	µg/L	Chemical specific
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical specific
f_{oc}	Organic carbon content of soil	kg/kg	0.002
ϑ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
ϑ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
H'	Henry's law constant	unitless	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution-attenuation factor	unitless	20

Equation 2 – Dilution-Attenuation Factor

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128

(May 1996) (Equation 37)

$$DAF = 1 + \frac{K * i * d}{I * L}$$

Parameter	Definition	Units	Default
DAF	Dilution-attenuation factor	unitless	20
K	Aquifer hydraulic conductivity	m/year	15,808
i	Hydraulic gradient	m/m	0.003
d	Mixing zone depth	m	3.4
I	Infiltration rate	m/year	0.28
L	Length of area of concern parallel to ground water flow	m	30.5

Equation 3 – Mixing Zone Depth

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128

(May 1996) (Equation 45)

$$d = (0.0112 * L^2)^{0.5} + d_a * \{1 - \exp[(-L * I)/(K * i * d_a)]\}$$

Parameter	Definition	Units	Default

d	Mixing zone depth	m	3.4
L	Length of area of concern parallel to ground water flow	m	30.5
d_a	Aquifer thickness	m	3.5
I	Infiltration rate	m/year	0.28
K	Aquifer hydraulic conductivity	m/year	15,808
i	Hydraulic gradient	m/m	0.003

Equation 4 – Soil Saturation Limit

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 9)

$$C_{sat} = \frac{S}{\rho_b} * [(K_{oc} * f_{oc} * \rho_b) + \theta_w + (H' * \theta_a)]$$

Parameter	Definition	Units	Default
C_{sat}	Soil saturation limit	mg/kg	Chemical specific
S	Water solubility	mg/L	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical specific
f_{oc}	Organic carbon content of soil	kg/kg	0.002

ϑ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
H'	Henry's law constant	unitless	Chemical specific
ϑ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18

Equation 5 – Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Target soil leachate concentration parameter in Equations 22 and 24)

$$MGW_{leachate} = GWRS * DAF$$

Parameter	Definition	Units	Default
$MGW_{leachate}$	Soil leachate remediation standard for the migration to ground water exposure pathway	µg/L	Chemical specific
GWRS	Ground water remediation standard	µg/L	Chemical specific
DAF	Dilution-attenuation factor	unitless	20

APPENDIX 5

DEVELOPMENT OF INDOOR AIR REMEDIATION STANDARDS FOR THE VAPOR INTRUSION

EXPOSURE PATHWAY

This appendix describes the procedures and equations used by the Department to develop the indoor air remediation standards for the vapor intrusion exposure pathway as contained at N.J.A.C. 7:26D Appendix 1, Tables 7 and 8. This appendix is also used to develop interim indoor air remediation standards for the vapor intrusion exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating indoor air remediation standards for the vapor intrusion exposure pathway pursuant to N.J.A.C. 7:26D-7.

If the calculated indoor air human health-based criterion for a contaminant is less than the reporting limit, the indoor air remediation standard defaults to the reporting limit.

Equations 1 and 2 below are derived from the USEPA, Regional Screening Levels (RSLs) – Equations (November 2018). A detailed explanation of the derivation of Equations 1 and 2 is contained at N.J.A.C. 7:26D Appendix 12.

Equation 1 – Carcinogenic Indoor Air Human Health-Based Criteria

$$IA_c = \frac{TR * AT * LT}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * IUR}$$

Parameter	Definition	Units	Default

IA_c	Carcinogenic indoor air human health-based criterion	µg/m^3	Chemical specific
TR	Target cancer risk	unitless	1 x 10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
EF	Exposure frequency	days/year	350 (Residential) 250 (Nonresidential-indoor worker)
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)
IUR	Inhalation unit risk	(µg/m^3)$^{-1}$	Chemical specific

Equation 2 – Noncarcinogenic Indoor Air Human Health-Based Criteria

$$IA_{nc} = \frac{THQ * AT * ED * \frac{1000\,\mu g}{mg}}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * \frac{1}{RfC}}$$

Parameter	Definition	Units	Default
IA_{nc}	Noncarcinogenic indoor air human health-based criterion	µg/m^3	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365

ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
EF	Exposure frequency	days/year	350 (Residential) 250 (Nonresidential-indoor worker)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)
RfC	Inhalation reference concentration	mg/m^3	Chemical specific

APPENDIX 6

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR SOIL FOR THE INGESTION-DERMAL EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)1i, an alternative remediation standard (ARS) for soil for the ingestion-dermal exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for this exposure pathway may be developed at any time.

(b) The ARS options listed in III(a) of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) An ARS for this exposure pathway may be developed based on site-specific alternative land uses in accordance with III(a) and III(b)1 of this appendix.

(d) An ARS for this exposure pathway may be developed based on site-specific modification of parameters in accordance with III(b)2 and 3 of this appendix.

(e) An ARS for lead for this exposure pathway may be developed based on use of other models and methods pursuant to III(b)4 of this appendix.

II. Required Approvals and Permits

(a) An ARS developed in accordance with III(a) and III(b) of this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS developed pursuant to III(a) and III(b)1 and 3 of this appendix to ensure that the continued use of the ARS remains valid.

(c) The Department shall not require the use of an institutional control, engineering control, and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS developed pursuant to III(b)2 of this appendix.

(d) Depending on the site-specific conditions the Department may require the use of an institutional control, engineering control, and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS developed pursuant to III(b)4 of this appendix.

III. Options and Procedures

(a) An ARS may be based on a site-specific alternative land use, which would involve an alternative exposure scenario (for example, exposure frequency and exposure duration) that is neither a residential nor a nonresidential land use scenario.

1. Examples of alternative land uses include, but are not limited to:

i. Active recreational land use, such as sports playing fields and playgrounds;

ii. Passive recreational land use, such as land and trails used for walking, cycling, and hunting;

iii. Restricted access areas, such as right-of-way areas used for the inspection and repair of utilities; and

iv. Infrequent access areas, such as ecological preservation and conservation areas.

2. The following actions shall be taken when developing an ARS pursuant to this appendix:

i. Determine the intended use of the site and the appropriate exposure frequency (EF) and exposure duration (ED) associated with the intended land use in accordance with Department guidance located on the Department’s website;

ii. Use the EF and ED in the Department’s calculator located on the Department’s website to calculate an alternative ingestion-dermal remediation standard; and

iii. Provide the following information to the Department in addition to the applicable form found on the Department’s website:

(1) The resultant ARS and the modified input parameters used in the Department’s calculator;

(2) A description and basis of how the input parameters were selected; and

(3) A description of any institutional controls and engineering controls associated with the ARS.

(b) For lead contamination, an ARS for this exposure pathway can be developed as follows:

1. Alternative Land Use Scenarios

i. An ARS for lead for an alternative land use may be based on the assessment of non-continuous nonresidential exposures identified in the USEPA's Assessing Intermittent or Variable Exposures at Lead Sites (USEPA, 2003)[1]; and

ii. Prior to the development of an ARS under III(b) of this appendix, consultation with the Department shall be required in accordance with Department guidance.

2. Site-Specific Changes to Default Values – Residential Exposure Scenario

i. An ARS for lead for a residential scenario may be based on input parameters identified by the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) (USEPA, 1994)[2]; and

ii. Prior to the development of an ARS for lead under III(b) of this appendix, consultation with the Department shall be required in accordance with Department guidance.

3. Site-Specific Changes to Default Values – Nonresidential Exposure Scenario

i. An ARS for lead for a nonresidential scenario may be based on the input parameters identified in the document Recommendations of the Technical Review Workgroup (TRW) for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposures to Lead in Soil (USEPA, 1996)[3]; and

ii. Prior to the development of an ARS under III(b) of this appendix, consultation with the Department shall be required in accordance with Department guidance.

4. Other models and methods

i. With prior approval by the Department, an ARS for lead may also be developed using scientific models and methods other than those described in III(b)2 or 3 above.

[1] USEPA. 2003. Assessing Intermittent or Variable Exposures at Lead Sites, Office of Solid Waste and Emergency Response, OSWER 9285.7-76.

[2] USEPA. 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Solid Waste and Emergency response, Washington, DC. OSWER 9285.7-15-1.

[3] USEPA. 1996. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil, USEPA Technical Workgroup for Lead. December 1996.

APPENDIX 7

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR SOIL FOR THE INHALATION EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)1ii, an alternative remediation standard (ARS) for soil for the inhalation exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for this exposure pathway may be developed at any time.

(b) The ARS options listed in III of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) The ARS options outlined in III of this appendix may be utilized for residential and nonresidential land use scenarios, as well as alternative land use scenarios described in III(a) of this appendix.

(d) An ARS for this exposure pathway may be developed based on modification of site-specific exposure parameters listed in III(b) of this appendix.

II. Required Approvals and Permits

(a) An ARS developed in accordance with III(a) of this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) An ARS developed in accordance with III(b) of this appendix does not require approval by the Department prior to use at the specific site or area of concern.

(c) The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS developed

pursuant to III(a), III(b)1iv, and III(b)3 of this appendix to ensure that the continued use of the ARS remains valid.

(d) The Department shall not require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS developed pursuant to III(b)1v and III(b)2 of this appendix.

III. Options and Procedures

(a) An ARS for this exposure pathway may be based on a site-specific alternative land use, which would involve an alternative exposure scenario (for example, exposure frequency, exposure time, and exposure duration) that is neither a residential nor a nonresidential land use scenario.

1. Examples of alternative land uses include, but are not limited to:

i. Active recreational land use, such as sports playing fields and playgrounds;

ii. Passive recreational land use, such as land and trails used for walking, cycling, and hunting; and

iii. Access areas, such as right-of-way areas used for the inspection and repair of utilities.

2. The following actions shall be taken when developing an ARS pursuant to this appendix:

i. Determine the intended use of the site and the appropriate exposure frequency (EF), exposure time (ET), and exposure duration (ED) associated with the intended land use in accordance with Department guidance;

ii. Use the EF, ET, and ED in the Department's calculator located on the Department's website to calculate the ARS; and

iii. Submit the following information to the Department in addition to the applicable form found on the Department's website:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected; and

(3) A description of institutional controls and engineering controls associated with the ARS.

(b) An ARS for soil for this exposure pathway may be based site-specific parameter modifications as follows:

1. Depth Range of Contamination:

i. Determine the actual depth range of contamination by delineation sampling pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-4, and Department guidance;

ii. Use the actual depth range of contamination in the Department's calculator located on the Department's website to calculate an alternative inhalation remediation standard;

iii. Provide the following information to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected, including all related laboratory results; and

(3) A description of any institutional controls and engineering controls associated with the ARS;

iv. The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS based on a site-specific depth range of contamination that begins at a depth greater than zero feet below ground surface to ensure that the continued use of the ARS remains valid; and

v. The Department shall not require the use of an institutional control, engineering control, or a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS based on a site-specific depth range of contamination that begins at the ground surface.

2. Soil Organic Carbon Content (foc):

i. Collect and analyze samples for determining foc in accordance with the appropriate Department guidance;

ii. Input the appropriate foc value(s) in the Department’s calculator located on the Department’s website when calculating an alternative inhalation remediation standard; and

iii. Provide the following to the Department in addition to the applicable form found on the Department’s website with the applicable remedial phase report:

(1) The resultant ARS and the modified input parameters used in the Department’s calculator; and

(2) A description and basis of how the input parameters were selected, including all related laboratory results.

3. Fraction of Vegetative Cover (V):

i. Determine V on the site in accordance with the appropriate Department guidance;

ii. Use V in the Department's calculator located on the Department's website to calculate the ARS for soil for the inhalation exposure pathway; and

iii. Provide the following information to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected, including all measurements and calculations; and

(3) A description of any institutional controls and engineering controls associated with the ARS.

APPENDIX 8

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR SOIL FOR THE MIGRATION TO GROUND WATER EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)1iii, an alternative remediation standard (ARS) for soil for the migration to ground water exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for soil for this exposure pathway may be developed at any time.

(b) An ARS may be developed based on the site-specific options described in III of this appendix and submitted to the Department with the appropriate form(s).

II. Required Approvals and Permits

(a) An ARS developed in accordance with III(a), III(b), and III(c) of this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) An ARS developed in accordance with III(d), III(e), III(f), and III(g) of this appendix does not require approval by the Department prior to use at the specific site or area of concern.

(c) With prior approval by the Department, an ARS may also be developed using scientific methods other than those described in III(a) though (g) below including relevant guidance from the USEPA, other states, and other relevant, applicable, and appropriate methods and practices that ensure the protection of public health and safety and of the environment.

(d) With the exception noted in III(c) of this appendix, an ARS developed pursuant to this appendix does not require the use of an institutional control, engineering control, and a remedial action permit, pursuant to N.J.A.C. 7:26C-7.

III. Options and Procedures

(a) Determination of a site-specific Dilution-Attenuation Factor (DAF) as follows:

1. Measure the length of the area of concern parallel to the ground water flow, the aquifer hydraulic conductivity, the aquifer gradient and, if necessary, aquifer thickness in accordance with the appropriate Department guidance.

2. Input the appropriate values into the Department's calculators (DAF calculator or Soil-Water Partition Equation calculator) located on the Department's website.

3. Provide the following to the Department in addition to the applicable form found on the Department's website:

i. The resultant ARS and the modified input parameters used in the Department's DAF calculator or the Department's Soil-Water Partition Equation calculator; and

ii. Documentation of the determination and basis of the site-specific parameters used to determine the DAF including all related tables, figures, and laboratory results.

(b) Seasonal Soil Compartment Model (SESOIL) modeling as follows:

1. Delineate contamination and determine the depth to ground water in accordance with the appropriate Department guidance.

2. If desired, determine soil texture in accordance with the appropriate Department guidance.

3. If desired, determine soil organic carbon content according to III(d) of this appendix.

4. Input the appropriate parameters into the SESOIL model in accordance with the appropriate Department guidance.

5. Provide the following to the Department in addition to the applicable form found on the Department's website:

i. For each ARS determined using the SESOIL model, a SESOIL model table showing the measured contaminant concentrations as a function of depth and the modeled SESOIL concentrations, results from the most current version of the SEVIEW model software of the SESOIL CLIMATE report, the SESOIL HYDROLOGIC CYCLE report, the SESOIL PROFILE AND LOAD REPORT, and the SESOIL POLLUTANT CYCLE report. The project file (*.prj file) from the SEVIEW project shall also be submitted; and

ii. A description and basis of how the SESOIL input parameters were determined, including all related tables, figures, and laboratory results.

6. An alternative software package equivalent to SEVIEW that has been authorized by the Department may be used as a substitute for SEVIEW in application of III(b) of this appendix.

(c) Seasonal Soil Compartment Model/Analytical Transient 1-,2-,3-Dimensional (SESOIL/AT123D) modeling as follows:

1. The SESOIL/AT123D model shall only be used when:

i. The contaminated ground water plume has been delineated in accordance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E and appropriate Department guidance;

ii. A Classification Exception Area (CEA) exists for contaminated ground water on the site; and

iii. An impermeable cap does not and will not exist above the vadose zone contamination. Any permeable cap used shall allow unrestricted ground water recharge.

2. Delineate the vadose zone contamination and determine the depth to ground water in accordance with the appropriate Department guidance.

3. Determine the soil organic carbon for both the vadose zone and the aquifer according to III(d) of this appendix.

4. Determine the soil texture for the vadose zone in accordance with the appropriate Department guidance.

5. If desired, determine the aquifer texture in accordance with the appropriate Department guidance.

6. Input the appropriate parameters into the SESOIL/AT123D model in accordance with the appropriate Department guidance.

7. Provide the following to the Department, in addition to the applicable form found on the Department's website:

i. For each ARS determined using the combined SESOIL/AT123D model, a SESOIL model table showing the measured vadose zone contaminant concentrations as a function of depth and the modeled SESOIL concentrations, a map of the delineated ground water plume (with concentration isopleths) showing AT123D ground water sources and the concentrations and dimensions used in the model for each source, the SEVIEW project map, results from the most current version of the SEVIEW model software of the SESOIL CLIMATE report, the SESOIL

HYDROLOGIC CYCLE report, the SESOIL PROFILE AND LOAD REPORT, the SESOIL POLLUTANT CYCLE report, an AT123D Point of Compliance Report at the downgradient edge of the Area of Concern at the centerline of the plume at the surface of the water table, and an AT123D Point of Compliance Report at the maximum extent of the plume at the centerline of the plume at the surface of the water table. For each AT123D Point of Compliance Report, the numerical concentration of the contaminant at the last time step (end of the CEA time period) shall be shown in an EXCEL window pasted on to the report. The project file (*.prj file) from the SEVIEW project shall also be submitted; and

ii. A description and basis of how the SESOIL/AT123D input parameters were determined, including all related tables, figures, and laboratory results.

8. Except for the existing CEA and the remedial action permit, the Department shall not require the use of any additional institutional control, engineering control, or a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS based on site-specific SESOIL/AT123D modeling.

9. An alternative software package equivalent to SEVIEW that has been authorized by the Department may be used as a substitute for SEVIEW in application of III(c) of this appendix.

(d) A site-specific soil organic carbon content (foc) in the Soil Water Partition Equation, found at N.J.A.C. 7:2DC Appendix 4 as follows:

1. Collect and analyze samples for determining foc in accordance with the appropriate Department guidance.

2. Input the appropriate foc value(s) in the Department's foc calculator located on the Department's website to determine the site-specific foc value.

3. Input the site-specific foc value into the Soil-Water Partition Equation calculator located on the Department's website in order to determine the alternative remediation standard.

4. Provide the following to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

i. The resultant ARS and the modified input parameters used in the Department's foc and soil-water partition calculators; and

ii. A description and basis of how the soil organic carbon content was selected, including all related tables, figures, and laboratory results.

