

State of Connecticut
Regulation of
Department of Energy and Environmental Protection
Concerning
Remediation Standards

The regulations of sections 22a-133k-1 to 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies are hereby amended as follows:

Sec. 22a-133k-1.

(a) Definitions[.]

For the purposes of [sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs, the following [definitions apply] terms shall have the following meaning:

[(1)] “[Analytical detection limit” means the minimum concentration of a substance that can be quantified consistently and reliably using methods approved by EPA and which concentration shall be (A) for a substance in ground water, equal to or less than the ground-water protection criterion for such substance determined (i) for a sample of ground water in a GA area using analytical methods specified in subpart C of 40 CFR part 141 or (ii) for a sample of ground water in a GB area using methods established pursuant to “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods”, SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460; or (B) for a substance in soil, equal to or less than the residential direct exposure criteria or the applicable pollutant mobility criteria, whichever is lower using methods established pursuant to “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods”, SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460.]

(1) “Application of pesticides” means the spraying, spreading, injection, placement, or other use of pesticides at a parcel for the pesticides’ intended purpose, but does not include other releases of pesticides such as those from the handling, mixing, storing, spilling, leaking or disposing of pesticides, or releases of pesticides from equipment cleaning or repair.

(2) “Aquifer protection area” [means an aquifer protection area] has the same meaning as [defined] provided in section 22a-354h of the Connecticut General Statutes.

(3) “Area of influence” [means as “area of influence”] has the same meaning as [defined] provided in section 22a-354b-1(a) of the Regulations of Connecticut State Agencies.

(4) “Areal extent of a ground[-]water plume” means the surface area beneath which ground[]water [has been or may be] is polluted by a release and in which [ground water] one or more substances from such release or mobilized by such release is [or may be] present at a concentration above the [analytical detection limit] laboratory reporting limit.

[(5)] “[Background concentration for ground water” with respect to a particular release means the concentration of a substance in ground water (A) at the nearest location upgradient of and unaffected by the release; or (B) if such release occurred at or created a ground-water divide, at the nearest location representative of ground water quality unaffected by any release.]

[(6)] “[Background concentration for soil” means the representative concentration of a substance in soil of similar texture and composition outside the subject release area and in the general geographic vicinity of such release area, but not within any other release area.]

(5) “Background concentration” means the concentration of a substance in soil or groundwater

that, based on a validated conceptual site model, is:

(A) In the general geographic vicinity of a release; and

(B) Either:

(i) Naturally occurring; or

(ii) Minimally affected by human influences at concentrations equal to or less than criteria specified in the RSRs.

[(7)](6) “Carcinogenic substance” means a substance defined as a “carcinogen” by federal or state agencies and for which a quantitative health risk extrapolation is available.

[(8)](7) “CFR” means the Code of Federal Regulations.

[(9)](8) “Commissioner” means the [Commissioner] commissioner of Energy and Environmental Protection or [his] the commissioner’s designee.

(9) “Conceptual site model” means a representation in three dimensions of environmental conditions at a release area that is developed through a multi-phased investigative approach which validates such representation with information about, including but not limited to, a substance’s release, fate and transport, and pathway to human and environmental receptors.

(10) “Demarcation layer” means a brightly-colored, tear-resistant, environmentally-stable marker layer installed at an appropriate depth, suitable to indicate the presence of polluted soil beneath such layer.

[(10)] “[Dense non-aqueous phase liquid]” means a non-aqueous phase liquid that has a density greater than water at 20 degrees Celsius.]

(11) “Department” means the Connecticut Department of Energy and Environmental Protection.

[(11)](12) “Dilution factor” means the ratio by which the concentration of a substance dissolving into soil water is reduced by dilution with groundwater or surface water, as applicable.

[(12)](13) “Dilution and attenuation factor” or “Dilution attenuation factor” means the ratio by which the concentration of a substance dissolving into soil water is reduced by dilution with groundwater and by sorption to unsaturated or saturated soil, or by degradation, transformation or stabilization of the substance.

(14) “Diminishing state groundwater plume” means a groundwater plume that has been characterized seasonally and in three dimensions, provided that the characterization of such plume:

(A) Is consistent with a validated conceptual site model; and

(B) Demonstrates that such plume:

(i) Is not migrating, or has very limited potential to migrate, in any direction; and

(ii) Is comprised only of substances whose concentrations have decreased and will continue to decrease over time, except for the concentrations of related breakdown components, provided it is demonstrated that concentrations of such breakdown components are not a known risk to human health and the environment.

[(13)](15) “Direct [Exposure] exposure [Criteria] criteria” or “DEC” means the [concentrations] criteria identified in Appendix A [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or any] of the RSRs, alternative direct exposure criteria approved by the [Commissioner] commissioner pursuant to section 22a-133k-2(d) of the [Regulations of Connecticut State Agencies] RSRs, or direct exposure criteria approved by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs .

[(14)](16) “Downgradient” means in the direction of the maximum rate of decrease of hydraulic head.

