Annex A
TITLE 25. ENVIRONMENTAL PROTECTION
PART I. DEPARTMENT OF ENVIRONMENTAL PROTECTION
Subpart D. ENVIRONMENTAL HEALTH AND SAFETY
ARTICLE VI. GENERAL HEALTH AND SAFETY
CHAPTER 250. ADMINISTRATION OF LAND RECYCLING PROGRAM
Subchapter C. STATEWIDE HEALTH STANDARDS

§ 250.304. MSCs for groundwater.

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(c) The MSCs for regulated substances contained in groundwater in aquifers used or currently planned to be used for drinking water or for agricultural purposes are the MCLs as established by the Department or the EPA in § 109.202 (relating to State MCLs, MRDLs and treatment technique requirements). For regulated substances where no MCL has been established, the MSCs are the Lifetime Health Advisory Levels (HAL) set forth in Drinking Water Standards and Health Advisories (DWSHA), EPA Office of Water Publication No. EPA 822-F-18-001 (March 2018 or as revised), except for substances designated in the DWSHA with cancer descriptor (L) "Likely to be carcinogenic to humans" or (L/N) "Likely to be carcinogenic above a specific dose but not likely to be carcinogenic below that dose because a key event in tumor formation does not occur below that dose." **[New] MSCs for regulated substances with HALs designated in the DWSHA with L or L/N cancer descriptors will be calculated by the Department and become effective upon publication in the *Pennsylvania Bulletin*. All other new** or revised MCLs or HALs **[promulgated by the Department or] published in the *Federal Register* by the EPA or in the *Pennsylvania Bulletin* by the Environmental Quality Board** shall become effective immediately **[for any demonstration of attainment completed after the date the new or revised MCLs or HALs become effective.] and shall supersede any MSCs previously promulgated for those regulated substances. For the purposes of this subsection, MCLs and HALs refer exclusively to final versions of promulgated MCLs and published versions of final HALs.**

(1) For regulated substances where neither an MCL nor a lifetime HAL has been established and for substances designated in the DWSHA with cancer descriptor (L) or (L/N), the MSCs are the lowest concentration calculated using the appropriate residential and nonresidential exposure assumptions and the equations in §§ 250.306 and 250.307 (relating to ingestion numeric values; and inhalation numeric values).

(2) If the Lifetime HAL for a substance designated in the DWSHA with cancer descriptor (L) or (L/N) is less than the MSC calculated under paragraph (1), then the Lifetime HAL shall be the MSC.

(3) IN ADDITION TO MEETING THE INDIVIDUAL MSC, IF MORE THAN ONE OF THE PFAS INCLUDED IN THE MCL HAZARD INDEX (HI) CALCULATION ARE DETECTED AT ANY CONCENTRATION IN A SAMPLE, AN HI MUST BE CALCULATED USING THE EQUATION IN § 250.707(b)(2)(iii).

<center>*   *   *   *   *</center>

(g) The references referred to in subsection (f) are:

<center>*   *   *   *   *</center>

(24) OECD (Organisation for Economic Co-operation and Development). 2002. *Hazard Assessment of Perfluorooctane Sulfonate (PFOS) and its Salts*. ENV/JM/RD (2002) 17/FINAL. Report of the Environment Directorate, Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology, Co-operation on Existing Chemicals, Paris, November 21, 2002.

(25) Kim, Minhee, et al. 2015. *Selecting reliable physicochemical properties of perfluoroalkyl and polyfluoroalkyl substances (PFASs) based on molecular descriptors. Environ. Pollution 196: 462—472.*

§ 250.305. MSCs for soil.

<center>*   *   *   *   *</center>

(b) The MSCs for regulated substances in soil are presented in Appendix A, Tables 3 and 4. The methodology for calculating MSCs in soil is detailed in subsections (c)—(e) and the MSCs are further limited to not exceed the physical capacity of the soil to contain a regulated substance. This physical limitation is based on an assumed porosity of 0.35, an assumed dry bulk density of soil of 1.8 kilograms per liter and an assumed density of a regulated substance of 1.0 kilograms per liter. This is calculated according to the equation in paragraph (1). For regulated substances which are organics and liquids at standard temperature and pressure (STP) as identified in Appendix A, Table 5 (Chemical Properties), the physical limitation is further limited based on residual saturation with the additional assumption of a residual saturation ratio of substance volume to soil volume of 0.051, as calculated in Equation (2).

$$(1)\ \left[C_{PL} = \frac{\rho_{RS} n}{\rho_B}\right]\ \underline{C_{PL} = \frac{\rho_{RS} \times n}{\rho_B}}$$

$$(2)\ \left[MSC = Sr * \frac{\rho_{RS} n}{\rho_B} * \times 1{,}000{,}000\ mg/kg = 10{,}000\ mg/kg\right]$$

$$\underline{MSC = Sr \times \frac{\rho_{RS} \times n}{\rho_B} \times 1{,}000{,}000\ mg/kg = 10{,}000\ mg/kg}$$

where:

C_{PL} = physical capacity of the soil

$[gr]_{RS}$ = density of the regulated substance = 1.0 kg/L

$[n]\ \underline{n}$ = porosity of the soil = 0.35

$[gr]_B$ = dry bulk density of the soil = 1.8 kg/L

$[Sr]\ \underline{Sr}$ = residual saturation ratio (substance vol./soil vol.) = 0.051

<center>*   *   *   *   *</center>

§ 250.306. Ingestion numeric values.

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(d) The default exposure assumptions used to calculate the ingestion numeric values are as follows:

Term		Residential		Nonresidential (Onsite Worker)
Systemic[1]	*Carcinogens*[2,6]			
THQ	Target Hazard Quotient	1	N/A	1
RfD_o	Oral Reference Dose (mg/kg-day)	Chemical-specific	N/A	Chemical-specific
BW	Body Weight (kg) Soil Groundwater	15 80	N/A	80 80
AT_{nc}	Averaging Time for systemic toxicants (yr) Soil Groundwater	6 30	N/A N/A	25 25
Abs	Absorption (unitless)[3]	1	1	1
EF	Exposure Frequency (d/yr) Soil Groundwater	250 350	250 350	180 250
ED	Exposure Duration (yr) Soil Groundwater	6 30	N/A N/A	25 25
IngR	Ingestion Rate Soil (mg/day) GW (L/day)	100 2.4	N/A N/A	50 1.2
CF	Conversion Factor Soil (kg/mg) GW (unitless)	1×10^{-6} 1	1×10^{-6} 1	1×10^{-6} 1
TR	Target Risk	N/A	1×10^{-5}	1×10^{-5}
CSF_o	Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	N/A	Chemical-specific	Chemical-specific
AT_c	Averaging Time for carcinogens (yr)	N/A	70	70
IFadj[4]	Ingestion Factor Soil (mg-yr/kg-day) GW (L-yr/kg day)	N/A	55 [1.2] **1.1**	15.6 0.38
AIFadj[5]	Combined Age-Dependent Adjustment Factor and Ingestion Factor Soil (mg-yr/kg-day) GW (L-yr/kg-day)	N/A	241 3.45	N/A
$CSFo_k$	TCE oral cancer slope factor for kidney cancer (mg/kg/day)$^{-1}$		9.3×10^{-3}	
$CSFo_l$	TCE oral cancer slope factor for non-Hodgkin lymphoma and liver cancer (mg/kg/day)$^{-1}$		3.7×10^{-2}	

Notes:

[1] Residential exposure to noncarcinogens is based on childhood (ages 1—6) exposure for soil, and adult exposure for groundwater, consistent with USEPA (1991).

[2] Residential exposure to carcinogens is based on combined childhood and adult exposure.

[3] The oral absorption factor takes into account absorption and bioavailability. In cases where the oral RfD or CSF is based on administered oral dose, the absorption factor would be limited to bioavailability. The default value is 1.

[4] The Ingestion Factor for the residential scenario is calculated using the equation If adj = $ED_c \times IR_c/BW_c + ED_a \times IR_a/BW_a$, where ED_c = 6 yr, IR_c = 100 mg/day for soils and 1 L/day for groundwater, BW_c = 15 kg, ED_a = 24 yr, IR_a = 50 mg/day for soils and 2.4 L/day for groundwater, and BW_a = 80 kg. The ingestion factor for the nonresidential scenario is calculated using the equation If adj = $ED \times IR/BW$, where ED = 25 yr, IR = 50 mg/day for soils and 1.2 L/day for groundwater, and BW = 80 kg.

[5] The Combined Age-Dependent Adjustment Factor and Ingestion Factor (AIFadj) for the residential scenario is calculated using the equation AIFadj = $[(ADAF_{0t;2} \times ED_{0t;2}) + (ADAF_{2-6} \times ED_{2-6})] \times IR_c / BW_c + [(ADAF_{0t;6-16} \times ED_{0t;6-16} + (ADAF_{0t;16} \times ED_{0t;16})] \times IR_a / BW_a$, where $ADAF_{0t;2}$ = 10, $ED_{0t;2}$ = 2 yr, $ADAF_{2-6}$ = 3, ED_{2-6} = 4 yr, IR_c = 100mg/day for soils and 1 L/day for groundwater, BW_c = 15 kg, $ADAF_{0t;6-16}$ = 3, $ED_{0t;6-16}$ = 10 yr, $ADAF_{0t;16}$ = 1, $ED_{0t;16}$ = 14 yr, IR_a = 50 mg/day for soils and 2.4 L/day for groundwater, and BW_a = 80 kg.