(e) The Synthetic Precipitation Leaching Procedure (SPLP) ARS options contained in technical guidance issued by the Department, except when combining with a site-specific DAF as provided in III(a) of this appendix. The procedure shall be as follows:

1. Collect samples and implement the SPLP procedure in accordance with the appropriate Department guidance.

2. Input the appropriate values into the Department's SPLP calculator located on the Department's website.

3. Provide the following to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

i. The resultant ARS and the modified input parameters used in the Department's SPLP calculator; and

ii. A description and basis of how the samples were selected, including all related laboratory results.

(f) Site-specific data for immobile contaminants only when:

1. The contaminant exhibits a very low mobility in soil as defined by a high soil organic carbon-water partition coefficient (Koc) or a high soil-water partition coefficient (Kd), factors that increase a contaminant's mobility are not present, and a clean zone of two feet or greater exists between the contamination and the water table, as described in appropriate Department guidance.

2. The procedure shall be as follows:

i. Collect and analyze soil samples in accordance with the appropriate Department guidance; and

ii. Provide a description and basis of how the samples were used to demonstrate compliance with the migration to ground water exposure pathway, including all related tables, figures, and laboratory results, to the Department, in addition to the applicable form found on the Department's website with the applicable remedial phase report.

3. If compliance with the migration to ground water exposure pathway is determined by the site-specific conditions in III(f)1 of this appendix only, then the numeric standards in this chapter shall not apply, but the pathway will be deemed to have been satisfactorily addressed on a narrative basis.

(g) Site-specific data for metals, semi-volatile contaminants, and volatile contaminants only when:

1. The highest concentrations of remaining contamination are located at the water table and no ground water impact above the ground water remediation standard is observed as demonstrated by ground water sampling, as described in appropriate Department guidance.

2. The procedure shall be as follows:

i. Collect and analyze soil and ground water samples in accordance with the appropriate Department guidance; and

ii. Provide a description and basis of how the samples were used to demonstrate compliance with the migration to ground water exposure pathway, including all related tables, figures, and laboratory results, to the Department in addition to the applicable form from the Department's website with the applicable remedial phase report.

3. If compliance with the migration to ground water exposure pathway is determined by the site-specific conditions in III(g) of this appendix only, then the numeric standards in this chapter shall not apply, but the pathway will be deemed to have been satisfactorily addressed on a narrative basis.

APPENDIX 9

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR INDOOR AIR FOR THE VAPOR INTRUSION EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)2, an alternative remediation standard (ARS) for indoor air for the vapor intrusion exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for this exposure pathway may be developed at any time.

(b) The ARS options listed in III of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) The ARS options outlined in III of this appendix may be utilized for nonresidential buildings, but they are not applicable to residential buildings.

(d) An ARS may be developed based on modification of site-specific exposure parameters listed in III of this appendix.

II. Required Approvals and Permits

(a) An ARS developed in accordance with this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS developed pursuant to this appendix to ensure that the continued use of the ARS remains valid.

III. Options and Procedures

(a) An ARS developed pursuant to this appendix is limited to site-specific modification of the following exposure parameters:

1. An alternative exposure frequency (EF) parameter representative of site-specific use that is incorporated in the applicable indoor air Equation 1 and 2 at N.J.A.C. 7:26D Appendix 5; or

2. An alternative exposure time (ET) parameter representative of site-specific use that is incorporated in the applicable indoor air Equation 1 and 2 at N.J.A.C. 7:26D Appendix 5.

(b) Examples where or when site-specific modification of exposure parameters may be acceptable include, but are not limited to:

1. A small generating station;

2. An isolated storage facility;

3. A restricted access area of a nonresidential building, such as a basement; or

4. Workday hours differing from eight hours.

(c) In developing an ARS pursuant to this appendix, the following supporting information, in addition to the applicable form found on the Department’s website, shall be submitted to the Department:

1. The resultant ARS and the modified input parameters used in the Department’s ARS calculator;

2. Support documentation justifying:

i. The basis for the site-specific parameters used to determine the ARS;

ii. The adequacy of proposed monitoring; and

iii. The adequacy of the institutional and engineering controls;

3. An overview of the history and contamination at the site or area of concern pertinent to the vapor intrusion exposure pathway including:

i. A description of any vapor intrusion investigation related to the ARS;

ii. The extent of soil and ground water contamination at the site affecting the vapor intrusion exposure pathway;

iii. A description of the subject building(s) and a scaled map of the site and surrounding area, identifying the subject building(s) and associated analytical results, including soil gas;

iv. Identification of the uses in the subject building(s) and the locations where receptors are present within the building(s);

v. A summary table presenting the analytical results, in accordance with N.J.A.C. 7:26E-1.6(b)6; and

4. Additional information used to develop the ARS.

APPENDIX 10

CHEMICAL AND PHYSICAL PROPERTIES OF CONTAMINANTS

Contaminant	CAS No.	Water Solubility (mg/L)	Henry's Law Constant (atm-m^3/mol, 25°C)	Henry's Law Constant (dimensionless, 25°C)	Air Diffusivity (cm^2/sec)	Water Diffusivity (cm^2/sec)	Soil Organic Carbon-Water Partition Coefficient, K_{oc} (L/kg)	Soil-Water Partition Coefficient, K_d (L/kg)

Acenaphthene	83-32-9	3.9	1.84E-04	7.5224E-03	5.0614E-02	8.3300E-06	5027	NA
Acetone (2-Propanone)	67-64-1	1000000	3.50E-05	1.4309E-03	1.0592E-01	1.1471E-05	2.364	NA
Acetophenone	98-86-2	6130	1.04E-05	4.2518E-04	6.5222E-02	8.7228E-06	51.85	NA
Aldrin	309-00-2	0.017	4.40E-05	1.7989E-03	2.2812E-02	5.8402E-06	82020	NA
Aluminum (total)	7429-90-5	NA	NA	NA	NA	NA	NA	1500
Anthracene	120-12-7	0.0434	5.56E-05	2.2731E-03	3.8973E-02	7.8522E-06	16360	NA
Antimony (total)	7440-36-0	NA	NA	NA	NA	NA	NA	45
Arsenic (total)	7440-38-2	NA	NA	NA	NA	NA	NA	26[1]
Atrazine	1912-24-9	34.7	2.36E-09	9.6484E-08	2.6466E-02	6.8378E-06	224.5	NA
Barium (total)	7440-39-3	NA	NA	NA	NA	NA	NA	17[1]
Benzaldehyde	100-52-7	6950	2.67E-05	1.0916E-03	7.4393E-02	9.4627E-06	11.09	NA
Benzene	71-43-2	1790	5.55E-03	2.2690E-01	8.9534E-02	1.0263E-05	145.8	NA
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.0094	1.20E-05	4.9059E-04	2.6144E-02	6.7495E-06	176900	NA
Benzo(a)pyrene	50-32-8	0.00162	4.57E-07	1.8683E-05	4.7583E-02	5.5597E-06	587400	NA
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.0015	6.57E-07	2.6860E-05	4.7583E-02	5.5597E-06	599400	NA
Benzo(k)fluoranthene	207-08-9	0.0008	5.84E-07	2.3875E-05	4.7583E-02	5.5597E-06	587400	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	35[1]
1,1'-Biphenyl	92-52-4	7.48	3.08E-04	1.2592E-02	4.7059E-02	7.5618E-06	5129	NA
Bis(2-chloroethoxy)methane	111-91-1	7800	3.85E-06	1.5740E-04	6.1186E-02	7.1492E-06	14.38	NA
Bis(2-chloroethyl)ether	111-44-4	17200	1.70E-05	6.9501E-04	5.6719E-02	8.7070E-06	32.21	NA
Bis(2-ethylhexyl)phthalate	117-81-7	0.27	2.70E-07	1.1038E-05	1.7340E-02	4.1807E-06	119600	NA
Bromodichloromethane (Dichlorobromomethane)	75-27-4	3032	2.12E-03	8.6672E-02	5.6263E-02	1.0731E-05	31.82	NA
Bromoform	75-25-2	3100	5.35E-04	2.1872E-02	3.5732E-02	1.0356E-05	31.82	NA
Bromomethane (Methyl bromide)	74-83-9	15200	7.34E-03	3.0008E-01	1.0050E-01	1.3468E-05	13.22	NA
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	223000	5.69E-05	2.3262E-03	9.1446E-02	1.0193E-05	4.51	NA
Butylbenzyl phthalate	85-68-7	2.69	1.26E-06	5.1513E-05	2.0832E-02	5.1733E-06	7155	NA
Cadmium	7440-43-9	NA	NA	NA	NA	NA	NA	23[1]
Caprolactam	105-60-2	772000	2.53E-08	1.0343E-06	6.9242E-02	8.9994E-06	24.5	NA
Carbon disulfide	75-15-0	2160	1.44E-02	5.8872E-01	1.0644E-01	1.2977E-05	21.73	NA
Carbon tetrachloride	56-23-5	793	2.76E-02	1.1284E+00	5.7143E-02	9.7849E-06	43.89	NA
Chlordane (alpha and gamma forms summed)	57-74-9	0.056[2]	4.86E-05[2]	1.9869E-03[2]	1.7900E-02[3]	4.3700E-06[3]	67540[5]	NA
4-Chloroaniline	106-47-8	3900	1.16E-06	4.7424E-05	7.0385E-02	1.0253E-05	112.7	NA
Chlorobenzene	108-90-7	498	3.11E-03	1.2715E-01	7.2130E-02	9.4765E-06	233.9	NA
Chloroethane (Ethyl chloride)	75-00-3	6710	1.11E-02	4.5380E-01	1.0376E-01	1.1619E-05	21.73	NA
Chloroform	67-66-3	7950	3.67E-03	1.5004E-01	7.6920E-02	1.0891E-05	31.82	NA
Chloromethane (Methyl chloride)	74-87-3	5320	8.82E-03	3.6059E-01	1.2396E-01	1.3648E-05	13.22	NA
2-Chloronaphthalene	91-58-7	11.7	3.20E-04	1.3082E-02	4.4691E-02	7.7301E-06	2478	NA
2-Chlorophenol (o-Chlorophenol)	95-57-8	11300	1.12E-05	4.57890E-04	6.6118E-02	9.4784E-06	398[1]	NA

Chrysene	218-01-9	0.002	5.23E-06	2.1382E-04	2.6114E-02	6.7495E-06	180500	NA
Cobalt (total)	7440-48-4	NA	NA	NA	NA	NA	NA	45
Copper (total)	7440-50-8	NA	NA	NA	NA	NA	NA	35
Cyanide	57-12-5	NA	NA	NA	NA	NA	NA	9.9
Cyclohexane	110-82-7	55	1.50E-01	6.1325E+00	7.9973E-02	9.1077E-06	145.8	NA
4,4'-DDD (p,p'-TDE)	72-54-8	0.09	6.60E-06	2.6983E-04	4.0608E-02	4.7447E-06	117500	NA
4,4'-DDE (p,p'-DDX)	72-55-9	0.04	4.16E-05	1.7007E-03	2.3000E-02	5.8592E-06	117500	NA
4,4'-DDT	50-29-3	0.0055	8.32E-06	3.4015E-04	3.7933E-02	4.4322E-06	168600	NA
Dibenz(a,h)anthracene	53-70-3	0.00249	1.41E-07	5.7645E-06	4.4567E-02	5.2073E-06	1912000	NA
Dibromochloromethane (Chlorodibromomethane)	124-48-1	2700	7.83E-04	3.2011E-02	3.6636E-02	1.0561E-05	31.82	NA
1,2-Dibromo-3-chloropropane	96-12-8	1230	1.47E-04	6.0098E-03	3.2135E-02	8.9048E-06	115.8	NA
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	3910	6.50E-04	2.6574E-02	4.3035E-02	1.0439E-05	39.6	NA
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	156	1.92E-03	7.8496E-02	5.6170E-02	8.9213E-06	382.9	NA
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	125[2]	2.63E-03[2]	1.0751E-01[2]	6.9200E-02[4]	7.8600E-06[4]	375.3[5]	NA
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	81.3	2.41E-03	9.8528E-02	5.5043E-02	8.6797E-06	375.3	NA
3,3'-Dichlorobenzidine	91-94-1	3.1	2.84E-11	1.1611E-09	4.7482E-02	5.5478E-06	3190	NA
Dichlorodifluoromethane (Freon 12)	75-71-8	280	3.43E-01	1.4023E+01	7.6029E-02	1.0839E-05	43.89	NA
1,1-Dichloroethane	75-34-3	5040	5.62E-03	2.2976E-01	8.3645E-02	1.0621E-05	31.82	NA
1,2-Dichloroethane	107-06-2	8600	1.18E-03	4.8242E-02	8.5722E-02	1.0995E-05	39.6	NA
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	2420	2.61E-02	1.0670E+00	8.6311E-02	1.0956E-05	31.82	NA
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	6410	4.08E-03	1.6680E-01	8.8406E-02	1.1335E-05	39.6	NA
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	4520	9.38E-03	3.8348E-01	8.7609E-02	1.1191E-05	39.6	NA
2,4-Dichlorophenol	120-83-2	5500	4.29E-06	1.7538E-04	4.8577E-02	8.6786E-06	159[1]	NA
1,2-Dichloropropane	78-87-5	2800	2.82E-03	1.1529E-01	7.3340E-02	9.7252E-06	60.7	NA
1,3-Dichloropropene (total)	542-75-6	2800	3.55E-03	1.4513E-01	7.6272E-02	1.0123E-05	72.17	NA
Dieldrin	60-57-1	0.195	1.00E-05	4.0883E-04	2.3286E-02	6.0062E-06	20090	NA
Diethylphthalate	84-66-2	1080	6.10E-07	2.4939E-05	2.6074E-02	6.7227E-06	104.9	NA
2,4-Dimethylphenol	105-67-9	7870	9.51E-07	3.8879E-05	6.2245E-02	8.3140E-06	491.8	NA
Di-n-butyl phthalate	84-74-2	11.2	1.81E-06	7.3998E-05	2.1436E-02	5.3255E-06	1157	NA
2,4-Dinitrophenol	51-28-5	2790	8.60E-08	3.5159E-06	4.06670E-02	9.0756E-06	0.0178[1]	NA
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	270	3.97E-07	1.6230E-05	5.9131E-02	6.9090E-06	587.4	NA
Di-n-octyl phthalate	117-84-0	0.022	2.57E-06	1.0506E-04	3.5559E-02	4.1548E-06	140800.00	NA
1,4-Dioxane	123-91-1	1000000	4.80E-06	1.9624E-04	8.7374E-02	1.0541E-05	2.633	NA
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	0.325	6.50E-05	2.6574E-03	2.2484E-02	5.7628E-06	6761	NA
Endrin	72-20-8	0.25	6.36E-06	2.600E-04	3.6158E-02	4.2248E-06	20090	NA
Ethylbenzene	100-41-4	169	7.88E-03	3.2216E-01	6.8465E-02	8.4558E-06	446.1	NA
Extractable Petroleum Hydrocarbons (Category 1)	various	NA	NA	NA	NA	NA	NA	NA

Extractable Petroleum Hydrocarbons (Category 2)	various	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	206-44-0	0.26	8.86E-06	3.6222E-04	2.7596E-02	7.1827E-06	55450	NA
Fluorene	86-73-7	1.69	9.62E-05	3.9329E-03	4.3974E-02	7.8890E-06	9160	NA
alpha-HCH (alpha-BHC)	319-84-6	2	6.70E-06	2.7392E-04	4.3284E-02	5.0574E-06	2807	NA
beta-HCH (beta-BHC)	319-85-7	0.24	4.40E-06	1.7988E-05	2.7667E-02	7.3955E-06	2807	NA
Heptachlor	76-44-8	0.18	2.94E-04	1.2020E-02	2.2344E-02	5.6959E-06	41260	NA
Heptachlor epoxide	1024-57-3	0.2	2.10E-05	8.5854E-04	2.4001E-02	6.2475E-06	10110	NA
Hexachlorobenzene	118-74-1	0.0062	1.70E-03	6.9501E-02	2.8974E-02	7.8497E-06	6195	NA
Hexachloro-1,3-butadiene	87-68-3	3.2	1.03E-02	4.2110E-01	2.6744E-02	7.0264E-06	845.2	NA
Hexachlorocyclopentadiene	77-47-4	1.8	2.70E-02	1.1038E+00	2.7238E-02	7.2170E-06	1404	NA
Hexachloroethane	67-72-1	50	3.89E-03	1.5904E-01	3.2094E-02	8.8904E-06	196.8	NA
n-Hexane	110-54-3	9.5	1.80E+00	7.3590E+01	7.3108E-02	8.1658E-06	131.5	NA
2-Hexanone	591-78-6	17200	9.32E-05	3.8103E-03	7.0356E-02	8.4404E-06	14.98	NA
Indeno(1,2,3-cd)pyrene	193-39-5	0.00019	3.48E-07	1.4227E-05	4.4784E-02	5.2327E-06	1951000	NA
Isophorone	78-59-1	12000	6.64E-06	2.7146E-04	5.2505E-02	7.5296E-06	65.15	NA
Isopropylbenzene	98-82-8	61.3	1.15E-02	4.7016E-01	6.0304E-02	7.8566E-06	697.8	NA
Lead (total)	7439-92-1	NA	NA	NA	NA	NA	NA	900
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	7.3	5.14E-06	2.1014E-04	4.3284E-02	5.0574E-06	2807	NA
Manganese (total)	7439-96-5	NA	NA	NA	NA	NA	NA	65
Mercury (total)	7439-97-6	NA	NA	NA	NA	NA	NA	0.20[1]
Methoxychlor	72-43-5	0.1	2.03E-07	8.2993E-06	2.2085E-02	5.5926E-06	26890	NA
Methyl acetate	79-20-9	243000	1.15E-04	4.7016E-03	9.5776E-02	1.1008E-05	3.064	NA
Methylene chloride (Dichloromethane)	75-09-2	13000	3.25E-03	1.3287E-01	9.9936E-02	1.2512E-05	21.73	NA
2-Methylnaphthalene	91-57-6	24.6	5.18E-04	2.1177E-02	5.2432E-02	7.7811E-06	2478	NA
4-Methyl-2-pentanone (MIBK)	108-10-1	19000	1.38E-04	5.6419E-03	6.9780E-02	8.3477E-06	12.6	NA
2-Methylphenol (o-cresol)	95-48-7	25900	1.20E-06	4.9060E-05	7.2835E-02	9.3168E-06	306.5	NA
4-Methylphenol (p-cresol)	106-44-5	21500	1.00E-06	4.0883E-05	7.2394E-02	9.2397E-06	300.4	NA
Methyl tert-butyl ether (MTBE)	1634-04-4	51000	5.87E-04	2.3998E-02	7.5267E-02	8.5904E-06	11.56	NA
Naphthalene	91-20-3	31	4.40E-04	1.7988E-02	6.0499E-02	8.3770E-06	1544	NA
Nickel (total)	7440-02-0	NA	NA	NA	NA	NA	NA	24[1]
4-Nitroaniline	100-01-6	728	1.26E-09	5.153E-08	6.3660E-02	9.7545E-06	109.1	NA
Nitrobenzene	98-95-3	2090	2.40E-05	9.8119E-04	6.8054E-02	9.4494E-06	226.4	NA
N-Nitrosodi-n-propylamine	621-64-7	13000	5.38E-06	2.1995E-04	5.6440E-02	7.7580E-06	275.4	NA
N-Nitrosodiphenylamine	86-30-6	35	1.21E-06	4.9648E-05	5.5886E-02	6.5299E-06	2632	NA
2,2'-oxybis (1-chloropropane)	108-60-1	1700	7.42E-05	3.0335E-03	3.9889E-02	7.3606E-06	82.92	NA
Pentachlorophenol	87-86-5	14	2.45E-08	1.0016E-06	2.9520E-02	8.0121E-06	5100[1]	NA
Phenol	108-95-2	82800	3.33E-07	1.3614E-05	8.3398E-02	1.0254E-05	187.2	NA
Polychlorinated biphenyls (PCBs)	1336-36-3	0.7	4.15E-04	1.6966E-02	2.4340E-02	6.2671E-06	78100	NA