[(15)](17) “Downgradient area” with respect to a release of a substance means the area bounded by:

(A) [the] The width of the release area of such substance perpendicular to the direction of groundwater flow[,];

(B) [two] Two side boundary lines parallel to the downgradient direction of ground water flow extending from the two endpoints of said width to the downgradient parcel boundary[.]; and

(C) [the] The downgradient parcel boundary extending between the two side boundary lines[.], excluding any portion of such downgradient area that is either [(i)] affected by any other release of such substance or [(ii)] beneath an existing permanent structure.

[(16)](18) “Engineered control” means any physical barrier, system, technology or method [, that permanently renders pollution in soil environmentally isolated or inaccessible, when combined with appropriate long-term inspections, maintenance or monitoring] that prevent exposure to polluted soil, or minimizes migration of liquids or vapor through such soil, and complies with the other requirements specified in section 22a-133k-2(f)(2) of the RSRs.

[(17)](19) “Environmental land use restriction” or “ELUR” [means an environmental land use restriction as defined] has the same meaning as provided in section 22a-133q-1 of the Regulations of Connecticut State Agencies.

[(18)](20) “Environmentally isolated soil” means polluted soil which is[: (A)(i) beneath an existing building or (ii) beneath another existing and permanent structure which the Commissioner has determined in writing would prevent the migration of pollutants; (B) not a continuing source of pollution; (C) not polluted with volatile organic substances or, if it is polluted with such substances, the concentration of such substances has been reduced in concentration to the maximum extent prudent; and (D)] above the seasonal high water table and is not subject to infiltration in accordance with section 22a-133k-2(c)(5)(A) of the RSRs, thereby preventing the leaching of pollutants from such soil into groundwater.

[(19)](21) “EPA” means the United States Environmental Protection Agency.

[(20)](22) “ETPH” means [the analytical results obtained using the “State of Connecticut, Department of Environmental Protection, Recommended Reasonable Confidence Protocols, Quality Assurance and Quality Control Requirements For Extractable Total Petroleum Hydrocarbons by the State of Connecticut, Department of Public Health ETPH Method”, Version 2.0 dated July 2006 that is available on the Department of Energy and Environmental Protection website at: http://www.ct.gov/deep/lib/deep/site_clean_up/guidance/RCP/RCP_Method_ETPH.pdf] extractable total petroleum hydrocarbons.

(23) “Environmental use restriction” or “EUR” has the same meaning as provided in section 22a-133q-1 of the Regulations of Connecticut State Agencies.

(24) “EUR regulations” has the same meaning provided in section 22a-133q-1 of the Regulations of Connecticut State Agencies.

[(21)](25) “Excess lifetime cancer risk” means the estimated probability that an individual’s exposure to a substance could result in cancer.

[(22)](26) “GA area” means an area where the ground[-]water classification is GA₂ [or] GAA, [respectively] or GAAs.

[(23)](27) “GB area” means an area where the ground[-]water classification is GB.

[(24)](28) “Ground[]water” means that portion of “waters” as defined in section 22a-423 of the Connecticut General Statutes [which portion is] at or below the water table.

[(25)](29) “Ground[-]water classification” means the ground[-]water classification [goal or the ground-water classification, whichever is more stringent,] established in the Water Quality Standards.

(30) “Groundwater criteria” means surface water protection criteria, water quality criteria, volatilization criteria, groundwater protection criteria, and background concentration, as applicable.

[(26)](31) “Ground[-]water divide” means a line on the water table from which the water table slopes downward in both directions away from such line.

(32) “Groundwater plume” means groundwater that has been polluted by a release and is emanating from a release area and in which one or more substances from such release is present at a

concentration above the laboratory reporting limit.

[(27)](33) “Ground[-]water protection criteria” or “GWPC” means the [concentrations] criteria identified in Appendix C [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative groundwater protection criteria calculated by an LEP or approved by the commissioner pursuant to section 22a-133k-3(d)(2) of the RSRs, or groundwater protection criteria approved by the commissioner pursuant to section 22a-133k-3(i)(1) the RSRs.

[(28)] [“Ground-water plume” means ground water which has been polluted by a release and in which ground water one or more substances from such release is present at a concentration above the analytical detection limit.]

(34) “Hardscape” means man-made features that are incorporated into landscaped areas, including walkways constructed with asphalt, concrete, or pavers; gravel parking areas and driveways; paved or gravel storm water features; placement of natural rock; rip-rap; and non-vegetated retaining walls.

[(29)](35) “Hazard index” means the calculation of the potential for non-cancer health effects as a result of exposure to one or more substances with the same or similar modes of toxic action or toxic endpoints.

[(30)](36) “Hydraulic gradient” means the change in hydraulic head per unit distance.

[(31)](37) “Hydraulic head” means the elevation to which water rises in a piezometer or a well.

(38) “Immobilization” or “Immobilize” means the act of binding a substance to create a solid that is resistant to leaching and eliminates or virtually eliminates the mobility of a substance from such solid, including but not limited to, solidification to physically bind or enclose a substance within a stabilized mass, stabilization through chemical reactions between a stabilizing agent and a substance, or encapsulation by coating a substance.