[6] For the equation to calculate the vinyl chloride residential MSC based on the carcinogenic effect, IRc = 100 mg/day for soils and 1 L/day for groundwater, BW_c = 15 kg.

(e) The residential ingestion numeric value for lead in soil was developed using the **[Uptake Biokinetic (UBK) Model for Lead (version 0.4)]** <u>Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® version (IEUBKwin v1.1 build 11) 32-bit version</u> developed by the EPA (U.S. Environmental Protection Agency**[. (1990) Uptake Biokinetic (UBK) Model for Lead (version 0.4). U.S. EPA/ECAO. August 1990 <u>February 2010)</u>**, in lieu of the algorithms presented in subsections (a) and (b). Default input values are identified in Appendix A, Table 7. **[Because the UBK model is applicable only to children, the nonresidential ingestion numeric value was calculated according to the method developed by the Society for Environmental Geochemistry and Health (Wixson, B. G. (1991)). The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. *Trace Substances in Environmental Health.* (11-20), using the following equations:**

$$S = \frac{1000\left[\left(\frac{T}{G^n}\right) - B\right]}{\delta}$$

]

<u>Because the IEUBK model is applicable only to children, the nonresidential ingestion numeric value was calculated using the EPA's Adult Lead Methodology in accordance with the guidance, exposure factors, equations and spreadsheets provided in EPA's *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (EPA-540-R-03-001, OSWER Dir #9285.7-54, January 2003), *OLEM Directive 9285.6-56 "Update to the Adult*</u>

Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters" **(May 2017) and the associated June 14, 2017, version of the** *Calculations of Preliminary Remediation Goals (PRGs) for Soil in Nonresidential Areas U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee* **spreadsheets.** Table 7 identifies each of the variables **[in this equation]** <u>used to calculate the nonresidential ingestion numeric value for lead</u>.

Subchapter D. SITE-SPECIFIC STANDARD

§ 250.404. Pathway identification and elimination.

(a) The person shall use Department or Department-approved EPA or ASTM guidance to identify any potential current and future exposure pathways for both human receptors and **[environmental]** <u>ecological</u> receptors identified in § 250.402 (relating to human health and environmental protection goals).

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Subchapter F. EXPOSURE AND RISK DETERMINATIONS

§ 250.605. Sources of toxicity information.

(a) For site-specific standards, the person shall use appropriate reference doses, reference concentrations, cancer slope factors and unit risk factors identified in Subchapter C (relating to Statewide health standards), unless the person can demonstrate that published data, available from one of the following sources, provides more current reference doses, reference concentrations, cancer slope factors or unit risk factors:

(1) Integrated Risk Information System (IRIS). **Cancer slope factors and inhalation unit risk factors for carcinogenic polycyclic aromatic hydrocarbons are derived using relative potency factors contained in United States Environmental Protection Agency July 1993 Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (EPA/600/R-93/089).**

(2) United States Environmental Protection Agency, National Center for Environmental Assessment (NCEA) Provisional Peer-Reviewed Toxicity Values (PPRTV).

(3) Other sources:

(i) Health Effects Assessment Summary Tables (HEAST).

(ii) Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles.

(iii) California EPA, California Cancer Potency Factors and Chronic Reference Exposure Levels.

(iv) EPA criteria documents, including drinking water criteria documents, drinking water health advisory summaries, ambient water quality criteria documents and air quality criteria documents.

(v) EPA Human Health Benchmarks for Pesticides (HHBP).

(vi) EPA PPRTV Appendix.

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§ 250.606. Development of site-specific standards.

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(d) The following factors shall be considered in the development of the risk assessment and in the development of site-specific standards:

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(3) The person shall consider current and probable future exposure scenarios, such as:

(i) Human ingestion of soil when direct contact exposure to the soil may reasonably occur.

(ii) Exposure to groundwater by ingestion with respect to leaching of regulated substances from soils to groundwater.

(iii) Human inhalation of regulated substances from volatilization and migration of these substances into **[below grade]** occupied space.

(iv) Human ingestion of regulated substances in surface water or other site-specific surface water exposure pathways with respect to regulated substances migration from soil to surface water.

(v) Human inhalation of regulated substances in air or other site-specific air exposure pathways with respect to the release of regulated substances from soil to air.

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Subchapter G. DEMONSTRATION OF ATTAINMENT

§ 250.703. General attainment requirements for soil.

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(b) The soil to which the attainment criteria are applied shall be determined by circumscribing with an irregular surface those concentrations detected during characterization which exceed the selected standard. Where this soil is to be removed from the site, the attainment demonstration applies to the base **and sidewalls** of the excavation defined by the limit of excavation.