Pyrene	129-00-0	0.135	1.19E-05	4.8651E-04	2.7787E-02	7.2479E-06	54340	NA
Selenium (total)	7782-49-2	NA	NA	NA	NA	NA	NA	14[1]
Silver (total)	7440-22-4	NA	NA	NA	NA	NA	NA	0.26[1]
Styrene	100-42-5	310	2.75E-03	1.1243E-01	7.1114E-02	8.7838E-06	446.1	NA
Tertiary butyl alcohol (TBA)	75-65-0	1000000[2]	9.05E-06[2]	3.6996E-04[2]	9.8500E-02[3]	1.1400E-05[3]	2.111[5]	NA
1,2,4,5-Tetrachlorobenzene	95-94-3	0.595	1.00E-03	4.0883E-02	3.1896E-02	8.7531E-06	2220	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.0002	5.00E-05	2.0442E-03	4.7028E-02	6.7568E-06	249100	NA
1,1,2,2-Tetrachloroethane	79-34-5	2830	3.67E-04	1.5004E-02	4.8921E-02	9.2902E-06	94.94	NA
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	206	1.77E-02	7.2363E-01	5.0466E-02	9.4551E-06	94.94	NA
2,3,4,6-Tetrachlorophenol	58-90-2	23	8.84E-06	3.6140E-04	5.0338E-02	5.8816E-06	3140[1]	NA
Toluene	108-88-3	526	6.64E-03	2.7146E-01	7.7804E-02	9.2043E-06	233.9	NA
Toxaphene	8001-35-2	0.55	6.00E-06	2.4530E-04	3.2439E-02	3.7902E-06	77200	NA
1,2,4-Trichlorobenzene	120-82-1	49	1.42E-03	5.8054E-02	3.9599E-02	8.4033E-06	1356	NA
1,1,1-Trichloroethane	71-55-6	1290	1.72E-02	7.0319E-01	6.4817E-02	9.5990E-06	43.89	NA
1,1,2-Trichloroethane	79-00-5	4590	8.24E-04	3.3688E-02	6.6890E-02	1.0026E-05	60.7	NA
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1280	9.85E-03	4.0270E-01	6.8662E-02	1.0221E-05	60.7	NA
Trichlorofluoromethane (Freon 11)	75-69-4	1100	9.70E-02	3.9657E+00	6.5356E-02	1.0048E-05	43.89	NA
2,4,5-Trichlorophenol	95-95-4	1200	1.62E-06	6.6230E-05	3.1394E-02	8.0893E-06	2340[1]	NA
2,4,6-Trichlorophenol	88-06-2	800	2.60E-06	1.0630E-04	3.1395E-02	8.0896E-06	999[1]	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	170	5.26E-01	2.1504E+01	3.7566E-02	8.5920E-06	196.8	NA
1,2,4-Trimethylbenzene	95-63-6	57	6.16E-03	2.5184E-01	6.0675E-02	7.9208E-06	614.3	NA
Vanadium (total)	7440-62-2	NA	NA	NA	NA	NA	NA	1000
Vinyl chloride	75-01-4	8800	2.78E-02	1.1365E+00	1.0712E-01	1.2004E-05	21.73	NA
Xylenes (total)	1330-20-7	106	6.63E-03	2.7105E-01	6.8515E-02	8.4640E-06	382.9	NA
Zinc (total)	7440-66-6	NA	NA	NA	NA	NA	NA	23[1]

NA = Not applicable

All values from USEPA Regional Screening Level Tables (http://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables, referenced May 2018), unless otherwise indicated. This website only posts the USEPA's most recent tables. Past tables may be obtained by contacting the USEPA.

[1] Kd or Koc value listed for pH 5.3 in Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, United States Environmental Protection Agency, Office of Emergency

and Remedial Response, Washington, DC, December 2002

(http://www.epa.gov/superfund/superfund-soil-screening-guidance)

[2] Experimental values from the USEPA's Estimation Program Interface Suite, V 4.11

(https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface)

[3] Calculated using the USEPA's WATER9 calculator, V 3.0.

(https://www3.epa.gov/ttn/chief/software/water/index.html)

[4] From the USEPA's WATER9 calculator, V 3.0 database

(https://www3.epa.gov/ttn/chief/software/water/index.html)

[5] Molecular Connectivity Index values from USEPA's Estimation Program Interface Suite, V 4.11

(https://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface)

APPENDIX 11

TOXICITY FACTORS USED IN THE DEVELOPMENT OF THE REMEDIATION STANDARDS

Table 1 – Soil Ingestion-Dermal Toxicity Factors

Contaminant	CAS No.	Soil Ingestion-dermal Recommendation	Soil Ingestion-dermal Toxicity Factor(s)
Acenaphthene	83-32-9	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1994) 0.06 mg/kg-day ABS 0.13
Acetone	67-64-1	IRIS RfD	IRIS RfD (2003) 0.9 mg/kg-day
Acetophenone	98-86-2	IRIS RfD	IRIS RfD (1989) 0.1 mg/kg-day
Aldrin	309-00-2	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1993) 17 (mg/kg-day)-1 IRIS RfD (1988) 0.00003 mg/kg-day
Aluminum	7429-90-5	PPRTV RfD	PPRTV RfD (2006) 1.0 mg/kg-day

Anthracene	120-12-7	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.3 mg/kg-day ABS 0.13
Antimony	7440-36-0	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1991) 0.0004 mg/kg-day GIABS 0.15
Arsenic	7440-38-2	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1998) 1.5 (mg/kg-day)-1 IRIS RfD (1993) 0.0003 mg/kg-day ABS 0.03
Atrazine	1912-24-9	IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	IRIS RfD (1993) 0.035 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Barium	7440-39-3	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (2005) 0.2 mg/kg-day GIABS 0.07
Benzaldehyde	100-52-7	PPRTV Slope Factor (SF) IRIS RfD	PPRTV SF (2015) 4E-03 (mg/kg-day)-1 IRIS RfD (1988) 0.1 mg/kg-day
Benzene	71-43-2	NJDWQI Slope Factor (SF) IRIS RfD[1]	NJDWQI SF (1994) 0.23 (mg/kg-day)-1 IRIS RfD (2003) 0.004 mg/kg-day
Benzo(a)anthracene	56-55-3	IRIS Slope Factor (SF)(benzo(a)pyrene - adjusted for benzo(a)pyrene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E-01(mg/kg-day)-1 (adjusted for benzo(a)anthracene) ABS 0.13
Benzo(a)pyrene	50-32-8	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E+00 (mg/kg-day)-1 IRIS RfD (2017) 3.0E-04 mg/kg-day ABS 0.13
Benzo(b)fluoranthene	205-99-2	IRIS Slope Factor (SF)(benzo(a)pyrene - adjusted for benzo(b)fluoranthene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E-01 (mg/kg-day)-1 (adjusted for benzo(b)fluoranthene) ABS 0.13
Benzo(k)fluoranthene	207-08-9		IRIS SF (2017) 1.0E-02(mg/kg-day)-1

		IRIS Slope Factor (SF)(benzo(a)pyrene - adjusted for benzo(k)fluoranthene) with a dermal absorption fraction (ABS)	(adjusted for benzo(k)fluoranthene) ABS 0.13
Beryllium	7440-41-7	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1998) 0.002 mg/kg-day GIABS 0.007
1,1'-Biphenyl	92-52-4	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2013) 0.008 (mg/kg-day)-1 IRIS RfD (2013) 0.5 mg/kg-day
Bis(2-chloroethoxy) methane	111-91-1	PPRTV RfD with a dermal absorption fraction (ABS)	PPRTV RfD (2006) 0.003 mg/kg-day ABS 0.1
Bis(2-chloroethyl) ether	111-44-4	IRIS Slope Factor (SF)	IRIS SF (1994) 1.1 (mg/kg-day)-1
Bis(2-ethylhexyl) phthalate	117-81-7	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1993) 0.014 (mg/kg-day)-1 IRIS RfD (2013) 0.02 mg/kg-day ABS 0.1
Bromodichloromethane	75-27-4	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1993) 0.062 (mg/kg-day)-1 IRIS RfD (1991) 0.02 mg/kg-day
Bromoform	75-25-2	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1991) 0.0079 (mg/kg-day)-1 IRIS RfD (1991) 0.02 mg/kg-day
Bromomethane	74-83-9	IRIS RfD	IRIS RfD (1991) 0.0014 mg/kg-day
2-Butanone	78-93-3	IRIS RfD[2]	IRIS RfD (2003) 0.6 mg/kg-day
Butylbenzylphthalate	85-68-7	PPRTV Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	PPRTV SF (2002) 0.0019 (mg/kg-day)-1 IRIS RfD (2013) 0.2 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Cadmium	7440-43-9	IRIS RfD with a dermal absorption fraction (ABS) and gastrointestinal absorption fraction (GIABS)	IRIS RfD (1994) 0.001 mg/kg-day ABS 0.001 GIABS 0.025
Caprolactam	105-60-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1988) 0.5 mg/kg-day ABS 0.1
Carbon disulfide	75-15-0	No ingestion-based toxicity factors are available	None

Carbon tetrachloride	56-23-5	NJDWQI Slope Factor (SF) IRIS RfD	NJDWQI SF (1994) 0.091 (mg/kg-day)-1 IRIS RfD (2011) 0.004 mg/kg-day
Chlordane (alpha plus gamma mixture)	57-74-9	NJDWQI Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	NJDWQI SF (2001) 2.3 (mg/kg-day)-1 IRIS RfD (1998) 0.0005 mg/kg-day ABS 0.04
4-Chloroaniline	106-47-8	PPRTV Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	PPRTV SF (2008) 0.2 (mg/kg-day)-1 IRIS RfD (1995) 0.004 mg/kg-day ABS 0.1
Chlorobenzene	108-90-7	NJDWQI RfD	NJDWQI RfD (1994) 0.0065 mg/kg-day
Chloroethane	75-00-3	No ingestion-based toxicity factors are available	None
Chloroform	67-66-3	IRIS RfD[3]	IRIS RfD (2001) 0.01 mg/kg-day
Chloromethane	74-87-3	No ingestion-based toxicity factors are available	None
2-Chloronaphthalene	91-58-7	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.08 mg/kg-day ABS 0.13
2-Chlorophenol	95-57-8	IRIS RfD	IRIS RfD (1993) 0.005 mg/kg-day
Chrysene	218-01-9	IRIS Slope Factor (SF) (benzo(a)pyrene – adjusted for chrysene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E-03 (mg/kg-day)-1 (adjusted for chrysene) ABS 0.13
Cobalt	7440-48-4	PPRTV RfD	PPRTV RfD (2008) 0.0003 mg/kg-day
Copper	7440-50-8	HEAST RfD	HEAST RfD (1997) 0.04 mg/kg-day
Cyanide	57-12-5	IRIS RfD	IRIS RfD (2010) 0.0006 mg/kg-day
Cyclohexane	110-82-7	No ingestion-based toxicity factors are available	None
4,4'-DDD	72-54-8	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1988) 0.24 (mg/kg-day)-1 ABS 0.1
4,4'-DDE	72-55-9	IRIS SF	IRIS SF (1988) 0.34 (mg/kg-day)-1
4,4'-DDT	50-29-3	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1991) 0.34 (mg/kg-day)-1 IRIS RfD (1996) 0.0005 mg/kg-day ABS 0.03

Dibenz(a,h)anthracene	53-70-3	IRIS Slope Factor (SF) (benzo(a)pyrene – adjusted for dibenz(a,h)anthracene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E+00 (mg/kg-day)-1 (adjusted for dibenz(a,h)anthracene) ABS 0.13
Dibromochloromethane	124-48-1	IRIS Slope Factor (SF) IRIS RfD and a Group C carcinogen factor	IRIS SF (1992) 0.084 (mg/kg-day)-1 IRIS RfD (1991) 0.02 mg/kg-day Group C carcinogen factor 10
1,2-Dibromo-3-chloropropane	96-12-8	PPRTV Slope Factor (SF) PPRTV RfD	PPRTV SF (2006) 0.8 (mg/kg-day)-1 PPRTV RfD (2006) 0.0002 mg/kg-day
1,2-Dibromoethane	106-93-4	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2004) 2.0 (mg/kg-day)-1 IRIS RfD (2004) 0.009 mg/kg-day
1,2-Dichlorobenzene	95-50-1	NJDWQI RfD	NJDWQI RfD (1994) 0.086 mg/kg-day
1,3-Dichlorobenzene	541-73-1	NJDWQI RfD	NJDWQI RfD (1994) 0.086 mg/kg-day
1,4-Dichlorobenzene	106-46-7	NJDWQI RfD with a Group C carcinogen factor[4]	NJDWQI RfD (1994) 0.01 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
3,3'-Dichlorobenzidine	91-94-1	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1993) 0.45 (mg/kg-day)-1 ABS 0.1
Dichlorodifluoromethane	75-71-8	IRIS RfD	IRIS RfD (1995) 0.2 mg/kg-day
1,1-Dichloroethane	75-34-3	CalEPA Slope Factor (SF) PPRTV RfD[5]	CalEPA SF (1992) 0.0057 (mg/kg-day)-1 PPRTV RfD (2006) 0.2 mg/kg-day
1,2-Dichloroethane	107-06-2	NJDWQI Slope Factor (SF)[6]	NJDWQI SF (1994) 0.12 (mg/kg-day)-1
1,1-Dichloroethene	75-35-4	NJDWQI RfD with a Group C carcinogen factor	NJDWQI RfD (1994) 0.00014 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
cis-1,2-Dichloroethene	156-59-2	NJDWQI RfD	NJDWQI RfD (1994) 0.01 mg/kg-day
trans-1,2-Dichloroethene	156-60-5	NJDWQI RfD	NJDWQI RfD (1994) 0.017 mg/kg-day
2,4-Dichlorophenol	120-83-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1988) 0.003 mg/kg-day ABS 0.1

1,2-Dichloropropane	78-87-5	PPRTV Slope Factor (SF) PPRTV RfD	PPRTV SF (2016) 0.037 (mg/kg-day)-1 PPRTV RfD (2016) 0.04 mg/kg-day
1,3-Dichloropropene (cis and trans)	542-75-6	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2000) 0.1 (mg/kg-day)-1 IRIS RfD (2000) 0.03 mg/kg-day
Dieldrin	60-57-1	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1993) 16 (mg/kg-day)-1 IRIS RfD (1990) 0.00005 mg/kg-day ABS 0.1
Diethylphthalate	84-66-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.8 mg/kg-day ABS 0.1
2,4-Dimethylphenol	105-67-9	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.02 mg/kg-day ABS 0.1
Di-n-butylphthalate	84-74-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.1 mg/kg-day ABS 0.1
2,4-Dinitrophenol	51-28-5	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1991) 0.002 mg/kg-day ABS 0.1
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1990) 0.68 (mg/kg-day)-1 ABS 0.1
Di-n-octylphthalate	117-84-0	PPRTV RfD with a dermal absorption fraction (ABS)	PPRTV RfD (2012) 0.01 mg/kg-day ABS 0.1
1,4-Dioxane	123-91-1	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2013) 0.1 (mg/kg-day)-1 IRIS RfD (2010) 0.03 mg/kg-day
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	IRIS RfD	IRIS RfD (1994) 0.006 mg/kg-day
Endrin	72-20-8	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1991) 0.0003 mg/kg-day ABS 0.1
Ethylbenzene	100-41-4	IRIS RfD[7]	IRIS RfD (1991) 0.1 mg/kg-day
Extractable Petroleum Hydrocarbons (EPH) (Category 1)	various	N.J.A.C. 7:26D – Appendix 2, Equation 5	See Table 1a – EPH Toxicity (below)
Extractable Petroleum Hydrocarbons (EPH) (Category 2)	various	N.J.A.C. 7:26D – Appendix 2, Equation 5	See Table 1a – EPH Toxicity (below)
Fluoranthene	206-44-0	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.04 mg/kg-day ABS 0.13