[(32)](39) “Inaccessible soil” means [polluted] soil [which is] that meets one of the following conditions:

(A) Is more than four feet below the ground surface;

(B) Is more than two feet below a paved ground surface comprised of [a minimum of three inches of] bituminous concrete that, at a minimum, is three inches thick or reinforced concrete [, which two feet may include the depth of any material used as sub-base for the pavement] that, at a minimum, is four inches thick;

(C)Is beneath a building or other permanent structure; or

[(C)] (D)Is polluted fill:

(i) [Is beneath] Beneath a [bituminous concrete or concrete] paved ground surface comprised of [a minimum of three inches of] bituminous concrete that, at a minimum, is three inches thick or reinforced concrete [if such fill is (i) polluted in excess of] that, at a minimum, is four inches thick; and

(ii) That exceeds the applicable direct exposure criteria [only by semi-volatile] solely due to:

(I)Semi-volatile organic substances or petroleum hydrocarbons that are normal constituents of bituminous concrete[, (ii) polluted by metals in]; or

(II)Metals at concentrations [not in excess of] that are equal to or less than two times the applicable direct exposure criteria[, or (iii) any combination of the substances or limits identified in clause (i) or (ii) of this subparagraph; or (D)(i) beneath an existing building or (ii) beneath another existing permanent structure provided written notice that such structure will be used to prevent human contact with such has been provided to the Commissioner].

[(33)](40) “Industrial/[or]commercial activity” means any activity related to the commercial production, distribution, manufacture or sale of goods [or], services, or any other activity which is not a residential activity [as defined in subdivision (58) of this subsection].

[(34)](41) “Industrial/commercial direct exposure criteria” means the [concentrations] criteria

identified as industrial/commercial direct exposure criteria in Appendix A [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative direct exposure criteria approved by the commissioner pursuant to section 22a-133k-2(d) of the RSRs, or direct exposure criteria approved by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs.

[(35)](42) “Industrial/commercial volatilization criteria” means the [concentrations] criteria identified as industrial/commercial volatilization criteria in [Appendices] Appendix E and Appendix F [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(c)(4) of the RSRs, or volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(i)(3) of the RSRs.

[(36)](43) “Intermittent watercourse” [means “intermittent watercourse”] is a type of watercourse, as the term is defined in section 22a-38 of the Connecticut General Statutes, delineated in accordance with section 22a-38 of the Connecticut General Statutes.

(44) “Laboratory Reporting Limit” means the lowest concentration at which an analyte can be detected in a sample of environmental media by a Connecticut certified laboratory, and which concentration can be reported with a reasonable degree of accuracy and precision pursuant to section 22a-133k-1(h) of the RSRs.

(45) “Licensed environmental professional” or “LEP” means an environmental professional who has a current valid license issued by the commissioner pursuant to section 22a-133v of the Connecticut General Statutes.

[(37)] [“Light non-aqueous phase liquid” means a non-aqueous phase liquid that has a density equal to or less than water at 20 degrees Celsius.]

[(38)](46) “Matrix interference [effect]” means [the inability to measure the concentration of] either a positive or negative effect when measuring the concentration of a substance in a sample [at the analytical detection due to chemical interferences within the sample which interferences cannot be compensated for using methods approved by EPA] that creates erroneous results for an analyte.

(47) “Maximum extent practicable” means the greatest degree of remediation that can be achieved using sound engineering and hydrogeologic practices without taking cost into consideration.

(48) “Maximum extent prudent” means the greatest degree of remediation that can be achieved using sound engineering and hydrogeologic practices that the commissioner deems reasonable, taking into consideration cost in proportion to social and environmental benefits, provided that a mere showing of expense will not necessarily render an alternative unreasonable.

(49) “Monitored natural attenuation” means representative groundwater monitoring of the natural attenuation of each substance in a groundwater plume to a concentration equal to or less than groundwater criteria, provided such monitoring demonstrates that:

(A) Such attenuation occurs within a reasonable timeframe after completing the remediation of a release in a manner that achieves compliance with the RSRs; and

(B) The only remaining groundwater plume from a release is a diminishing state groundwater plume.

[(39)](50) “Natural attenuation” means a decrease in concentration of a substance in ground[]water through operation of natural physical or chemical processes, including but not limited to, adsorption, absorption, dilution, phase transfer, oxidation, organic complexation, biodegradation, dispersion and diffusion.

(51) “Naturally occurring” means present in the environment in forms that have not been influenced by human activity.

[(40)](52) “Ninety-five percent upper confidence level of the arithmetic mean” means a value that, when repeatedly calculated for randomly drawn subsets of size n from a population, equals or

exceeds the population arithmetic mean ninety-five percent of the time.

[(41)](53) “Non-aqueous phase liquid” or “NAPL” means a liquid that is not dissolved in water.

(54) “Notice of Activity and Use Limitation” or “NAUL” has the same meaning provided in section 22a-133q-1 of the Regulations of Connecticut State Agencies.

[(42)](55) “Organoleptic” means the capability to produce a detectable sensory stimulus such as odor or taste.

[(43)](56) “Parcel” means a piece, tract, or lot of land, together with the buildings and other improvements situated thereon, a legal description of which piece, [parcel,] tract, or lot is contained in a deed or other instrument of conveyance.

[(44)](57) “[PCB] PCBs” means polychlorinated biphenyls.

[(45)](58) “PPB” means parts per billion.