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(d) For statistical methods under § 250.707(b)(1)(i) **and (iv)** (relating to statistical tests), the number of sample points required for each distinct area of contamination to demonstrate attainment shall be determined in the following way:

*   *   *   *   *

§ 250.704. General attainment requirements for groundwater.

*   *   *   *   *

(e) For statistical methods under § 250.707(b)(2)(ii), **(iii),** and (c), the minimum number of samples required for demonstrating attainment shall be as specified by the documentation of the chosen method.

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§ 250.707. Statistical tests.

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(b) The following statistical tests may be accepted by the Department to demonstrate attainment of the Statewide health standard. The statistical test for soil shall apply to each distinct area of contamination. The statistical test for groundwater will apply to each compliance monitoring well. Testing shall be performed individually for each regulated substance identified in the final report site investigation as being present at the site for which a person wants relief from liability under the act. The application of a statistical method must meet the criteria in subsection (d).

(1) For soil attainment determination at each distinct area of contamination, subparagraph **[(i), (ii) or (iii)] (i), (ii), (iii) or (iv)** shall be met in addition to the attainment requirements in § § 250.702 and 250.703 (relating to attainment requirements; and general attainment requirements for soil).

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(iii) For sites with a petroleum release where full site characterization, as defined in § 250.204(b) (relating to final report), has not been done in association with an excavation remediation, attainment of the Statewide health standard shall be demonstrated using the following procedure:

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(D) A vapor intrusion analysis is not necessary if the requirements of § 250.707(b)(1)(iii) are met in addition to the following:

(I) At least one soil sample is collected on the sidewall nearest an inhabited building within the appropriate proximity distance to a potential vapor intrusion source and there are not substantially higher field instrument readings elsewhere.

(II) Observations of obvious contamination and the use of appropriate field screening instruments verify that contamination has not contacted or penetrated the foundation of an inhabited building.

(III) Groundwater contamination has not been identified as a potential vapor intrusion concern.

(iv) For sites with a release of lead or lead compounds that has been remediated to attain an MSC for lead based on an ingestion numeric value calculated in accordance with the requirements of § 250.306(e) (relating to ingestion numeric values) and Appendix A, Table 7, the arithmetic average of all attainment samples, which shall be randomly collected in a single event from the site, shall be equal to or less than the applicable MSC.

(2) For groundwater attainment determination at each compliance monitoring well, subparagraph (i) or (ii) shall be met in addition to the attainment requirements in § 250.702 and § 250.704 (relating to general attainment requirements for groundwater).

(i) Seventy-five percent of all samples collected within each monitoring well over time shall be equal to or less than the Statewide health standard or the limit related to PQLs with no individual sample exceeding both of the following:

(A) Ten times the Statewide health standard on the property.

(B) Two times the Statewide health standard beyond the property boundary.

(ii) As applied in accordance with EPA approved methods on statistical analysis of environmental data, as identified in subsection (e), the 95% UCL level of the arithmetic mean shall be at or below the Statewide health standard.

(iii) FOR ATTAINMENT OF THE PFAS HI MSC AS NOTED IN § 250.304(c)(3), THE DATA MUST MAINTAIN A ROLLING AVERAGE HI OF LESS THAN ONE FOR THE MOST RECENT FOUR QUARTERS OF SAMPLING DATA FOR THE PFAS DETECTED USING THE EQUATION:

$$HI = (C_{GEN-X}/MSC_{GEN-X})+(C_{PFBS}/MSC_{PFBS})+(C_{PFHXS}/MSC_{PFHXS})+(C_{PFNA}/MSC_{PFNA})$$

WHERE:

C_{GEN-X} = **GEN-X CONCENTRATION**
MSC_{GEN-X} = **GEN-X MSC**
C_{PFBS} = **PFBS CONCENTRATION**
MSC_{PFBS} = **PFBS MSC**
C_{PFHXS} = **PFHxS CONCENTRATION**
MSC_{PFHXS} = **PFHxS MSC**
C_{PFNA} = **PFNA CONCENTRATION**
MSC_{PFNA} = **PFNA MSC**

THE COMPOUNDS TO BE INCLUDED ARE NOTED WITH AN "HI" IN APPENDIX A, TABLE 1. THE MSC VALUES TO BE USED IN THIS CALCULATION ARE THE USED AQUIFER RESIDENTIAL VALUES.

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(d) Except for the statistical methods identified in **[subsections (a)(1)(i) and (b)(1)(i) and (2)(i)]** **subsection (a)(1)(i), subsection (b)(1)(i), subsection (b)(1)(iv), ~~and~~ subsection (b)(2)(i)**, **AND SUBSECTION (b)(2)(iii),** a demonstration of attainment of one or a combination of remediation standards shall comply with the following:

*   *   *   *   *