Fluorene	86-73-7	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.04 mg/kg-day ABS 0.13
alpha-HCH (alpha-BHC)	319-84-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) ATSDR RfD with a dermal absorption fraction (ABS)	IRIS SF (1993) 6.3 (mg/kg-day)-1 ATSDR RfD (2013) 0.008 mg/kg-day ABS 0.1
beta-HCH (beta-BHC)	319-85-7	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) and Group C carcinogen factor	IRIS SF (1993) 1.8 (mg/kg-day)-1 ABS 0.1 Group C carcinogen factor 10
Heptachlor	76-44-8	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1993) 4.5 (mg/kg-day)-1 IRIS RfD (1991) 0.0005 mg/kg-day
Heptachlor epoxide	1024-57-3	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1993) 9.1 (mg/kg-day)-1 IRIS RfD (1991) 0.000013 mg/kg-day
Hexachlorobenzene	118-74-1	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1996) 1.6 (mg/kg-day)-1 IRIS RfD (1991) 0.0008 mg/kg-day
Hexachloro-1,3-butadiene	87-68-3	IRIS Slope Factor (SF) PPRTV RfD and a Group C carcinogen factor	IRIS SF (1991) 0.078 (mg/kg-day)-1 PPRTV RfD (2007) 0.001 mg/kg-day Group C carcinogen factor 10
Hexachlorocyclopentadiene	77-47-4	IRIS RfD	IRIS RfD (2001) 0.006 mg/kg-day
Hexachloroethane	67-72-1	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2011) 0.04 (mg/kg-day)-1 IRIS RfD (2003) 0.0007 mg/kg-day
n-Hexane	110-54-3	No ingestion-based toxicity factors are available[17]	None
2-Hexanone	591-78-6	IRIS RfD	IRIS RfD (2009) 0.005 mg/kg-day
Indeno(1,2,3-cd) pyrene	193-39-5	IRIS Slope Factor (SF) (benzo(a)pyrene – adjusted for indeno(1,2,3-cd)pyrene) with a dermal absorption fraction (ABS).	IRIS SF (2017) 1.0E-01(mg/kg-day)-1 (adjusted for indeno(1,2,3-cd)pyrene) ABS 0.13
Isophorone	78-59-1	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1992) 0.00095 (mg/kg-day)-1 IRIS RfD (2003) 0.2 mg/kg-day ABS 0.1 Group C carcinogen factor 10

		and a Group C carcinogen factor	
Isopropylbenzene	98-82-8	IRIS RfD	IRIS RfD (1997) 0.1 mg/kg-day
Lead	7439-92-1	USEPA IEUBK model for children USEPA ALM for adults	IEUBK (1994) Children ALM (1996) Adults
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	CalEPA Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	CalEPA SF (1992) 1.1 (mg/kg-day)-1 IRIS RfD (1988) 0.0003 mg/kg-day ABS 0.04
Manganese	7439-96-5	EPA RSL RfD	EPA RSL RfD (2018) 0.024 mg/kg-day
Mercury	7439-97-6	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1995) 0.0003 mg/kg-day GIABS 0.07
Methoxychlor	72-43-5	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1991) 0.005 mg/kg-day ABS 0.1
Methyl acetate	79-20-9	HEAST RfD	HEAST RfD (1997) 1.0 mg/kg-day
Methylene chloride	75-09-2	NJDWQI Slope Factor (SF) IRIS RfD	NJDWQI SF (1994) 0.014 (mg/kg-day)-1 IRIS RfD (2011) 0.006 mg/kg-day
2-Methylnaphthalene	91-57-6	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (2003) 0.004 mg/kg-day ABS 0.13
4-Methyl-2-pentanone	108-10-1	No ingestion-based toxicity factors are available	None
2-Methylphenol	95-48-7	IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	IRIS RfD (2008) 0.05 mg/kg-day ABS 0.1 Group C carcinogen factor 10
4-Methylphenol	106-44-5	ATSDR RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	ATSDR RfD (2013) 0.1 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Methyl tert-butyl ether (MTBE)	1634-04-4	NJDWQI RfD with a Group C carcinogen factor[8]	NJDWQI RfD (1994) 0.01 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
Naphthalene	91-20-3	NJDWQI RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	NJDWQI RfD (1994) 0.041 mg/kg-day ABS 0.13 (RfD includes Group C Carcinogen factor adjustment of 10)

Nickel	7440-02-0	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1996) 0.02 mg/kg-day GIABS 0.04
4-Nitroaniline	100-01-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) PPRTV RfD with a dermal absorption fraction (ABS)	IRIS SF (2009) 0.02 (mg/kg-day)-1 PPRTV RfD (2009) 0.004 mg/kg-day ABS 0.1
Nitrobenzene	98-95-3	IRIS RfD	IRIS RfD (2009) 0.002 mg/kg-day
N-Nitroso-di-n-propylamine	621-64-7	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1993) 7.0 (mg/kg-day)-1 ABS 0.1
N-Nitrosodiphenylamine	86-30-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1993) 0.0049 (mg/kg-day)-1 ABS 0.1
2,2'-Oxybis(1-choloropropane)	108-60-1	IRIS RfD	IRIS RfD (1991) 0.04 mg/kg-day
Pentachlorophenol	87-86-5	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (2010) 0.4 (mg/kg-day)-1 IRIS RfD (2010) 0.005 mg/kg-day ABS 0.25
Phenol	108-95-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (2002) 0.3 mg/kg-day ABS 0.1
Polychlorinated biphenyls (PCBs)	1336-36-3	NJDWQI Slope Factor (SF) with a dermal absorption fraction (ABS)	NJDWQI SF (1994) 2 (mg/kg-day)-1 ABS 0.14
Pyrene	129-00-0	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.03 mg/kg-day ABS 0.13
Selenium	7782-49-2	IRIS RfD	IRIS RfD (1991) 0.005 mg/kg-day
Silver	7440-22-4	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1996) 0.005 mg/kg-day GIABS 0.04
Styrene	100-42-5	IRIS RfD	IRIS RfD (1990) 0.2 mg/kg-day
Tertiary butyl alcohol (TBA)	75-65-0	NJDEP RfD with a Group C carcinogen factor	NJDEP RfD (1997) 0.018 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
1,2,4,5-Tetrachlorobenzene	95-94-3	IRIS RfD	IRIS RfD (1991) 0.0003 mg/kg-day
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (2012) 7E-10 mg/kg-day ABS 0.03
1,1,2,2-Tetrachloroethane	79-34-5	IRIS Slope Factor (SF) IRIS RfD[9]	IRIS SF (2010) 0.2 (mg/kg-day)-1

			IRIS RfD (2010) 0.02 mg/kg-day
Tetrachloroethene (PCE)	127-18-4	IRIS Slope Factor (SF) IRIS RfD[10]	IRIS SF (2012) 0.0021 (mg/kg-day)-1 IRIS RfD (2012) 0.006 mg/kg-day
2,3,4,6-Tetrachlorophenol	58-90-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1992) 0.03 mg/kg-day ABS 0.1
Toluene	108-88-3	IRIS RfD	IRIS RfD (2005) 0.08 mg/kg-day
Toxaphene	8001-35-2	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1991) 1.1 (mg/kg-day)-1 ABS 0.1
1,2,4-Trichlorobenzene	120-82-1	IRIS RfD[11]	IRIS RfD (1996) 0.01 mg/kg-day
1,1,1-Trichloroethane	71-55-6	IRIS RfD[12]	IRIS RfD (2007) 2 mg/kg-day
1,1,2-Trichloroethane	79-00-5	IRIS Slope Factor (SF) IRIS RfD with a Group C carcinogen factor[13]	IRIS SF (1994) 0.057 (mg/kg-day)-1 IRIS RfD (1994) 0.004 mg/kg-day Group C carcinogen factor 10
Trichloroethene (TCE)	79-01-6	IRIS Slope Factor (SF)[14] IRIS RfD	IRIS SF (2011) 0.046 (mg/kg-day)-1 IRIS RfD (2011) 0.0005 mg/kg-day
Trichlorofluoromethane	75-69-4	IRIS RfD	IRIS RfD (1992) 0.3 mg/kg-day
2,4,5-Trichlorophenol	95-95-4	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1988) 0.1 mg/kg-day ABS 0.1
2,4,6-Trichlorophenol	88-06-2	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) PPRTV RfD with a dermal absorption fraction (ABS)	IRIS SF (1994) 0.011 (mg/kg-day)-1 PPRTV RfD (2007) 0.001 mg/kg-day ABS 0.1
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	No ingestion-based toxicity factors are available[15]	None
1,2,4-Trimethylbenzene	95-63-6	IRIS RfD	IRIS RfD (2016) 0.01 mg/kg-day
Vanadium	7440-62-2	EPA RSL RfD with a gastrointestinal absorption fraction (GIABS)	EPA RSL RfD (2018) 0.005 mg/kg-day GIABS 0.026
Vinyl Chloride	75-01-4	IRIS Slope Factor (SF) IRIS RfD[16]	IRIS SF (2000) 0.72 (mg/kg-day)-1 IRIS RfD (2000) 0.003 mg/kg-day

Xylenes	1330-20-7	NJDWQI RfD	NJDWQI RfD (1994) 0.15 mg/kg-day
Zinc	7440-66-6	IRIS RfD	IRIS RfD (2005) 0.3 mg/kg-day

Table 1a – EPH Toxicity

Applies to both:

EPH - Category 1 (Number 2 Heating Oil/Diesel Fuel)

EPH - Category 2 (Heavier petroleum products)

Note: EPH excludes lighter petroleum products including gasoline and mineral spirits

Effective Carbon Range Aliphatics	Surrogate	Toxicity Factor	Toxicity Factor Reference Source
9 - 12	PHC Mixture	RfD 0.10 mg/kg-day ABS 0.1	Canada 2000 and MADEP 2003
12 - 16	PHC Mixture	RfD 0.10 mg/kg-day ABS 0.1	Canada 2000 and MADEP 2003
16 - 21	White Mineral Oil	RfD 2.0 mg/kg-day ABS 0.1	TPHCWG 1997 and MADEP 2003
21 - 40	White Mineral Oil	RfD 2.0 mg/kg-day ABS 0.1	TPHCWG 1997 and MADEP 2003
Effective Carbon Range Aromatics	Surrogate	Toxicity Factor	Toxicity Factor Reference Source
10 - 12	Naphthalene	RfD 0.041 mg/kg-day ABS 0.13	NJDWQI (1994)
12 - 16	Acenaphthene	RfD 0.06 mg/kg-day ABS 0.13	IRIS (1994)
16 - 21	Fluorene	RfD 0.04 mg/kg-day ABS 0.13	IRIS (1990)
21 - 36	Fluoranthene	RfD 0.04 mg/kg-day ABS 0.13	IRIS (1993)

[1] Both the NJDWQI slope factor and IRIS RfD for benzene are based on a route to route conversion of an inhalation study, which was determined to be acceptable by the USEPA as

substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[2] Although a NJDWQI RfD for 2-butanone exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route to route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route to route conversion of toxicity factors.

[3] Although a CalEPA slope factor for chloroform exists, the USEPA believes there is a threshold effect for cancer. As such, an RfD based soil remediation standard is protective of both cancer and non-cancer health endpoints.

[4] Although a CalEPA Slope Factor for 1,4-dichlorobenzene exists, there are questions about the study used to develop the slope factor. As such, the Department has decided not to develop an ingestion-dermal soil remediation standard for 1,4-dichlorobenzene using this slope factor.

[5] Although a NJDWQI RfD for 1,1-dichloroethane exists, it is based on an inhalation route to route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route to route conversion of toxicity factors.

[6] Although a PPRTV RfD for 1,2-dichloroethane exists, it is listed as an appendix value. PPRTV appendix values are based on a study(s) that has flaws as determined by the USEPA. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop soil remediation standards.

[7] Although a CalEPA slope factor for ethylbenzene exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors.

[8] Although a CalEPA slope factor for methyl tert-butyl ether exists, there are questions about the study used to develop the slope factor. As such, the Department has decided not to develop an ingestion-dermal soil remediation standard for methyl tert-butyl ether using this slope factor.

[9] Although an NJDWQI RfD for 1,1,2,2-tetrachloroethane exists, the Department has decided to use an IRIS RfD to develop a non-cancer-based ingestion-dermal soil remediation standard as the IRIS RfD is based on a newer toxicology assessment.

[10] Although an NJDWQI slope factor for tetrachloroethene exists, the Department has decided that the existing IRIS Slope Factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard. The IRIS slope factor uses the newest PBPK models (extrapolating from an inhalation unit risk factor to an oral slope factor). An ingestion-dermal soil remediation standard for tetrachloroethene can also be developed using an IRIS RfD. The RfD uses the newest PBPK models (extrapolating from an inhalation RfC to oral RfD).

[11] Although an NJDWQI RfD for 1,2,4-trichlorobenzene exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors. In addition, a USEPA

PPRTV slope factor for 1,2,4-trichlorobenzene is available, however the Slope Factor is based on a controversial mouse liver tumor study that many researchers have dismissed. The Department has decided not to develop an ingestion-dermal soil remediation standard based on the PPRTV slope factor.

[12] Although an NJDWQI RfD for 1,1,1-trichloroethane exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with USEPA policy concerning route-to-route conversion of toxicity factors.

[13] Although an NJDWQI slope factor for 1,1,2-trichloroethane exists, the Department determined that the IRIS slope factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard.

[14] Although an NJDWQI slope factor for trichloroethene exists, the Department determined that the IRIS slope factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard. The IRIS slope factor uses the newest PBPK models (extrapolating from an inhalation unit risk factor to an oral slope factor).

[15] Although an IRIS RfD for 1,1,2-Trichloro-1,2,2-trifluoroethane exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with USEPA policy concerning route-to-route conversion of toxicity factors.

[16] Although an NJDWQI slope factor exists for vinyl chloride, the Department determined that the IRIS slope factor is a scientifically better toxicity value to develop a cancer-based ingestion – dermal soil remediation standard.

[17] Although a NJDWQI RfD (1994) for n-hexane exists, it is based on an inhalation route to route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route to route conversion of toxicity factors. This policy conforms with USEPA policy concerning route to route conversion of toxicity factors.

Table 2 – Soil Inhalation Toxicity Factors

Contaminant	CAS No.	Soil Inhalation Recommendation	Soil Inhalation Toxicity Factor(s)
Acenaphthene	83-32-9	No inhalation-based toxicity factors are available[18]	None
Acetone	67-64-1	No inhalation-based toxicity factors are available[1]	None
Acetophenone	98-86-2	No inhalation-based toxicity factors are available[2]	None
Aldrin	309-00-2	No inhalation-based toxicity factors are available[17]	None
Aluminum	7429-90-5	PPRTV RfC	PPRTV RfC (2006) 5E-03 mg/m3
Anthracene	120-12-7	No inhalation-based toxicity factors are available[18]	None
Antimony	7440-36-0	No inhalation-based toxicity factors are available[19]	None
Arsenic	7440-38-2	IRIS IUR	IRIS IUR (1998) 4.3E-03 (ug/m3)-1
Atrazine	1912-24-9	No inhalation-based toxicity factors are available	None
Barium	7440-39-3	HEAST RfC	HEAST RfC (1997) 5E-04 mg/m3
Benzaldehyde	100-52-7	No inhalation-based toxicity factors are available	None

Benzene	71-43-2	IRIS IUR IRIS RfC	IRIS IUR (2000) 7.8E-06 (ug/m3)-1 IRIS RfC (2003) 3E-02 mg/m3
Benzo(a)anthracene	56-55-3	IRIS IUR (benzo(a)pyrene) adjusted for benzo(a)anthracene	IRIS IUR (2017) 6.0E-05 (ug/m3)-1 (adjusted for benzo(a)anthracene)
Benzo(a)pyrene	50-32-8	IRIS IUR IRIS RfC	IRIS IUR (2017) 6.0E-04 (ug/m3)-1 IRIS RfC (2017) 2.0E-06 mg/m3
Benzo(b)fluoranthene	205-99-2	IRIS IUR (benzo(a)pyrene) adjusted for benzo(b)fluoranthene	IRIS IUR (2017) 6.0E-05 (ug/m3)-1 (adjusted for benzo(b)fluoranthene)
Benzo(k)fluoranthene	207-08-9	IRIS IUR (benzo(a)pyrene) adjusted for benzo(k) fluoranthene	IRIS IUR (2017) 6.0E-06 (ug/m3)-1 (adjusted for benzo(k) fluoranthene)
Beryllium	7440-41-7	IRIS IUR IRIS RfC	IRIS IUR (1998) 2.4E-03 (ug/m3)-1 IRIS RfC (1998) 2E-05 mg/m3
1,1'-Biphenyl	92-52-4	No inhalation-based toxicity factors are available	None
Bis(2-chloroethoxy) methane	111-91-1	No inhalation-based toxicity factors are available	None
Bis(2-chloroethyl) ether	111-44-4	No inhalation-based toxicity factors are available[17]	None
Bis(2-ethylhexyl) phthalate	117-81-7	No inhalation-based toxicity factors are available[17]	None
Bromodichloromethane	75-27-4	No inhalation-based toxicity factors are available[17]	None
Bromoform	75-25-2	No inhalation-based toxicity factors are available[17]	None
Bromomethane	74-83-9	IRIS RfC	IRIS RfC (1992) 5E-03 mg/m3
2-Butanone	78-93-3	IRIS RfC[3]	IRIS RfC (2003) 5E+00 mg/m3
Butylbenzylphthalate	85-68-7	No inhalation-based toxicity factors are available	None
Cadmium	7440-43-9	IRIS IUR ATSDR RfC	IRIS IUR (1992) 1.8E-03 (ug/m3)-1 ATSDR RfC (2013) 1E-05 mg/m3
Caprolactam	105-60-2	CalEPA RfC	CalEPA RfC (2013) 2.2E-03 mg/m3
Carbon disulfide	75-15-0	IRIS RfC	IRIS RfC (1995) 7E-01 mg/m3