[(46)](59) “PPM” means parts per million.

[(47)](60) “Person” [means person as defined] has the same meaning as provided in section 22a-2(b) of the Connecticut General Statutes.

(61) “Pesticide” has the same meaning as provided in section 22a-47(w) of the Connecticut General Statutes.

[(48)](62) “Pollutant mobility criteria” or “PMC” means the [concentrations] criteria identified in Appendix B [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or any] of the RSRs, alternative pollutant mobility criteria calculated by an LEP or approved by the [Commissioner] commissioner pursuant to [subsection] section 22a-133k-2(d) of the [Regulations of Connecticut State Agencies] RSRs, or pollutant mobility criteria approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs.

[(49)](63) “Polluted fill” means soil [or sediment] which contained polluting substances at the time such soil [or sediment] was deposited as fill material.

(64) “Polluted material” means soil that has been historically intermixed with coal ash, wood ash, coal fragments, coal slag, coal clinkers, asphalt paving fragments, or any combination thereof.

[(50)](65) “Polluted soil” means soil affected by a release of a substance at a concentration above the [analytical detection limit] laboratory reporting limit for such substance.

[(51)](66) “Pollution” [means pollution as defined] has the same meaning as provided in section 22a-423 of the Connecticut General Statutes.

[(52)] [“Potable water” means public water as defined in section 22a-423 of the General Statutes.]

[(53)](65) “Potential public water supply resource” means any [(A) any] “potential well [field] fields” as defined in section 22a-354a of the Connecticut General Statutes, or [(B)] any area [identified] mapped by the [Commissioner] commissioner pursuant to section 22a-354c(b) of the Connecticut General Statutes.

[(54)] [“Prudent” means reasonable, after taking into consideration cost, in light of the social and environmental benefits.]

(66) “Public roadway” means any portion of a federal, state, town, or other public highway, including but not limited to, road, street, parkway, limited access highway, boulevard, or avenue paved with bituminous concrete or concrete, under the control of the federal government, the state or any political subdivision of the state, any quasi-governmental entity or municipal economic development agency or entity created or operating under the Connecticut General Statutes, that is dedicated, appropriated, or opened to the movement of vehicles or pedestrians, including appurtenant sidewalks, medians, and shoulders, but excluding landscaped or grassy areas beyond the outer edge of the travel way.

(67) “Public water supply distribution system” means any combination of pipes, tanks, pumps, etc. which delivers water from the source(s) or treatment facility to the consumer from any water company, as defined in section 25-32a of the Connecticut General Statutes supplying water to two (2)

or more consumers, or twenty-five (25) or more persons daily, at least sixty (60) days of the year.

(68) “Q99” means the daily stream flow that is predicted to be equaled or exceeded on 99 percent of days in a year, and is calculated using methods developed by the U.S. Geological Survey (StreamStats).

[(55)](69) “Release” means any discharge, spillage, uncontrolled loss, seepage, filtration, leakage, injection, escape, dumping, pumping, pouring, emitting, emptying, or disposal of a substance.

[(56)](70) “Release area” means the land area at and beneath which polluted soil is located as a result of a release.

[(57)](71) “Remediation” means the containment, removal, mitigation, or abatement of pollution[, a potential source of pollution], or a substance which poses a risk to human health or the environment, and includes but is not limited to the reduction of pollution by natural attenuation.

(72) “Reasonable confidence protocols” or “RCPs” means any reasonable confidence protocols, quality assurance requirements, or quality control requirements, posted by the commissioner on the Department’s internet website, regarding the laboratory measurements of the concentration of a substance in a sample.

(73) “Remediation Standard Regulations” or “RSRs” means sections 22a-133k-1 to 22a-133k-3, inclusive of the Regulations of Connecticut State Agencies, including Appendix A to Appendix I, inclusive, of the aforementioned regulations.

[(58)](74) “Residential activity” means any activity [related to a] at:

(A) [residence or dwelling] A place intended for people to live, including but not limited to, a residence, dwelling, house, apartment, condominium, [or] nursing home, or dormitory;

(B) A pre-school, primary school, secondary school, [hospital,] day care center, playground, or outdoor recreational area; or

(C) A hospital, solely for the purposes of compliance with volatilization criteria.

[(59)](75) “Residential direct exposure criteria” means the [concentrations] criteria identified as residential direct exposure criteria in Appendix A [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative direct exposure criteria approved by the commissioner pursuant to section 22a-133k-2(d) of the RSRs, or direct exposure criteria approved by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs.

[(60)](76) “Residential volatilization criteria” means the [concentrations] criteria identified as residential volatilization criteria in [Appendices] Appendix E and Appendix F [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(c)(4) of the RSRs, or volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(i)(3) of the RSRs.

[(61)](77) “Seasonal high water table” means, on an annual basis, the highest plane in the ground at which [plane] all pore spaces are filled with water at atmospheric pressure.

[(62)](78) “Seasonal low water table” means, on an annual basis, the lowest plane in the ground at which [plane] all pore spaces are filled with water at atmospheric pressure.

[(63)](79) “Sediment” means unconsolidated material occurring in a [stream channel, estuarine waters, or marine waters] “watercourse” as that term is defined in Section 22a-38 of the Connecticut General Statutes, and in estuarine water or marine water.

(80) “Semi-volatile organic substance” means an organic substance that has a higher molecular weight and higher boiling point than a volatile organic substance.

[(64)] [“Seven day, ten year low flow” or “7Q10” means the lowest seven consecutive day mean stream discharge rate with a recurrence interval of ten (10) years.]

[(65)](81) “Soil” means unconsolidated geologic material overlying bedrock, [but not] including but not limited to, sediment that has been removed from any surface water body and placed on dry

land.

[(66)](82) “Soil water” means that portion of “waters,” as defined in section 22a-423 of the Connecticut General Statutes, which [portion] is above the water table.

(83) “Soil vapor” means gaseous substances in the space between particles of soil.

[(67)](84) “SPLP” means Synthetic Precipitation Leaching Procedure EPA Method 1312 as set forth in “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods”, SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460.

[(68)](85) “Substance” means an element, compound or material which, when added to air, water, soil or sediment, may alter the physical, chemical, biological or other characteristic of such air, water, soil or sediment.

(86) “Subject area” means an area where the RSRs, require an EUR to be placed and maintained as part of the selected remedial approach. Subject area includes the area subject to the restrictions and requirements of an EUR after such EUR has been recorded. There can be multiple subject areas on a parcel, or an entire parcel may comprise a single subject area.

[(69)](87) “Surface-water protection criteria” or “SWPC” means the [concentrations] criteria identified in Appendix D [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or any] of the RSRs, alternative surface[-] water protection criteria calculated by an LEP or approved by the [Commissioner] commissioner pursuant to [subsection] section 22a-133k-3(b)(3) of the Regulations of Connecticut State Agencies RSRs, or surface water protection criteria approved by the commissioner pursuant to section 22a-133k-3(i)(2) of the RSRs.

[(70)](88) “TCLP” means Toxicity Characteristic Leaching Procedure EPA Method 1311 as set forth in “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods”, SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460.

[(71)](89) “Technically [practicable] impracticable” means, [with respect to remediation, the greatest degree of remediation that can] a determination by the commissioner, that further reduction of the concentration of a substance in soil or groundwater cannot be achieved using sound engineering and hydrogeologic remediation practices.

(90) “TI Zone” means the areal extent of a substance that is technically impracticable to remediate to the applicable groundwater criteria.

[(72)](91) “Upgradient” means in the direction of maximum rate of increase of hydraulic head.

[(73)](92) “Upgradient area” with respect to a release area of a substance means the area bounded by:

(A) [the] The width of the release area of such substance perpendicular to the direction of ground[-]water flow[.];

(B) [two] Two side boundary lines parallel to the upgradient direction of ground[-]water flow extending from the two endpoints of said width to the upgradient parcel boundary[.]; and

(C) [the] The upgradient parcel boundary extending between the two side boundary lines[.], excluding any portion of such upgradient area that is [(i)] affected by any other release of such substance, or [(ii)] beneath an existing permanent structure.

[(74)](93) “Volatilization criteria” means the [concentrations] criteria identified in Appendix E and Appendix F [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies or] of the RSRs, alternative volatilization criteria approved by the [Commissioner] commissioner pursuant to [subdivision]section 22a-133k-3(c)(4)of the [Regulations of Connecticut State Agencies] RSRs, or volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(i)(3) of the RSRs.

[(75)](94) “Volatilization criteria for ground water” means the [concentrations] criteria identified in Appendix E [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative volatilization criteria approved by the commissioner pursuant to

section 22a-133k-3(c)(4) of the RSRs, or volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(i)(3) of the RSRs.

[(76)](95) “Volatilization criteria for soil vapor” means the [concentrations] criteria identified in Appendix F [to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] of the RSRs, alternative volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(c)(4) of the RSRs, or volatilization criteria approved by the commissioner pursuant to section 22a-133k-3(i)(3) of the RSRs.

(96) “Volatile organic substance” means an organic substance that has a high vapor pressure and low boiling point at room temperature.

(97) “Volatile petroleum substance” means a volatile organic substance found in gasoline, diesel fuel, fuel oil, heating oil, kerosene, jet fuel, or similar fuels, along with volatile organic substances that may have been used as fuel additives.

[(77)](98) “Water table” means the plane in the ground at which [plane] all pore spaces are filled with water at atmospheric pressure.

(99) “Water Quality Criteria” means the lower of the human health or aquatic life criteria contained in Table 3 of the Water Quality Standards.

[(78)](100) “Water Quality Standards” means the [latest adopted] Connecticut Water Quality Standards [and Criteria adopted by the Commissioner pursuant to section 22a-426 of the General Statutes] in sections 22a-426-1 through 22a-426-9 of the Regulations of Connecticut State Agencies and the Classification Maps adopted pursuant to section 22a-426 of the Connecticut General Statutes.

[(79)](101) “Wetland” has the same meaning as [means] “wetlands” as provided [defined] in [sections] section 22a-38(15) of the Connecticut General Statutes [and] or “wetland” as provided in section 22a-29(2) of the Connecticut General Statutes.

[(80)] [“Zone of influence” means zone of influence as defined in section 22a-430-3(a) of the Regulations of Connecticut State Agencies.]