Carbon tetrachloride	56-23-5	IRIS IUR IRIS RfC	IRIS IUR (2010) 6E-06 (ug/m3)-1 IRIS RfC (2010) 1E-01 mg/m3
Chlordane (alpha plus gamma mixture)	57-74-9	IRIS RfC	IRIS RfC (1998) 7E-04 mg/m3
4-Chloroaniline	106-47-8	No inhalation-based toxicity factors are available	None
Chlorobenzene	108-90-7	PPRTV RfC	PPRTV RfC (2006) 5E-02 mg/m3
Chloroethane	75-00-3	IRIS RfC	IRIS RfC (1991) 1E+01 mg/m3
Chloroform	67-66-3	ATSDR RfC No other inhalation-based toxicity factors are available[17]	ATSDR RfC (2013) 9.8E-02 mg/m3
Chloromethane	74-87-3	IRIS RfC[4]	IRIS RfC (2001) 9E-02 mg/m3
2-Chloronaphthalene	91-58-7	No inhalation-based toxicity factors are available	None
2-Chlorophenol	95-57-8	No inhalation-based toxicity factors are available[17]	None
Chrysene	218-01-9	IRIS IUR (benzo(a)pyrene) adjusted for chrysene	IRIS IUR (2017) 6.0E-07 (ug/m3)-1 (adjusted for chrysene)
Cobalt	7440-48-4	PPRTV IUR PPRTV RfC	PPRTV IUR (2008) 9E-03(ug/m3)-1 PPRTV RfC (2008) 6E-06 mg/m3
Copper	7440-50-8	No inhalation-based toxicity factors are available[5]	None
Cyanide	57-12-5	IRIS RfC	IRIS RfC (2010) 8E-04 mg/m3
Cyclohexane	110-82-7	IRIS RfC	IRIS RfC (2003) 6E+00 mg/m3
4,4'-DDD	72-54-8	No inhalation-based toxicity factors are available[17]	None
4,4'-DDE	72-55-9	No inhalation-based toxicity factors are available[17]	None
4,4'-DDT	50-29-3	No inhalation-based toxicity factors are available[17]	None
Dibenz(a,h)anthracene	53-70-3	IRIS IUR (benzo(a)pyrene) adjusted for dibenzo(a,h) anthracene	IRIS IUR (2017) 6.0E-04(ug/m3)-1 (adjusted for dibenzo(a,h) anthracene)
Dibromochloromethane	124-48-1	No inhalation-based toxicity factors are available[17]	None
1,2-Dibromo-3-chloropropane	96-12-8	PPRTV IUR IRIS RfC	PPRTV IUR (2006) 6E-03 (ug/m3)-1 IRIS RfC (1991) 2E-04 mg/m3

1,2-Dibromoethane	106-93-4	IRIS IUR IRIS RfC	IRIS IUR (2004) 6E-04 (ug/m3)-1 IRIS RfC (2004) 9E-03 mg/m3
1,2-Dichlorobenzene	95-50-1	HEAST RfC	HEAST RfC (1997) 2E-01 mg/m3
1,3-Dichlorobenzene	541-73-1	No inhalation-based toxicity factors are available	None
1,4-Dichlorobenzene	106-46-7	IRIS RfC No other inhalation-based toxicity factors are available[17]	IRIS RfC (1994) 8E-01 mg/m3
3,3'-Dichlorobenzidine	91-94-1	No inhalation-based toxicity factors are available	None
Dichlorodifluoromethane	75-71-8	No inhalation-based toxicity factors are available[6]	None
1,1-Dichloroethane	75-34-3	No inhalation-based toxicity factors are available[7]	None
1,2-Dichloroethane	107-06-2	PPRTV RfC No other inhalation-based toxicity factors are available[17]	PPRTV RfC (2010) 7E-03 mg/m3
1,1-Dichloroethene	75-35-4	A soil inhalation remediation standard can be developed using an IRIS RfC with a Group C carcinogen factor	IRIS RfC (2002/2005) 2E-01 mg/m3 RfC Group C carcinogen factor 10
cis-1,2-Dichloroethene	156-59-2	No inhalation-based toxicity factors are available	None
trans-1,2-Dichloroethene	156-60-5	No inhalation-based toxicity factors are available[8]	None
2,4-Dichlorophenol	120-83-2	No inhalation-based toxicity factors are available[17]	None
1,2-Dichloropropane	78-87-5	PPRTV IUR IRIS RfC	PPRTV IUR (2016) 3.7E-06 (ug/m3)-1 IRIS RfC (1991) 4E-03 mg/m3
1,3-Dichloropropene (cis and trans)	542-75-6	IRIS IUR IRIS RfC	IRIS IUR (2000) 4E-06 (ug/m3)-1 IRIS RfC (2000) 2E-02 mg/m3
Dieldrin	60-57-1	No inhalation-based toxicity factors are available	None
Diethylphthalate	84-66-2	No inhalation-based toxicity factors are available[17]	None
2,4-Dimethylphenol	105-67-9	No inhalation-based toxicity factors are available[17]	None
Di-n-butylphthalate	84-74-2	No inhalation-based toxicity factors are available[17]	None
2,4-Dinitrophenol	51-28-5	No inhalation-based toxicity factors are available[17]	None
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	No inhalation-based toxicity factors are available[17]	None

Di-n-octylphthalate	117-84-0	No inhalation-based toxicity factors are available[9]	None
1,4-Dioxane	123-91-1	IRIS IUR IRIS RfC	IRIS IUR (2013) 5.0E-06 (ug/m3)-1 IRIS RfC (2013) 3E-02 mg/m3
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	No inhalation-based toxicity factors are available[17]	None
Endrin	72-20-8	No inhalation-based toxicity factors are available[17]	None
Ethylbenzene	100-41-4	CalEPA IUR IRIS RfC	CalEPA IUR (2007) 2.5E-06 (ug/m3)-1 IRIS RfC (1991) 1E+00 mg/m3
Extractable Petroleum Hydrocarbons (EPH) (Category 1)	various	No inhalation-based toxicity factors are available	None
Extractable Petroleum Hydrocarbons (EPH) (category 2)	various	No inhalation-based toxicity factors are available	None
Fluoranthene	206-44-0	No inhalation-based toxicity factors are available[18]	None
Fluorene	86-73-7	No inhalation-based toxicity factors are available[18]	None
alpha-HCH (alpha-BHC)	319-84-6	No inhalation-based toxicity factors are available[17]	None
beta-HCH (beta-BHC)	319-85-7	No inhalation-based toxicity factors are available[17]	None
Heptachlor	76-44-8	No inhalation-based toxicity factors are available[17]	None
Heptachlor epoxide	1024-57-3	No inhalation-based toxicity factors are available[17]	None
Hexachlorobenzene	118-74-1	No inhalation-based toxicity factors are available[17]	None
Hexachloro-1,3-butadiene	87-68-3	No inhalation-based toxicity factors are available[17]	None
Hexachlorocyclopentadiene	77-47-4	IRIS RfC	IRIS RfC (2001) 2E-04 mg/m3
Hexachloroethane	67-72-1	IRIS RfC	IRIS RfC (2011) 3E-02 mg/m3
n-Hexane	110-54-3	IRIS RfC	IRIS RfC (2005) 7E-01 mg/m3
2-Hexanone	591-78-6	IRIS RfC	IRIS RfC (2009) 3E-02 mg/m3
Indeno(1,2,3,-cd) pyrene	193-39-5	IRIS IUR (benzo(a)pyrene) adjusted for indeno(1,2,3,-cd) pyrene.	IRIS IUR (2017) 6.0E-05 (ug/m3)-1 (adjusted for indeno(1,2,3,-cd) pyrene)
Isophorone	78-59-1	CalEPA RfC	CalEPA RfC (2001) 2E-00 mg/m3

Isopropylbenzene	98-82-8	IRIS RfC	IRIS RfC (1997) 4E-01 mg/m3
Lead	7439-92-1	No inhalation-based toxicity factors are available[17]	None
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	No inhalation-based toxicity factors are available[17]	None
Manganese	7439-96-5	IRIS RfC	IRIS RfC (1993) 5E-05 mg/m3
Mercury	7439-97-6	IRIS RfC	IRIS RfC (1995) 3E-04 mg/m3
Methoxychlor	72-43-5	No inhalation-based toxicity factors are available[17]	None
Methyl acetate	79-20-9	No inhalation-based toxicity factors are available	None
Methylene chloride	75-09-2	IRIS IUR IRIS RfC	IRIS IUR (2011) 1E-08 (ug/m3)-1 IRIS RfC (2011) 6E-01 mg/m3
2-Methylnaphthalene	91-57-6	No inhalation-based toxicity factors are available[18]	None
4-Methyl-2-pentanone	108-10-1	IRIS RfC	IRIS RfC (2003) 3E+00 mg/m3
2-Methylphenol	95-48-7	No inhalation-based toxicity factors are available[17]	None
4-Methylphenol	106-44-5	No inhalation-based toxicity factors are available[17]	None
Methyl tert-butyl ether (MTBE)	1634-04-4	CalEPA IUR IRIS RfC with a Group C carcinogen factor	CalEPA IUR (1999) 2.6E-07 (ug/m3)-1 IRIS RfC (1993) 3E+00 mg/m3 Group C carcinogen factor 10
Naphthalene	91-20-3	CalEPA IUR IRIS RfC with a Group C carcinogen factor	CalEPA IUR (2011) 3.4E-05 (ug/m3)-1 IRIS RfC (1998) 3E-03 mg/m3 Group C carcinogen factor 10
Nickel	7440-02-0	IRIS IUR CalEPA RfC	IRIS IUR (1987/2006) 2.4E-04 (ug/m3)-1 CalEPA RfC (2012) 1.4E-05 mg/m3
4-Nitroaniline	100-01-6	PPRTV RfC	PPRTV RfC (2009) 6E-03 mg/m3
Nitrobenzene	98-95-3	IRIS IUR IRIS RfC.	IRIS IUR (2009) 4E-05 (ug/m3)-1 IRIS RfC (2009) 9E-03 mg/m3
N-Nitroso-di-n- propylamine	621-64-7	No inhalation-based toxicity factors are available[17]	None

N-Nitrosodiphenylamine	86-30-6	No inhalation-based toxicity factors are available[17]	None
2,2'-Oxybis(1-choloropropane)	108-60-1	No inhalation-based toxicity factors are available	None
Pentachlorophenol	87-86-5	No inhalation-based toxicity factors are available[17]	None
Phenol	108-95-2	CalEPA RfC	CalEPA RfC (2000) 2E-01 mg/m3
Polychlorinated biphenyls (PCBs)	1336-36-3	No inhalation-based toxicity factors are available[17]	None
Pyrene	129-00-0	No inhalation-based toxicity factors are available[18]	None
Selenium	7782-49-2	No inhalation-based toxicity factors are available	None
Silver	7440-22-4	No inhalation-based toxicity factors are available[17]	None
Styrene	100-42-5	IRIS RfC[10]	IRIS RfC (1992) 1E+00 mg/m3
Tertiary butyl alcohol (TBA)	75-65-0	No inhalation-based toxicity factors are available[17]	None
1,2,4,5-Tetrachlorobenzene	95-94-3	No inhalation-based toxicity factors are available	None
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	No inhalation-based toxicity factors are available	None
1,1,2,2-Tetrachloroethane	79-34-5	No inhalation-based toxicity factors are available[17]	None
Tetrachloroethene (PCE)	127-18-4	IRIS IUR IRIS RfC	IRIS IUR (2012) 2.6E-07 (ug/m3)-1 IRIS RfC (2012) 4E-02 mg/m3
2,3,4,6-Tetrachlorophenol	58-90-2	No inhalation-based toxicity factors are available	None
Toluene	108-88-3	IRIS RfC	IRIS RfC (2005) 5E+00 mg/m3
Toxaphene	8001-35-2	No inhalation-based toxicity factors are available[17]	None
1,2,4-Trichlorobenzene	120-82-1	PPRTV RfC	PPRTV RfC (2009) 2E-03 mg/m3
1,1,1-Trichloroethane	71-55-6	IRIS RfC[11]	IRIS RfC (2007) 5E+00 mg/m3
1,1,2-Trichloroethane	79-00-5	No inhalation-based toxicity factors are available[12]	None
Trichloroethene (TCE)	79-01-6	IRIS IUR IRIS RfC[13]	IRIS IUR (2011) 4.1E-06 (ug/m3)-1 IRIS RfC (2011) 2E-03 mg/m3
Trichlorofluoromethane	75-69-4	No inhalation-based toxicity factors are available[14]	None
2,4,5-Trichlorophenol	95-95-4	No inhalation-based toxicity factors are available[17]	None

2,4,6-Trichlorophenol	88-06-2	No inhalation-based toxicity factors are available[17]	None
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	PPRTV RfC	PPRTV RfC (2016) 5E+00 mg/m3
1,2,4-Trimethylbenzene	95-63-6	IRIS RfC	IRIS RfC (2016) 6E-02 mg/m3
Vanadium	7440-62-2	ATSDR RfC	ATSDR RfC (2012) 1E-04 mg/m3
Vinyl Chloride	75-01-4	IRIS IUR IRIS RfC[15]	IRIS IUR (2000) 4.4E-06 (ug/m3)-1 IRIS RfC (2000) 1E-01 mg/m3
Xylenes	1330-20-7	IRIS RfC	IRIS RfC (2003) 1.E-01 mg/m3
Zinc	7440-66-6	No inhalation-based toxicity factors are available[16]	None

[1] An ATSDR RfC exists for acetone using the results of the Stewart 1975 study. The USEPA IRIS notes that this study should only be used in the development of a short-term exposure RfC and not a long-term (chronic) exposure RfC.

[2] A HEAST RfC exists for acetophenone, but a subsequent PPRTV review (2010) questions the use of the HEAST RfC.

[3] A NJDWQI RfC exists for 2-butanone, but the IRIS RfC has been determined by the Department to be more appropriate. The existing NJDWQI RfC is based on a route-to-route conversion of a NJDWQI RfD. The Department’s Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with USEPA policy concerning route-to-route conversion of toxicity factors.

[4] A HEAST IUR exists for chloromethane, but a subsequent PPRTV review (2012) states that the use of the HEAST IUR is "Inadequate for an assessment of carcinogenic potential."

[5] A CalEPA RfC that once existed for copper has been retracted by CalEPA.

[6] A HEAST RfC and a PPRTV RfC exist for dichlorodifluoromethane. Both RfCs are derived using the same study (Prendergast 1967). The PPRTV is listed as an appendix value. The PPRTV RfC is listed as an appendix value because the Prendergast study was determined by the USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop soil remediation standards. As the HEAST RfC developed using the Prendergast study, the Department decided not to use this RfC in the development of a soil remediation standard.

[7] A HEAST RfC exists for 1,1-dichloroethane, but a subsequent PPRTV review (2006) indicated that data were inadequate to derive a chronic exposure RfC for 1,1-dichloroethane. A CalEPA IUR also exists for 1,1-dichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors.

[8] A PPRTV RfC exists for trans-1,2-dichloroethene but a subsequent IRIS assessment (2010) stated "the available inhalation data from the Freund study are insufficient to support reference value derivation and RfC."

[9] A 1985 USEPA IUR that once existed for di-n-octylphthalate has been retracted by the USEPA.

[10] A HEAST 1991 IUR exists for styrene but USEPA NCEA does not recommend its use.

[11] Although an NJDWQI RfC exists for 1,1,1-trichloroethane, the Department determined that the IRIS RfC is a scientifically better toxicity value to develop a non-cancer-based soil inhalation remediation standard.

[12] Although a PPRTV RfC for 1,1,2-trichloroethane exists, it is listed as an Appendix value. The PPRTV Appendix value is based on a study that was determined by USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV Appendix values to develop soil remediation standards. An IRIS IUR also exists for 1,1,2-trichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors.

[13] The IRIS RfC for trichloroethene is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[14] A HEAST RfC exists for trichlorofluoromethane, but a subsequent PPRTV review (2009) indicated that data used to derive the RfC were inadequate.

[15] The IRIS RfC for vinyl chloride is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[16] A CalEPA RfC that once existed for zinc has been retracted by CalEPA.

[17] There is an inhalation toxicity factor available for this contaminant, but it is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted with physiologically-based pharmacokinetic modeling, for the development of soil remediation standards based on route-to-route conversion of toxicity factors.

[18] The 2008 inhalation toxicity factor was based on an equivalency factor from Nisbet and LaGoy (1992). Nisbet and LaGoy did not conduct any original research and relied on studies using dermal application and subcutaneous injection, with one study using intrapulmonary administration (not inhalation). This Nisbet and LaGoy study develops TEFs for PAHs compared to B[a]P. The Department did not use this study because it was not derived from an inhalation study.

[19] The former IRIS RfC was withdrawn.

Table 3 – Indoor Air Toxicity Factors

Contaminant	CAS No.	VI Recommendation	VI Toxicity Factor(s)
Acenaphthene	83-32-9	Not applicable	Not applicable
Acetone	67-64-1	No inhalation-based toxicity factors are available[1]	None
Acetophenone	98-86-2	Not applicable	Not applicable
Aldrin	309-00-2	Not applicable	Not applicable
Aluminum	7429-90-5	Not applicable	Not applicable
Anthracene	120-12-7	Not applicable	Not applicable
Antimony	7440-36-0	Not applicable	Not applicable
Arsenic	7440-38-2	Not applicable	Not applicable
Atrazine	1912-24-9	Not applicable	Not applicable

Barium	7440-39-3	Not applicable	Not applicable
Benzaldehyde	100-52-7	Not applicable	Not applicable
Benzene	71-43-2	IRIS IUR IRIS RfC	IRIS IUR (2000) 7.8E-06 (ug/m3)-1 IRIS RfC (2003) 3E-02 mg/m3
Benzo(a)anthracene	56-55-3	Not applicable	Not applicable
Benzo(a)pyrene	50-32-8	Not applicable	Not applicable
Benzo(b)fluoranthene	205-99-2	Not applicable	Not applicable
Benzo(k)fluoranthene	207-08-9	Not applicable	Not applicable
Beryllium	7440-41-7	Not applicable	Not applicable
1,1'-Biphenyl	92-52-4	Not applicable	Not applicable
Bis(2-chloroethoxy) methane	111-91-1	Not applicable	Not applicable
Bis(2-chloroethyl) ether	111-44-4	Not applicable	Not applicable
Bis(2-ethylhexyl) phthalate	117-81-7	Not applicable	Not applicable
Bromodichloromethane	75-27-4	No inhalation-based toxicity factors are available[13]	None

Bromoform	75-25-2	No inhalation-based toxicity factors are available[13]	None
Bromomethane	74-83-9	IRIS RfC	IRIS RfC (1992) 5E-03 mg/m3
2-Butanone	78-93-3	VI standard can be developed using IRIS RfC[2]	IRIS RfC (2003) 5E+00 mg/m3
Butylbenzylphthalate	85-68-7	Not applicable	Not applicable
Cadmium	7440-43-9	Not applicable	Not applicable
Caprolactam	105-60-2	Not applicable	Not applicable
Carbon disulfide	75-15-0	IRIS RfC	IRIS RfC (1995) 7E-01 mg/m3
Carbon tetrachloride	56-23-5	IRIS IUR IRIS RfC	IRIS IUR (2010) 6E-06 (ug/m3)-1 IRIS RfC (2010) 1E-01 mg/m3
Chlordane (alpha plus gamma mixture)	57-74-9	Not applicable	Not applicable
4-Chloroaniline	106-47-8	Not applicable	Not applicable
Chlorobenzene	108-90-7	PPRTV RfC	PPRTV RfC (2006) 5E-02 mg/m3
Chloroethane	75-00-3	IRIS RfC	IRIS RfC (1991) 1E+01 mg/m3
Chloroform	67-66-3	ATSDR RfC No other inhalation-based toxicity factors are available[13]	ATSDR RfC (2013) 9.8E-02 mg/m3
Chloromethane	74-87-3	IRIS RfC[3]	IRIS RfC (2001) 9E-02 mg/m3

2-Chloronaphthalene	91-58-7	Not applicable	Not applicable
2-Chlorophenol	95-57-8	Not applicable	Not applicable
Chrysene	218-01-9	Not applicable	Not applicable
Cobalt	7440-48-4	Not applicable	Not applicable
Copper	7440-50-8	Not applicable	Not applicable
Cyanide	57-12-5	Not applicable	Not applicable
Cyclohexane	110-82-7	IRIS RfC	IRIS RfC (2003) 6E+00 mg/m3
4,4'-DDD	72-54-8	Not applicable	Not applicable
4,4'-DDE	72-55-9	Not applicable	Not applicable
4,4'-DDT	50-29-3	Not applicable	Not applicable
Dibenz(a,h)anthracene	53-70-3	Not applicable	Not applicable
Dibromochloromethane	124-48-1	No inhalation-based toxicity factors are available[13]	None
1,2-Dibromo-3-chloropropane	96-12-8	Not applicable	Not applicable
1,2-Dibromoethane	106-93-4	IRIS IUR IRIS RfC	IRIS IUR (2004) 6E-04 (ug/m3)-1 IRIS RfC (2004) 9E-03 mg/m3
1,2-Dichlorobenzene	95-50-1	HEAST RfC	HEAST RfC (1997) 2E-01 mg/m3

1,3-Dichlorobenzene	541-73-1	No inhalation-based toxicity factors are available	None
1,4-Dichlorobenzene	106-46-7	IRIS RfC No other inhalation-based toxicity factors are available[13]	IRIS RfC (1996) 8E-01 mg/m3
3,3'-Dichlorobenzidine	91-94-1	Not applicable	Not applicable
Dichlorodifluoromethane	75-71-8	No inhalation-based toxicity factors are available[4]	None
1,1-Dichloroethane	75-34-3	No inhalation-based toxicity factors are available[5]	None
1,2-Dichloroethane	107-06-2	PPRTV RfC No other inhalation-based toxicity factors are available[13]	PPRTV RfC (2010) 7E-03 mg/m3
1,1-Dichloroethene	75-35-4	IRIS RfC with a Group C carcinogen factor	IRIS RfC (2002/2005) 2E-01 mg/m3 Group C carcinogen factor 10
cis-1,2-Dichloroethene	156-59-2	No inhalation-based toxicity factors are available	None
trans-1,2-Dichloroethene	156-60-5	No inhalation-based toxicity factors are available[6]	None
2,4-Dichlorophenol	120-83-2	Not applicable	Not applicable
1,2-Dichloropropane	78-87-5	PPRTV IUR IRIS RfC	PPRTV IUR (2016) 3.7E-06 (ug/m3)-1 IRIS RfC (1991) 4E-03 mg/m3

1,3-Dichloropropene (cis and trans)	5422-75-6	IRIS IUR IRIS RfC	IRIS IUR (2000) 4E-06 (ug/m3)-1 IRIS RfC (2000) 2E-02 mg/m3
Dieldrin	60-57-1	Not applicable	Not applicable
Diethylphthalate	84-66-2	Not applicable	Not applicable
2,4-Dimethylphenol	105-67-9	Not applicable	Not applicable
Di-n-butylphthalate	84-74-2	Not applicable	Not applicable
2,4-Dinitrophenol	51-28-5	Not applicable	Not applicable
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	Not applicable	Not applicable
Di-n-octyl phthalate	117-84-0	Not applicable	Not applicable
1,4-Dioxane	123-91-1	IRIS IUR IRIS RfC	IRIS IUR (2013) 5.0E-06 (ug/m3)-1 IRIS RfC (2013) 3E-02 mg/m3
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	Not applicable	Not applicable
Endrin	72-20-8	Not applicable	Not applicable
Ethylbenzene	100-41-4	CalEPA IUR IRIS RfC	CalEPA IUR (2007) 2.5E-06 (ug/m3)-1 IRIS RfC (1991) 1E+00 mg/m3
Extractable Petroleum Hydrocarbons (EPH) (Category 1)	various	Not applicable	Not applicable
Extractable Petroleum Hydrocarbons (EPH) (Category 2)	various	Not applicable	Not applicable

Fluoranthene	206-44-0	Not applicable	Not applicable
Fluorene	86-73-7	Not applicable	Not applicable
alpha-HCH (alpha-BHC)	319-84-6	Not applicable	Not applicable
beta-HCH (beta-BHC)	319-85-7	Not applicable	Not applicable
Heptachlor	76-44-8	Not applicable	Not applicable
Heptachlor epoxide	1024-57-3	Not applicable	Not applicable
Hexachlorobenzene	118-74-1	Not applicable	Not applicable
Hexachloro-1,3-butadiene	87-68-3		None
Hexachlorocyclopentadiene	77-47-4	Not applicable	Not applicable
Hexachloroethane	67-72-1	Not applicable	Not applicable
n-Hexane	110-54-3	IRIS RfC	IRIS RfC (2005) 7E-01 mg/m3
2-Hexanone	591-78-6	Not applicable	Not applicable
Indeno(1,2,3,-cd) pyrene	193-39-5	Not applicable	Not applicable
Isophorone	78-59-1	Not applicable	Not applicable
Isopropylbenzene	98-82-8	Not applicable	Not applicable
Lead	7439-92-1	Not applicable	Not applicable

Lindane (gamma-HCH) (gamma-BHC)	58-89-9	Not applicable	Not applicable
Manganese	7439-96-5	Not applicable	Not applicable
Mercury	7439-97-6	IRIS RfC	IRIS RfC (1995) 3E-04 mg/m3
Methoxychlor	72-43-5	Not applicable	Not applicable
Methyl acetate	79-20-9	No inhalation-based toxicity factors are available	None
Methylene chloride	75-09-2	IRIS IUR IRIS RfC	IRIS IUR (2011) 1E-08 (ug/m3)-1 IRIS RfC (2011) 6E-01 mg/m3
2-Methylnaphthalene	91-57-6	Not applicable	Not applicable
4-Methyl-2-pentanone	108-10-1	IRIS RfC	IRIS RfC (2003) 3E+00 mg/m3
2-Methylphenol	95-48-7	Not applicable	Not applicable
4-Methylphenol	106-44-5	Not applicable	Not applicable
Methyl tert-butyl ether (MTBE)	1634-04-4	CalEPA IUR IRIS RfC	CalEPA IUR (1999) 2.6E-07 (ug/m3)-1 IRIS RfC (1993) 3E+00 mg/m3

Naphthalene	91-20-3	CalEPA IUR IRIS RfC with a Group C carcinogen factor	CalEPA IUR (2004) 3.4E-05 (ug/m3)-1 IRIS RfC (1998) 3E-03 mg/m3 Group C carcinogen
Nickel	7440-02-0	Not applicable	Not applicable
4-Nitroaniline	100-01-6	Not applicable	Not applicable
Nitrobenzene	98-95-3	Not applicable	Not applicable
N-Nitroso-di-n propylamine	621-64-7	Not applicable	Not applicable
N-Nitrosodiphenylamine	86-30-6	Not applicable	Not applicable
2,2'-Oxybis(1-choloropropane)	108-60-1	Not applicable	Not applicable
Pentachlorophenol	87-86-5	Not applicable	Not applicable
Phenol	108-95-2	Not applicable	Not applicable
Polychlorinated biphenyls (PCBs)	1336-36-3	Not applicable	Not applicable
Pyrene	129-00-0	Not applicable	Not applicable
Selenium	7782-49-2	Not applicable	Not applicable
Silver	7440-22-4	Not applicable	Not applicable
Styrene	100-42-5	VI standard can be developed using IRIS RfC[7]	IRIS RfC (1993) 1E+00 mg/m3

Tertiary butyl alcohol (TBA)	75-65-0	No inhalation-based toxicity factors are available[13]	None
1,2,4,5-Tetrachlorobenzene	95-94-3	Not applicable	Not applicable
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	Not applicable	Not applicable
1,1,2,2-Tetrachloroethane	79-34-5	No inhalation-based toxicity factors are available[13]	None
Tetrachloroethene (PCE)	127-18-4	IRIS IUR IRIS RfC	IRIS IUR (2012) 2.6E-07 (ug/m3)-1 IRIS RfC (2012) 4E-02 mg/m3
2,3,4,6-Tetrachlorophenol	58-90-2	Not applicable	Not applicable
Toluene	108-88-3	IRIS RfC	IRIS RfC (2005) 5E+00 mg/m3
Toxaphene	8001-35-2	Not applicable	Not applicable
1,2,4-Trichlorobenzene	120-82-1	PPRTV RfC	PPRTV RfC (2009) 2E-03 mg/m3
1,1,1-Trichloroethane	71-55-6	IRIS RfC[8]	IRIS RfC (2007) 5E+00 mg/m3
1,1,2-Trichloroethane	79-00-5	No inhalation-based toxicity factors are available[9]	None
Trichloroethene (TCE)	79-01-6	IRIS IUR IRIS RfC[10]	IRIS IUR (2011) 4.1E-06 (ug/m3)-1 IRIS RfC (2011) 2E-03 mg/m3

Trichlorofluoromethane	75-69-4	No inhalation-based toxicity factors are available[11]	None
2,4,5-Trichlorophenol	95-95-4	Not applicable	Not applicable
2,4,6-Trichlorophenol	88-06-2	Not applicable	Not applicable
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	PPRTV RfC	PPRTV RfC (2016) 5E+00 mg/m3
1,2,4-Trimethylbenzene	95-63-6	IRIS RfC	IRIS RfC (2016) 6E-02 mg/m3
Vanadium	7440-62-2	Not applicable	Not applicable
Vinyl Chloride	75-01-4	IRIS IUR. IRIS RfC[12]	IRIS IUR (2000) 4.4E-06 (ug/m3)-1 IRIS RfC (2000) 1E-01 mg/m3
Xylenes	1330-20-7	IRIS RfC	IRIS RfC (2003) 1.E-01 mg/m3
Zinc	7440-66-6	Not applicable	Not applicable

[1] An ATSDR RfC exists for acetone using the results of the Stewart 1975 study. The USEPA IRIS notes that this study should only be used in the development of a short-term exposure RfC and not a long-term (chronic) exposure RfC.

[2] A NJDWQI RfC exists for 2-butanone, but the IRIS RfC has been determined by the Department to be more appropriate. The existing NJDWQI RfC is based on a route-to-route conversion of a NJDWQI RfD. The Department’s Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of indoor air remediation standards

based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors.

[3] A HEAST IUR exists for chloromethane, but a subsequent PPRTV review (2012) states that the use of the HEAST IUR is "Inadequate for an assessment of carcinogenic potential."

[4] A HEAST RfC and a PPRTV RfC exist for dichlorodifluoromethane. Both RfCs are derived using the same study (Prendergast 1967). The PPRTV is listed as an appendix value. The PPRTV RfC is listed as an appendix value because the Prendergast study was determined by the USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop remediation standards. As the HEAST RfC was developed using the Prendergast study data, the Department decided not to use this RfC in the development of a remediation standard.

[5] A HEAST RfC exists for 1,1-dichloroethane, but a subsequent PPRTV review (2006) indicated that data were inadequate to derive a chronic exposure RfC for 1,1-dichloroethane. A CalEPA IUR also exists for 1,1-dichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of indoor air remediation standards based on route-to-route conversion of toxicity factors.

[6] A PPRTV RfC exists for trans-1,2-dichloroethene but a subsequent IRIS assessment (2010) stated "the available inhalation data from the Freund study are insufficient to support reference value derivation and RfC."

[7] A HEAST 1991 IUR exists for styrene but the USEPA NCEA does not recommend its use.

[8] Although an NJDWQI RfC exists for 1,1,1-trichloroethane, the Department determined that the IRIS RfC is a scientifically better toxicity value to develop a non-cancer-based soil inhalation remediation standard.

[9] Although a PPRTV RfC for 1,1,2-trichloroethane exists, it is listed as an appendix value. The PPRTV appendix value is based on a study that was determined by the USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop remediation standards. An IRIS IUR also exists for 1,1,2-trichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of indoor air remediation standards based on route-to-route conversion of toxicity factors.

[10] The IRIS RfC for trichloroethene is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[11] A HEAST RfC exists for trichlorofluoromethane, but a subsequent PPRTV review (2009) indicated that data used to derive the RfC were inadequate.

[12] The IRIS RfC for vinyl chloride is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[13] There is an inhalation toxicity factor available for this contaminant, but it is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted with physiologically-based

pharmacokinetic modeling, for the development of indoor air remediation standards based on route-to-route conversion of toxicity factors.

References

ALM (Adult Lead Model).2003. Recommendation of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Lead Exposure to Lead in Soil. USEPA, Office of Solid Waste and Emergency Response, Washington, D.C. EPA-540-R-03-001.

ATSDR (Agency for Toxic Substances and Disease Registry).2018. Minimal Risk Levels for Hazardous Substances. http://www.atsdr.cdc.gov/mrls/mrllist.asp

CalEPA (California Environmental Protection Agency). Office of Environmental Health Hazard Assessment (OEHHA). OEHHA Toxicity Criteria Database. http://www.oehha.ca.gov/risk/chemicalDB/index.asp

Canada 2000: Canadian Council of Ministers of the Environment (CCME). 2000. Canada-Wide Standards for Petroleum Hydrocarbons (PHCs) in soil: Scientific Rationale. Supporting Document.

EPA RSL (United States Environmental Protection Agency). 2018. Regional Screening Levels for Chemical Contaminants at Superfund Sites. November 2018. https://www.epa.gov/risk/regional-screening-levels-rsls

HEAST – Health Effects Assessment Summary: Annual Update FY 1997. United States Environmental Protection Agency, Office of Research and Development, Office of Emergency and Remedial Response, Washington, DC. NTIS PB97-921199. http://epa-heast.ornl.gov/index.html

IEUBK. 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. USEPA, Office of Solid Waste and Emergency Response, Washington, DC. OSWER9285.7-15-1.

IRIS (Integrated Risk Information System). United States Environmental Protection Agency. http://www.epa.gov/IRIS/

MADEP (Massachusetts Department of Environmental Protection). 2003. Updated Petroleum Standards. Hydrocarbon Toxicity Values for the VPH/EPH/APH Methodology, Final. Office of Research and Standards.

NJDEP (New Jersey Department of Environmental Protection). 1997. Interim Specific Criterion for Tertiary Butyl Alcohol. Memorandum dated September 12, 1997.

NJDWQI (New Jersey Drinking Water Quality Institute). 1994. Maximum Contaminant Level Recommendation for Hazardous Contaminants in Drinking Water, Appendix A, Health-Based Maximum Contaminant Level Support Documents and Addenda. (A-280 Values).