(b) Applicability[.]

(1) General Applicability

(A) [Sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] The RSRs apply to any action taken to remediate polluted soil, surface water or [a] ground[-]water [plume] at or emanating from a release area which action is required pursuant to Chapter 445, Chapter 446k, or section 22a-208a(c)(2) of the Connecticut General Statutes, including but not limited to, any such action required to be taken or verified by a licensed environmental professional.

(B) [Sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] The RSRs do not apply to:

(i) Naturally occurring substances found in the environment in the absence of a release; or

(ii) Pollution within the zone of influence of a ground[-]water discharge permitted by the [Commissioner under] commissioner in accordance with section 22a-430 of the Connecticut General Statutes.

(2) Characterization

All investigation and remediation undertaken to comply with the RSRs shall be based on appropriate representative characterization of a release, using a conceptual site model developed in accordance with prevailing standards and guidelines, such as the Department’s “Site Characterization Guidance Document” as amended.

(3) Other Requirements

[Any person conducting a] All remediation [in accordance with said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] undertaken to satisfy the RSRs shall [obtain] be conducted in accordance with all federal, state, and local requirements,

including but not limited to, 40 CFR Part 761, all permits, and other required authorizations [required by state, federal and local law and shall comply with all applicable state, federal and local laws, including without limitation the requirements of 40 CFR Part 761]. In the event that any provision of [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] the RSRs conflicts with any provision of any other statute or regulation, the more stringent provision shall prevail. Nothing in this subsection shall be construed as requiring any further remediation of any release which has been remediated and which remediation has been approved in writing by the [Commissioner] commissioner, unless the [Commissioner] commissioner takes action to require such remediation pursuant to any section of Chapter 446k of the Connecticut General Statutes.

(4) Construction of Regulations

In the construction of the RSRs, terms or words in the singular may be construed and applied to more than one thing and terms or words in the plural may be construed and applied to the singular or just one thing.

(c) Time-frames for Issuance of Approvals by the Commissioner[.]

[The Commissioner shall, no later than thirty days after the date of receipt of a request for his approval of any variance from or alternative criteria pursuant to sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, provide to the requester in writing] The commissioner shall provide estimated time frames for [the Commissioner to (1) determine whether additional information is needed for him to evaluate the] review upon request[;].[and (2) approve or deny a complete request. In addition, no later than one hundred and eighty days following adoption of said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner shall make available general estimated written time frames for the Commissioner to approve any variance or alternative criterion pursuant to these regulations, including estimated time frames for the Commissioner to (1) determine whether additional information is needed to evaluate the request; and (2) approve or deny a complete request.] In establishing estimated time frames pursuant to this subsection, the [Commissioner] commissioner shall take into account available resources, the complexity of the request, and the environmental and economic significance of the remediation[, and shall expedite any request associated with any voluntary remediation pursuant to section 22a-133x, 22a-133y or 22a-134a of the General Statutes].

(d) Public Participation[.]

(1) [Public Hearing on Remediation. If the Commissioner determines that there is substantial public interest in any remediation proposed pursuant to Chapter 445, Chapter 446k or section 22a-208a(c) of the General Statutes, he may hold a public hearing on such proposed remediation, and he shall hold a hearing upon receipt of a petition signed by twenty-five or more persons. Notice of any such hearing shall be published in a newspaper of substantial circulation in the area of the proposed remediation at least thirty days prior to such hearing. Such hearing need not be conducted pursuant to the provisions of Chapter 54 of the General Statutes.] Public Notice of Remediation

The public participation requirements of this subsection shall apply after a release has been investigated and a remedial action plan has been prepared. When public notice is required by law remediation shall not commence until after the requirements of this subsection have been completed. Except that the requirements of this subsection shall not apply to actions undertaken during an emergency or during other unplanned time critical remedial actions.

(A) Providing Public Notice

The public notice prescribed in subparagraph (B) of this subdivision shall be provided through all of the following means:

(i) Submit copies of such notice to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and to the chief elected municipal official and the Director of Health of the municipality in

which remediation will occur:

(ii) Publishing such notice in a newspaper having a general circulation in the municipality in which the remediation will occur; and

(iii) By either:

(I) Mailing a copy of such notice to each owner of record of each parcel that abuts the parcel to be remediated, at the address for such parcel on the last-completed grand list of the municipality in which the parcel is located; or

(II) Erecting and maintaining for at least thirty (30) days, a sign on the parcel to be remediated. Such sign shall be not less than six feet by four feet, shall be clearly visible from the public roadway, and shall include the words “ENVIRONMENTAL CLEAN UP IN PROGRESS. FOR FURTHER INFORMATION CONTACT:” and include a telephone number and an electronic mail address from which any interested party may obtain additional information about the proposed remediation.