PPRTV (Provisional Peer Reviewed Toxicity Values for Superfund). United States Environmental Protection Agency. http://hhpprtv.ornl.gov/index.html

TPHCWG (Total Petroleum Hydrocarbon Working Group). 1997. Edwards, D.A., Andriot, M.D., Amoruso, M.A., Tummey, A.C., Bevan, C.J., and Tveit, A. TPHCWG Series: Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs). Volume 4.

TPHCWG (Total Petroleum Hydrocarbon Working Group). 1997. Hayes, L.A., Youngren, S.H., and Nakles, D.V. TPHCWG Series: Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs). Volume 4.

USEPA (United States Environmental Protection Agency). 2004. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. OSWER 9285.7-02EP. July 2004.

APPENDIX 12

DERIVATION OF EQUATION EQUIVALENCY USED FOR THE DEVELOPMENT OF SOIL AND INDOOR AIR REMEDIATION STANDARDS

This appendix demonstrates the equivalency between the equations used by the Department in the development of the soil and indoor air remediation standards, and the equations used by

the USEPA in the development of soil and indoor air risk-based screening levels. This appendix demonstrates the equivalency for the following Department soil and indoor air remediation standard equations:

- N.J.A.C. 7:26D Appendix 2, Equation 1, Residential Carcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 2, Equation 2, Residential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 2, Equation 3, Nonresidential Carcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 2, Equation 4, Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 3, Equation 1, Carcinogenic Inhalation Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 3, Equation 2, Noncarcinogenic Inhalation Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 5, Equation 1, Carcinogenic Indoor Air Human Health-based Criterion Equation; and
- N.J.A.C. 7:26D Appendix 5, Equation 2, Noncarcinogenic Indoor Air Human Health-based Criterion Equation.

N.J.A.C. 7:26D Appendix 2, Equation 1 – Residential Carcinogenic Ingestion-Dermal Human Health-Based Criterion Equation

The origin of the Department residential soil remediation standard for the ingestion-dermal exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}ca\text{-}tot}\,(mg/kg) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}ing}} + \frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}der}} + \frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-ca-inh}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{res-soil-ca-ing}}\right) + \left(\frac{1}{SL_{res-soil-ca-der}}\right)}$$

The RSLE states that:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing}\left(mg/kg\right) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\left(70\ years\right)\right)}{CSF_o\left(\frac{mg}{kg\text{-}day}\right)^{-1} \times RBA \times IFS_{res\text{-}adj}\left(\frac{36{,}750\ mg}{kg}\right) \times \left(\frac{10^{-6}kg}{mg}\right)}$$

and

$$SL_{res\text{-}soil\text{-}ca\text{-}der}\left(mg/kg\right) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\left(70\ years\right)\right)}{\left(\frac{CSF_o\left(\frac{mg}{kg\text{-}day}\right)^{-1}}{GIABS}\right) \times DFS_{res\text{-}adj}\left(\frac{103{,}390\ mg}{kg}\right) \times ABS_d \times \left(\frac{10^{-6}kg}{mg}\right)}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing} = \frac{TR\ x\ AT_{res}\ x\ LT}{CSF_o\ x\ RBA\ x\ IFS_{res-adj}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

and

$$SL_{res\text{-}soil\text{-}ca\text{-}der} = \frac{TR\ x\ AT_{res}\ x\ LT}{\left(\frac{CSF_o}{GIABS}\right)\ x\ DFS_{res-adj}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Because $GIABS = \frac{CSF_o}{CSF_d}$ the second equation further simplifies to:

$$SL_{res-soil-ca-der} = \frac{TR\ x\ AT_{res}\ x\ LT}{CSF_d\ x\ DFS_{res-adj}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{res-soil-ca-ing}}\right) + \left(\frac{1}{SL_{res-soil-ca-der}}\right)}$$

1. Insert the simplified equations for $SL_{res\text{-}soil\text{-}ca\text{-}ing}$ and $SL_{res\text{-}soil\text{-}ca\text{-}der}$ described above into the denominator of the $SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}derm}$ equation, which then becomes:

$$\frac{1}{\left[\left[\frac{1}{\left(\frac{TR \text{ x } AT_{res} \text{ x } LT}{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6} \text{ kg}}{mg}\right)}\right)}\right] + \left[\frac{1}{\left(\frac{TR \text{ x } AT_{res} \text{ x } LT}{CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6} \text{ kg}}{mg}\right)}\right)}\right]\right]}$$

2. Simplify the reciprocal (in the denominator of the equation immediately above) containing the equivalent expression of $SL_{res\text{-}soil\text{-}ca\text{-}ing}$ by multiplying it by the term:

$$\frac{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6} \text{ kg}}{mg}\right)}{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6} \text{ kg}}{mg}\right)}$$

This is the same as multiplying the reciprocal of the expression by 1.

3. Similarly, simplify the reciprocal containing the equivalent expression of $SL_{res\text{-}soil\text{-}ca\text{-}der}$ by multiplying it by the term:

$$\frac{\mathrm{CSF_d\ x\ DFS_{res-adj}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}}{\mathrm{CSF_d\ x\ DFS_{res-adj}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}}$$

Again, this is effectively multiplying by 1.

4. This results in the expression:

$$\frac{1}{\left(\frac{\mathrm{CSF_o\ x\ RBA\ x\ IFS_{res-adj}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}}{\mathrm{TR\ x\ AT_{res}\ x\ LT}}\right) + \left(\frac{\mathrm{CSF_d\ x\ DFS_{res-adj}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}}{\mathrm{TR\ x\ AT_{res}\ x\ LT}}\right)}$$

5. After separating the common term ($\frac{10^{-6}\ \mathrm{kg}}{\mathrm{mg}}$) from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the expression:

$$\mathrm{TR\ x\ AT_{res}\ x\ LT}$$

Performing steps 1 through 5 above results in the following expression:

$\mathrm{SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}derm}}$ =

$$\frac{\mathrm{TR\ x\ AT_{res}\ x\ LT}}{\left(\frac{10^{-6}\ kg}{mg}\right)\ x\ \left[\left(\mathrm{CSF_o\ x\ RBA\ x\ IFS_{res-adj}}\right) + \left(\mathrm{CSF_d\ x\ DFS_{res-adj}\ x\ ABS_d}\right)\right]}$$

This USEPA terminology (immediately above), which is for a residential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{res}	*AT*	Averaging time
LT	*LT*	Lifetime
CSF_o	CSF_o	Oral cancer slope factor
RBA	None	Relative Bio-availability
$IFS_{res\text{-}adj}$	IFS_{adj}	Age-adjusted soil ingestion rate
CSF_d	CSF_D	Dermal cancer slope factor
$DFS_{res\text{-}adj}$	DFS_{adj}	Age-adjusted soil dermal contact factor
ABS_d	ABS_d	Dermal absorption fraction
$\frac{10^{-6}\ \mathrm{kg}}{\mathrm{mg}}$	$\frac{10^{-6} kg}{mg}$	Unit conversion factor
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$ID_c = \frac{TR\ x\ AT\ x\ LT}{\left(\frac{10^{-6}\ kg}{mg}\right)\ x\ \left[\left(CSF_o\ x\ IFS_{adj}\right) + \left(CSF_D\ x\ DFS_{adj}\ x\ ABS_d\right)\right]}$$

Note that the USEPA term $SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}derm}$ is the equivalent of the Department term ID_c. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is equivalent to the Department equation presented in N.J.A.C. 7:26D Appendix 2 as Equation 1 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 1 is:

$$ID_c = \frac{TR * AT * LT}{(10^{-6} kg/mg) * [(CSF_O * IFS_{adj}) + (CSF_D * DFS_{adj} * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 2, Equation 2 – Residential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria Equation

The origin of the Department residential soil remediation standard for the ingestion-dermal exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}nc\text{-}tot\text{-}c}\ (mg/kg) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}c}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address

the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-nc-inh-c}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-ing-c}}\right) + \left(\frac{1}{SL_{res-soil-nc-der-c}}\right)}$$

The Department calculation of the residential noncarcinogenic ingestion-dermal criterion is based on a child exposure scenario. As such, the RSLE states that:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}\left(mg/kg\right) = \frac{THQ \times AT_{res\text{-}c}\left(\frac{365\ days}{year} \times ED_{res\text{-}c}\left(6\ years\right)\right) \times BW_{res\text{-}c}\left(15\ kg\right)}{EF_{res\text{-}c}\left(\frac{350\ days}{year}\right) \times ED_{res\text{-}c}\left(6\ years\right) \times \frac{RBA}{RfD_o\left(\frac{mg}{kg\text{-}day}\right)} \times IRS_{res\text{-}c}\left(\frac{200\ mg}{day}\right) \times \frac{10^{-6}kg}{1mg}}$$

and

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}\left(mg/kg\right) = \frac{THQ \times AT_{res\text{-}c}\left(\frac{365\ days}{year} \times ED_{res\text{-}c}\left(6\ years\right)\right) \times BW_{res\text{-}c}\left(15\ kg\right)}{EF_{res\text{-}c}\left(\frac{350\ days}{year}\right) \times ED_{res\text{-}c}\left(6\ years\right) \times \frac{1}{\left(RfD_o\left(\frac{mg}{kg\text{-}day}\right) \times GIABS\right)} \times SA_{res\text{-}c}\left(\frac{2373\ cm^2}{day}\right) \times AF_{res\text{-}c}\left(\frac{0.2\ mg}{cm^2}\right) \times ABS_d \times \frac{10^{-6}kg}{1mg}}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c} = \frac{THQ \times AT_{res-c} \times ED_{res-c} \times BW_{res-c}}{EF_{res-c} \times ED_{res-c} \times \left(\frac{RBA}{RDO_0}\right) \times IRS \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

and

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c} = \frac{THQ \times AT_{res-c} \times ED_{res-c} \times BW_{res-c}}{EF_{res-c} \times ED_{res-c} \times \left(\frac{1}{RfD_0 \times GIABS}\right) \times SA_{res-c} \times AF_{res-c} \times ABS_d \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

Because GIABS = $\frac{RfD_D}{RfD_o}$ the second equation further simplifies to:

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c} = \frac{THQ \times AT_{res-c} \times ED_{res-c} \times BW_{res-c}}{EF_{res-c} \times ED_{res-c} \times \left(\frac{1}{RfD_D}\right) \times SA_{res-c} \times AF_{res-c} \times ABS_d \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-ing-c}}\right) + \left(\frac{1}{SL_{res-soil-nc-der-c}}\right)}$$

1. Insert the simplified equations for $SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}$ and $SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}$ described above into the denominator of the $SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ equation, which then becomes:

$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ =

$$\frac{1}{\left[\left[\frac{1}{\left(\frac{\text{THQ x AT}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x BW}_{\text{res-c}}}{\text{EF}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x }\left(\frac{\text{RBA}}{\text{RDO}_0}\right)\text{ x IRS x }\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right]+\left[\frac{1}{\left(\frac{\text{THQ x AT}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x BW}_{\text{res-c}}}{\text{EF}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x }\left(\frac{1}{\text{RfD}_{\text{D}}}\right)\text{ x SA}_{\text{res-c}}\text{ x AF}_{\text{res-c}}\text{ x ABS}_{\text{d}}\text{ x }\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right]\right]}$$

2. Simplify the reciprocals in the denominator of the equation immediately above (similar to what was done in the derivation of N.J.A.C. 7:26D Appendix 2, Equation 1 above) using the respective terms:

$$\frac{\text{EF}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x }\left(\frac{\text{RBA}}{\text{RDO}_0}\right)\text{ x IRS x }\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{\text{EF}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x }\left(\frac{\text{RBA}}{\text{RDO}_0}\right)\text{ x IRS x }\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

and

$$\frac{\text{EF}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x }\left(\frac{1}{\text{RfD}_{\text{D}}}\right)\text{ x SA}_{\text{res-c}}\text{ x AF}_{\text{res-c}}\text{ x ABS}_{\text{d}}\text{ x }\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{\text{EF}_{\text{res-c}}\text{ x ED}_{\text{res-c}}\text{ x }\left(\frac{1}{\text{RfD}_{\text{D}}}\right)\text{ x SA}_{\text{res-c}}\text{ x AF}_{\text{res-c}}\text{ x ABS}_{\text{d}}\text{ x }\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

Again, this is the same as multiplying each of the reciprocals in the equation denominator by 1.

3. This results in the following:

$$\text{SL}_{\text{res-soil-nc-ing-der-c}} =$$

$$\frac{1}{\left(\frac{EF_{res-c}\ x\ ED_{res-c}\ x\ \left(\frac{RBA}{RfD_0}\right)\ x\ IRS\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}}\right) + \left(\frac{EF_{res-c}\ x\ ED_{res-c}\ x\ \left(\frac{1}{RfD_D}\right)\ x\ SA_{res-c}\ x\ AF_{res-c}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}}\right)}$$

4. After separating out the common terms ($\frac{10^{-6}\ kg}{mg}$) and ($EF_{res-c}\ x\ ED_{res-c}$) from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the expression:

$$THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}$$

Performing steps 1 through 4 above results in the following expression:

$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ =

$$\frac{THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}}{\left[\left(\left(\frac{RBA}{RfD_0}\right)\ x\ IRS\right) + \left(\left(\frac{1}{RfD_D}\right)\ x\ SA_{res-c}\ x\ AF_{res-c}\ x\ ABS_d\right)\right]\ x\ (EF_{res-c}\ x\ ED_{res-c})\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

This USEPA terminology (immediately above), which is for a residential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
$AT_{res\text{-}c}$	*AT*	Averaging time
$EF_{res\text{-}c}$	*EF*	Exposure frequency – child
$BW_{res\text{-}c}$	*BW*	Body weight - child

$ED_{res\text{-}c}$	*ED*	Exposure duration - child
RBA	None	Relative Bio-availability
RfD_o	RfD_o	Oral reference dose
IRS	*IR*	Soil ingestion rate - child
RfD_D	RfD_D	Dermal reference dose
$SA_{res\text{-}c}$	*SA*	Skin surface area - child
$AF_{res\text{-}c}$	*AF*	Soil adherence factor - child
ABS_d	ABS_d	Dermal absorption fraction
$\frac{10^{-6}\ \text{kg}}{\text{mg}}$	$\frac{10^{-6}\text{kg}}{\text{mg}}$	Unit conversion factor
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ =

$$\frac{THQ\ x\ AT\ x\ ED\ x\ BW}{(EF\ x\ ED)\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)\ x\left[\left(\left(\frac{1}{RfD_0}\right)\ x\ IR\right)+\ \left(\frac{1}{RfD_D}\ x\ SA\ x\ AF\ x\ ABS_d\right)\right]}$$

Note that the USEPA term $SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ is the equivalent of the Department term ID_{nc}. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented

immediately above is equivalent to the Department equation presented in N.J.A.C. 7:26D Appendix 2 as Equation 2 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26d Appendix 2, Equation 2 is:

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6} kg/mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 2, Equation 3 – Nonresidential Carcinogenic Ingestion-Dermal Human Health-Based Criteria

The origin of the Department nonresidential soil remediation standard for the ingestion-dermal exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{ow\text{-}soil\text{-}ca\text{-}tot}(mg/kg) = \frac{1}{\frac{1}{SL_{ow\text{-}soil\text{-}ca\text{-}ing}} + \frac{1}{SL_{ow\text{-}soil\text{-}ca\text{-}der}} + \frac{1}{SL_{ow\text{-}soil\text{-}ca\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{ow-soil-ca-inh}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{ow-soil-ca-ing}}\right) + \left(\frac{1}{SL_{ow-soil-ca-der}}\right)}$$

The Department calculation of the nonresidential carcinogenic ingestion-dermal criterion is based on an adult outdoor worker exposure scenario.

As such, the RSLE states:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing}\,(mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\,(70\ years)\right) \times BW_{ow}\,(80\ kg)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\,(25\ years) \times CSF_{o}\left(\frac{mg}{kg\text{-}day}\right)^{-1} \times RBA \times IR_{ow}\left(100\ \frac{mg}{day}\right) \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}ca\text{-}der}\,(mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\,(70\ years)\right) \times BW_{ow}\,(80\ kg)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\,(25\ years) \times \left(\frac{CSF_{o}\left(\frac{mg}{kg\text{-}day}\right)^{-1}}{GIABS}\right) \times SA_{ow}\left(\frac{3527\ cm^{2}}{day}\right) \times AF_{ow}\left(\frac{0.12\ mg}{cm^{2}}\right) \times ABS_{d} \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing} = \frac{TR\ x\ AT_{ow}\ x\ LT\ x\ BW_{ow}}{EF_{ow}\ x\ ED_{ow}\ x\ CSF_{o}\ x\ RBA\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}ca\text{-}der} = \frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times \left(\frac{CSF_o}{GIABS}\right) \times SA_{ow} \times AF_{ow} \times ABS_d \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

Because GIABS = $\frac{CSF_o}{CSF_D}$ the second equation further simplifies to:

$$SL_{ow\text{-}soil\text{-}ca\text{-}der} = \frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_D \times SA_{ow} \times AF_{ow} \times ABS_d \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{ow-soil-ca-ing}}\right) + \left(\frac{1}{SL_{ow-soil-ca-der}}\right)}$$

1. Insert the simplified equations for $SL_{ow\text{-}soil\text{-}ca\text{-}ing}$ and $SL_{ow\text{-}soil\text{-}ca\text{-}der}$ described above into the denominator of the $SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der}$ equation, which then becomes:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} =$$

$$\frac{1}{\left[\left(\frac{1}{\left(\frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_o \times RBA \times IR_{ow} \times \left(\frac{10^{-6}\,kg}{mg}\right)}\right)}\right)\right] + \left[\left(\frac{1}{\left(\frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_D \times SA_{ow} \times AF_{ow} \times ABS_d \times \left(\frac{10^{-6}\,kg}{mg}\right)}\right)}\right)\right]}$$

2. Simplify the reciprocals in the equation denominator immediately above (similar to what was done in the derivation of N.J.A.C. 7:26D Appendix 2, Equation 1 above) using the respective terms:

$$\frac{EF_{ow}\ x\ ED_{ow}\ x\ CSF_o\ x\ RBA\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{EF_{ow}\ x\ ED_{ow}\ x\ CSF_o\ x\ RBA\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

and

$$\frac{EF_{ow}\ x\ ED_{ow}\ x\ \ CSF_D\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{EF_{ow}\ x\ ED_{ow}\ x\ \ CSF_D\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Again, this is the same as multiplying the reciprocals in the equation denominator by 1.