(B) Contents of Public Notice

Except for a sign erected in accordance with subparagraph (A)(iii)(II) of this subdivision, public notice of remediation required pursuant to subparagraph (A) of this subdivision shall include, at a minimum:

(i) The name and address of the owner of the parcel on which remediation will be undertaken and the person responsible for such remediation;

(ii) The address of the parcel or, if no address is available, a description of the location of the parcel relative to the nearest intersection of named streets;

(iii) The remediation identification number assigned by the Department;

(iv) A brief description of the nature of the release and the substances being remediated;

(v) An electronic mail and postal mailing address, telephone number, and a point of contact to whom comments regarding the remediation can be submitted and from whom any interested person may obtain additional information about the proposed remediation;

(vi) A statement that public comments may be submitted, via electronic mail or in writing, for thirty (30) days after the date of publication of such notice; and

(vii) A brief description of the proposed remediation or a website where such information may be obtained. This description shall include, but need not be limited to:

(I) Use of any variance, engineered control, or EUR under the RSRs; and

(II) The approximate schedule to initiate and complete remediation, including any milestones or interim steps.

(2) [Comment Procedures. Any public notice published or mailed pursuant to section 22a-133x, 22a-133y or 22a-134a of the General Statutes shall provide that comments on the proposed remediation may be submitted to the Commissioner within forty-five days of the publication or mailing of such notice. The Commissioner shall forward a copy of all comments received by the date specified in the public notice and all comments made at a public hearing to the owner of the subject parcel and, if different, the person undertaking remediation at such parcel. The person undertaking remediation at the subject parcel shall, within sixty days of receiving such comments, submit to the Commissioner a written summary of all such comments and a written response to each such comment. The Commissioner shall review such summary and responses and shall adopt it as his own, adopt it with modifications, or reject it and prepare a response to each such comment. The Commissioner shall send a copy of the initial summary and responses and of his action with respect thereto to each person who submitted comments on the remediation proposal.] Response to Public Comment

(A) There shall be a public comment period on the proposed remediation for thirty (30) days after publication of the newspaper notice required by subdivision (1)(A)(ii) of this subdivision.

(B) If no comments on the proposed remediation are received during the public comment period,

the person responsible for remediation may commence with the proposed remediation.

(C) If comments on the proposed remediation are received during the public comment period, within thirty (30) days after close of the public comment period, the person responsible for remediation shall submit to the commissioner a written summary of all such comments and a proposed response to each such comment.

(D) Based on the summary of comments and proposed responses, the commissioner may:

(i) Direct the person responsible for remediation to send the written summary and response document to each person who submitted comments within thirty (30) days after the direction is given by the commissioner. If an electronic mail address is known, the summary and response document may be sent to a commenter using electronic mail;

(ii) Revise the written summary and response document and direct the person responsible for remediation to send the written summary and response document, as revised by the commissioner, to each person who submitted comments within thirty (30) days after the direction is given by the commissioner. If an electronic mail address is known, the summary and response document as revised by the commissioner may be sent to a commenter using electronic mail;

(iii) Determine that there is substantial public interest in the proposed remediation and direct the person responsible for the remediation to hold a public meeting regarding the proposed remediation. Notice of any such meeting shall be published in a newspaper of substantial circulation in the area of the proposed remediation at least thirty (30) days prior to such meeting. At such meeting all interested persons shall have reasonable opportunity to submit data, views, or arguments orally or in writing. Any such meeting shall not be conducted as, nor be considered to be, a contested case as that term is defined in section 4-166 of the Connecticut General Statutes. After the public meeting, the person responsible for remediation shall comply with subparagraph (C) of this subdivision and, except for this clause, the commissioner may then take actions specified under this subparagraph; or

(iv) Determine that the proposed remediation is premature, inadequate or deficient and indicate additional measures to be taken, including but not limited to, additional investigation or different remediation.

(E) Within thirty (30) days after a public meeting held in accordance with subparagraph (D)(iii) of this subdivision, the person responsible for remediation shall provide to the commissioner a written summary of and response to any comments received during the public meeting and the commissioner may then take any of the actions in subclauses (i), (ii), or (iv) of subparagraph (D) of this subdivision.

[(2)](3) Requirements for Additional Public Notice

(A) If after commencing remediation there is a substantial change to the remedial actions for which notice of remediation has already been provided, the requirements of subdivision (1) and (2) of this subsection shall apply to and be complied with prior to undertaking any such change. For purposes of this subparagraph, a substantial change shall include, but not be limited to, use of any variance for environmentally isolated soil, inaccessible soil, engineered controls, or technical impracticability, for which public notice was not previously provided.

(B) After providing public notice of remediation in accordance with this subsection, if the remediation for which public notice was provided is not substantially initiated within three years of publication of such notice, notwithstanding the previous compliance with this subsection, the requirements of subdivision (1) and (2) of this subsection shall be undertaken again before remediation can commence.

(4) Compliance with the requirements of this subsection shall satisfy, as applicable, the notice requirements in sections 22a-133x, 22a-133y, 22a-134a, or 32-769 of the Connecticut General Statutes.

(5) For the purposes of this subsection, “the person responsible for remediation” shall mean the person legally required to investigate and remediate a parcel, or for voluntary remediation, the owner

or person undertaking the investigation and remediation.