3. This results in the following:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} =$$

$$\frac{1}{\left(\frac{EF_{ow}\ x\ ED_{ow}\ x\ CSF_o\ x\ RBA\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{TR\ x\ AT_{ow}\ x\ LT\ x\ BW_{ow}}\right) + \left(\frac{EF_{ow}\ x\ ED_{ow}\ x\ \ CSF_D\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{TR\ x\ AT_{ow}\ x\ LT\ x\ BW_{ow}}\right)}$$

4. After separating out the common terms $(EF_{ow} \text{ x } ED_{ow})$ and $(\frac{10^{-6}\ kg}{mg})$ from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the expression:

$$TR \text{ x } AT_{ow} \text{ x } LT \text{ x } BW_{ow}$$

Performing steps 1 through 4 above results in the following expression:

$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der}$ =

$$\frac{TR \text{ x } AT_{ow} \text{ x } LT \text{ x } BW_{ow}}{(EF_{ow} \text{ x } ED_{ow}) \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right) \text{ x } ((CSF_o \text{ x } RBA \text{ x } IR_{ow}) + (CSF_D \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d))}$$

This USEPA terminology (immediately above), which is for a nonresidential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{ow}	*AT*	Averaging time - outdoor worker
LT	*LT*	Lifetime
CSF_o	*CSF_o*	Oral cancer slope factor
RBA	None	Relative Bio-availability
IR_{ow}	*IR*	Soil ingestion rate – outdoor worker
CSF_d	*CSF_D*	Dermal cancer slope factor
AF_{ow}	A*F*	Soil adherence factor – outdoor worker

ABS_d	ABS_d	Dermal absorption fraction
$\frac{10^{-6}\ \text{kg}}{\text{mg}}$	$\frac{10^{-6} kg}{mg}$	Unit conversion factor
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{\text{ow-soil-ca-ing-der}} = \frac{TR\ x\ AT\ x\ LT\ x\ BW}{(EF\ x\ ED)\ x\ \left(\frac{10^{-6}\ kg}{mg}\right) x\ \left((CSF_O\ x\ IR) + (\ CSF_D\ x\ SA\ x\ AF\ x\ ABS_d)\right)}$$

Note that the USEPA term $SL_{\text{ow-soil-ca-ing-der}}$ is the equivalent of the Department term ID_c. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is equivalent to the Department equation presented in N.J.A.C. 7:26D Appendix 2 as Equation 3 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 3 is:

$$ID_c = \frac{TR * AT * LT * BW}{EF * ED * 10^{-6}\ kg/mg * [(CSF_O * IR) + (CSF_D * SA * AF * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 2, Equation 4 – Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria

The origin of the Department nonresidential soil remediation standard for the ingestion-dermal exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{ow\text{-}soil\text{-}nc\text{-}tot}\,(mg/kg) = \frac{1}{\frac{1}{SL_{ow\text{-}soil\text{-}nc\text{-}ing}} + \frac{1}{SL_{ow\text{-}soil\text{-}nc\text{-}der}} + \frac{1}{SL_{ow\text{-}soil\text{-}nc\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{ow-soil-nc-inh}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{ow-soil-nc-ing}}\right) + \left(\frac{1}{SL_{ow-soil-nc-der}}\right)}$$

The Department calculation of the nonresidential noncarcinogenic ingestion-dermal criterion is based on an adult outdoor worker exposure scenario. As such, the RSLE states:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing}\left(mg/kg\right) = \frac{THQ \times AT_{ow\text{-}a}\left(\frac{365\ days}{year} \times ED_{ow}\left(25\ years\right)\right) \times BW_{ow}\left(80\ kg\right)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\left(25\ years\right) \times \frac{RBA}{RfD_o\left(\frac{mg}{kg\text{-}day}\right)} \times IR_{ow}\left(100\ \frac{mg}{day}\right) \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}nc\text{-}der}\left(mg/kg\right) = \frac{THQ \times AT_{ow\text{-}a}\left(\frac{365\ days}{year} \times ED_{ow}\left(25\ years\right)\right) \times BW_{ow}\left(80\ kg\right)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\left(25\ years\right) \times \left(\frac{1}{RfD_o\left(\frac{mg}{kg\text{-}day}\right) \times GIABS}\right) \times SA_{ow}\left(\frac{3527\ cm^2}{day}\right) \times AF_{ow}\left(\frac{0.12\ mg}{cm^2}\right) \times ABS_d \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing} = \frac{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{RBA}{RfD_o}\right)\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}nc\text{-}der} = \frac{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{1}{RfD_o\ x\ GIABS}\right)\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Because GIABS = $\frac{RfD_D}{RfD_o}$ the second equation further simplifies to:

$$SL_{ow\text{-}soil\text{-}nc\text{-}der} = \frac{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

1. Insert the simplified equations for $SL_{ow\text{-}soil\text{-}nc\text{-}ing}$ and $SL_{ow\text{-}soil\text{-}nc\text{-}der}$ described above into the denominator of the $SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der}$ equation which then becomes:

$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der}$ =

$$\frac{1}{\left[\left[\frac{1}{\left(\frac{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right] + \left[\frac{1}{\left(\frac{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right]\right]}$$

2. Simplify the reciprocals in the equation denominator immediately above (similar to what was done in the derivation of N.J.A.C. 7:26D Appendix 2, Equation 1 above) using the respective terms:

$$\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

and

$$\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

Again, this is the same as multiplying each of the reciprocals in the equation denominator by 1.

3. This results in the following:

$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der}$ =

$$\frac{1}{\left(\frac{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{RBA}{RfD_o}\right)\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}\right) + \left(\frac{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{1}{RfD_D}\right)\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}\right)}$$

4. After separating out the common terms ($\frac{10^{-6}\ kg}{mg}$) and $(EF_{ow}\ x\ ED_{ow})$ from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the term:

$$THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}$$

Performing steps 1 through 4 above results in the following expression:

SLow-soil-nc-ing-der =

$$\frac{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}{(EF_{ow}\ x\ ED_{ow})\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)\ \left[\left(\left(\frac{RBA}{RfD_0}\right)\ x\ IR_{ow}\right) + \left(\left(\frac{1}{RfD_D}\right)\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\right)\right]}$$

This USEPA terminology (immediately above), which is for a nonresidential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
AT_{ow}	*T*	Averaging time – outdoor worker
EF_{ow}	*EF*	Exposure frequency – outdoor worker
BW_{ow}	BW	Body weight – outdoor worker
ED_{ow}	*ED*	Exposure duration – outdoor worker
RBA	None	Relative Bio-availability
RfD_o	RfD_o	Oral reference dose
IR_{ow}	*IR*	Soil ingestion rate – outdoor worker
RfD_D	RfD_D	Dermal reference dose
SA_{ow}	*SA*	Skin surface area – outdoor worker
AF_{ow}	*AF*	Soil adherence factor – outdoor worker
ABS_d	ABS_d	Dermal absorption fraction
$\frac{10^{-6}\ \mathrm{kg}}{\mathrm{mg}}$	$\frac{10^{-6}kg}{mg}$	Unit conversion factor
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der} = \frac{THQ\ x\ AT\ x\ ED\ x\ BW}{(EF\ x\ ED)\ x\ \left(\frac{10^{-6}\ kg}{mg}\right) x\ \left(\left(\frac{1}{RfD_O}\ x\ IR\right) + \left(\frac{1}{RfD_D}\ x\ SA\ x\ AF\ x\ ABS_d\right)\right)}$$

Note that the USEPA term $SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der}$ is the equivalent if the Department term ID_{nc}. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 2 as Equation 4 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 4 is:

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6}\ kg/mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 3, Equation 1 – Carcinogenic Inhalation Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the carcinogenic-based inhalation exposure pathway soil criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use

scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential soil remediation standard for the inhalation exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}ca\text{-}tot}\,(mg/kg) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}ing}} + \frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}der}} + \frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by isolating the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-ca-inh-a}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the inhalation aspect, which is designated:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-inh-a}}\right)} = SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}$$

The RSLE states that:

$$SL_{res\text{-}soil\text{-}ca\text{-}inh}\,(mg/kg) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\,(70\ years)\right)}{IUR\left(\frac{\mu g}{m^3}\right)^{-1} \times \left(\frac{1000\ \mu g}{mg}\right) \times EF_{res}\left(\frac{350\ days}{year}\right) \times \left(\frac{1}{VF_{ulim}\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right) \times ED_{res}\,(26\ years) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right)}$$

The above equation includes the units for the listed input parameters. Deleting the units simplifies the equation to:

$$SL_{res\text{-}soil\text{-}ca\text{-}inh} = \frac{TR\ x\ AT_{res}\ x\ LT}{IUR\ x\ \left(\frac{1000\ ug}{mg}\right)\ x\ EF_{res}\ x\ \left[\frac{1}{VF_{ulim}} + \frac{1}{PEF}\right]\ x\ ED_{res}\ x\ ET_{res}\ x\ \left(\frac{1\ day}{24\ hours}\right)}$$

This USEPA terminology, which is for a residential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{res}	*AT*	Averaging time - residential
LT	*LT*	Lifetime
IUR	*IUR*	Inhalation unit risk factor
EF_{res}	*EF*	Exposure frequency - residential
VF_{ulim}	*VF*	Soil-to-air volatilization factor
PEF	*PEF*	Particulate emission factor
EDres	*ED*	Exposure duration - residential
ETres	*ET*	Exposure time - residential

$\frac{1000\ \text{ug}}{\text{mg}}$	$\frac{1000\ ug}{mg}$	Unit conversion factor
$\frac{1\ \text{day}}{24\ \text{hours}}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{\text{res-soil-ca -inh}} = \frac{TR\ x\ AT\ x\ LT}{IUR\ x\ \left(\frac{1000\ ug}{mg}\right)\ x\ EF\ x\ \left[\frac{1}{VF}+\frac{1}{PEF}\right]\ x\ ED\ x\ ET\ x\ \left(\frac{1\ day}{24\ hours}\right)}$$

As the USEPA term $SL_{\text{res-soil-ca-inh}}$ is the equivalent of the Department term Inh_c, the equation presented above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 3 as Equation 1 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 3, Equation 1 is:

$$Inh_c = \frac{TR * AT * LT}{IUR * 1000\ {}^{\mu g}\!/_{mg} * EF * \left(\frac{1}{VF}+\frac{1}{PEF}\right) * ED * ET * \frac{1day}{24hours}}$$

N.J.A.C. 7:26D Appendix 3, Equation 2 – Noncarcinogenic Inhalation Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the noncarcinogenic-based inhalation exposure pathway soil criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential soil remediation standard for the inhalation exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}nc\text{-}tot\text{-}a}\,(mg/kg) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}a}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}a}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by isolating the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-nc-inh-a}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the inhalation aspect, which is designated:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-inh-a}}\right)} = SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}$$

The RSLE states that:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}\left(mg/kg\right) = \frac{THQ \times AT_{res\text{-}a}\left(\frac{365\ days}{year} \times ED_{res}\left(26\ years\right)\right)}{EF_{res\text{-}a}\left(\frac{350\ days}{year}\right) \times ED_{res}\left(26\ years\right) \times ET_{res\text{-}a}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times \frac{1}{RfC\left(\frac{mg}{m^3}\right)} \times \left(\frac{1}{VF_{ulim}\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right)}$$

The above equation includes the units for the listed input parameters. Deleting the units simplifies the equation to:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{THQ\ x\ AT_{res-a}\ x\ ED_{res}}{EF_{res-a}\ x\ ED_{res}\ x\ ET_{res-a}\ x\ \frac{1\ day}{24\ hours}\ x\ \frac{1}{RfC}\ x\ \left(\frac{1}{VF_{ulim}} + \frac{1}{PEF}\right)}$$

This USEPA terminology, which is for a residential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
$AT_{res\text{-}a}$	*AT*	Averaging time – residential adult
$EF_{res\text{-}a}$	*EF*	Exposure frequency – residential adult
$ED_{res\text{-}a}$	*ED*	Exposure duration – residential adult
$ET_{res\text{-}a}$	*ET*	Exposure time - residential adult
RfC	*RfC*	Reference concentration

VF_{ulim}	*VF*	Soil-to-air volatilization factor
PEF	*PEF*	Particulate emission factor
$\frac{1\ \text{day}}{24\ \text{hours}}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{THQ\ x\ AT\ x\ ED}{EF\ x\ ED\ x\ ET\ x\ \frac{1\ day}{24\ hours}\ x\ \frac{1}{RfC}\ x\ \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

As the USEPA term $SL_{res\text{-}soil\text{-}nc\text{-}inh}$ is the equivalent of the Department term Inh_{nc}, the equation presented above is equivalent to the Department equation presented in N.J.A.C. 7:26D Appendix 3 as Equation 2 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 3, Equation 2 is:

$$Inh_{nc} = \frac{THQ * AT * ED}{EF * ED * ET * \frac{1day}{24hours} * \frac{1}{RfC} * \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

N.J.A.C. 7:26D Appendix 5, Equation 1 – Carcinogenic Indoor Air Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the carcinogenic indoor air human health-based criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential indoor air remediation standard for the vapor intrusion exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}air\text{-}ca}\left(\mu g/m^3\right) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\left(70\ years\right)\right)}{EF_{res}\left(\frac{350\ days}{year}\right) \times ED_{res}\left(26\ years\right) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times IUR\left(\mu g/m^3\right)^{-1}}$$

The above equation includes the units for the listed input parameters. Deleting the units simplifies the equation to:

$$SL_{res\text{-}air\text{-}ca} = \frac{TR\ x\ AT_{res}\ x\ LT}{EF_{res}\ x\ ED_{res}\ x\ ET_{res}\ x\ \left(\frac{1\ day}{24\ hours}\right)\ x\ IUR}$$

This USEPA terminology, which is for a residential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition

TR	*TR*	Target cancer risk
AT_{res}	*AT*	Averaging time - residential
LT	*LT*	Lifetime
IUR	*IUR*	Inhalation unit risk factor
EF_{res}	*EF*	Exposure frequency - residential
EDres	*ED*	Exposure duration - residential
ETres	*ET*	Exposure time - residential
$\frac{1\ \text{day}}{24\ \text{hours}}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}air\text{-}ca} = \frac{TR\ x\ AT\ x\ LT}{EF\ x\ ED\ x\ ET\ x\ \left(\frac{1\ day}{24\ hours}\right)\ x\ IUR}$$

As the USEPA term $SL_{res\text{-}air\text{-}ca}$ is the equivalent of the Department term IA_c , the equation presented above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 5 as Equation 1 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 5, Equation 1 is:

$$IA_c = \frac{TR * AT * LT}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * IUR}$$

N.J.A.C. 7:26D Appendix 5, Equation 2 – Noncarcinogenic Indoor Air Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the noncarcinogenic indoor air human health-based criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential indoor air remediation standard for the vapor intrusion exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}air\text{-}nc}\left(\mu g/m^3\right) = \frac{THQ \times AT_{res\text{-}a}\left(\frac{365\ days}{year} \times ED_{res}\left(26\ years\right)\right) \times \left(\frac{1000\ \mu g}{mg}\right)}{EF_{res}\left(\frac{350\ days}{year}\right) \times ED_{res}\left(26\ years\right) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times \frac{1}{RfC\left(\frac{mg}{m^3}\right)}}$$

The above equation includes the units for the listed input parameters. Deleting these units simplifies the equation to:

$$SL_{res\text{-}air\text{-}nc} = \frac{THQ \text{ x } AT_{res-a} \text{ x } ED_{res} \text{ x } \left(\frac{1000\ ug}{mg}\right)}{EF_{res} \text{ x } ED_{res} \text{ x } ET_{res} \text{ x } \left(\frac{1\ day}{24\ hours}\right) \text{ x } \left(\frac{1}{RfC}\right)}$$

This USEPA terminology, which is for a residential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
$AT_{res\text{-}a}$	*AT*	Averaging time – residential adult
EF_{res}	*EF*	Exposure frequency – residential adult
ED_{res}	*ED*	Exposure duration – residential adult
ET_{res}	*ET*	Exposure time - residential adult
RfC	*RfC*	Reference concentration
$\frac{1000\ ug}{mg}$	$\frac{1000\ ug}{mg}$	Unit conversion factor
$\frac{1\ day}{24\ hours}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}air\text{-}nc} = \frac{THQ \ x \ AT \ x \ ED \ x \left(\frac{1000\ ug}{mg}\right)}{EF \ x \ ED \ x \ ET \ x \left(\frac{1\ day}{24\ hours}\right) x \left(\frac{1}{RfC}\right)}$$

As the USEPA term $SL_{res\text{-}air\text{-}nc}$ is the equivalent of the Department term IA_{nc}, the equation presented above is equivalent to the equation presented at N.J.A.C. 7:26D Appendix 5 as Equation 2 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 5, Equation 2 is:

$$IA_{nc} = \frac{THQ * AT * ED * \frac{1000\ \mu g}{mg}}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * \frac{1}{RfC}}$$

References

USEPA (2018) Regional Screening Levels (RSLs) – Equations (November 2018)

https://www.epa.gov/risk/regional-screening-levels-rsls-equations