(e) **[Periodic review.]Environmental Use Restrictions**

[The Commissioner shall periodically review sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies to determine whether the implementation of such regulations is successfully protecting public health and the environment from the hazards of pollution. The Commissioner shall also evaluate whether the implementation of the regulations streamlines the process of conducting remediation projects in Connecticut, based upon, among other things, his review of the number of remediation projects completed in accordance with said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the number of such projects reviewed by the Commissioner pursuant to section 22a-133x or 22a-134a of the General Statutes, the length of time required for the Commissioner's review of complete requests for approval of alternative criteria or variances, and the number of remediation projects conducted pursuant to sections 22a-133x, 22a-133y and 22a-134a of the General Statutes, which projects were verified by a licensed environmental professional. Such reviews shall be conducted at intervals of no more than five years, provided that nothing in this subsection shall preclude the Commissioner, at his discretion, from conducting such a review at any time and further provided that the first such review shall be conducted no later than eighteen months after the effective date of sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies. As a result of such a periodic review, the Commissioner may conclude that the goals of this subsection and section 22a-133k of the General Statute are being met, or he may conclude that revisions to such regulations are necessary to ensure that the implementation of said sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies achieves such goals, in which case he may revise such Regulations as he deems necessary to achieve those goals.]

(1) Whenever an EUR is required under the RSRs:

(A) An ELUR may always be used; and

(B) A NAUL may only be used:

(i) Pursuant to section 22a-133k-2(b)(2) of the RSRs, provided the subject area is zoned for industrial/commercial use and no holder of an interest in such area, other than the owner of such area, has a right of residential activity or use;

(ii) Pursuant to section 22a-133k-2(b)(3)(B) of the RSRs, provided the concentrations of substances in such inaccessible soil do not exceed ten times the applicable direct exposure criteria;

(iii) Pursuant to section 22a-133k-2(b)(6) of the RSRs;

(iv) Pursuant to section 22a-133k-2(c)(5)(A) of the RSRs, provided that:

(I) The concentrations of substances in such soil do not exceed ten times the applicable pollutant mobility criteria; or

(II) The total volume of soil that is environmentally isolated that exceeds ten times the applicable pollutant mobility criteria is equal to or less than ten cubic yards;

(v) Pursuant to section 22a-133k-2(d)(2)(A) of the RSRs;

(vi) Pursuant to section 22a-133k-2(f)(1) of the RSRs;

(vii) Pursuant to section 22a-133k-2(f)(2)(B) or section 22a-133k-2(f)(2)(C) of the RSRs, provided that the concentrations of the substances in polluted soil at the subject area are equal to or less than ten times the applicable direct exposure criteria;

(viii) Pursuant to section 22a-133k-3(c)(1) or section 22a-133k-3(c)(2)(A) of the RSRs, provided the subject area is zone for industrial commercial use and no holder of an interest in such area, other than the owner of such area, has a right of residential activity or use;

(ix) Pursuant to section 22a-133k-3(c)(2)(B) of the RSR

(x) Pursuant to sections 22a-133k-3(c)(3), 22a-133k-3(c)(4), and 22a-133k-3(c)(5) of the RSRs; or

(xi) When an ELUR is required and the parcel on which it is to be recorded is owned by the State

of Connecticut or the State of Connecticut purchase a property subject to an existing ELUR the NAUL shall be approved by the commissioner.

(2) Each EUR under the RSRs shall be subject to and comply with all applicable requirements in section 22a-133o of the Connecticut General Statutes, the EUR Regulations and the RSRs.

(3) If the RSRs require an EUR:

(A) Such EUR shall be in effect prior to:

(i) An LEP's verification, including an LEP's interim verification as those terms are defined in section 22a-134 (19) and (28) of the Connecticut General Statutes; or

(ii) When required by the commissioner, the review and approval of the remediation by the commissioner; or

(B) When voluntary remediation is conducted pursuant to section 22a-133y of the Connecticut General Statutes, the documents required to be prepared by sections 22a-133q-2(b) or 22a-133q-3(b) of the EUR Regulations, as applicable, shall be submitted as part of the final remedial action report at the time such report is submitted to the commissioner. Upon approval of such report by the commissioner, the EUR shall be executed within 36 days of such approval and be put into effect in accordance with the EUR regulation.

(4) An EUR shall only be deemed to be in effect when such EUR is recorded on the land records in compliance with the EUR regulations.

(5) When a remedy is selected under the RSRs for which an EUR is required to be in effect for different subject areas on a parcel, a request shall be submitted to the commissioner to extend any deadline specified in the RSRs to prepare the materials required to obtain and request such EUR. The commissioner may approve or deny in writing such extension request. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that significant progress has been made to complete the remediation of the parcel and strict adherence to the stated deadline would create an extraordinary hardship.

(f) **Financial Assurance**

(1) A financial assurance shall be required to support an engineered control variance or a technical impracticability variance. Such assurance shall be:

(A) Established and maintained for the duration of the period that the engineered control or technical impracticability variance will be used to achieve compliance with the RSRs;

(B) Directly available to the commissioner to cover the costs of complying with the variance, including but not limited to, operation, maintenance, inspection, monitoring, reporting, and other reasonably anticipated repairs and contingencies, in the event that the commissioner determines that such measures have not been performed as required by the RSRs; and

(C) Established in an amount equal to the cost of twenty percent of thirty years of operation, maintenance, inspection, monitoring, reporting, and other reasonably anticipated repairs and contingencies, which amount shall be maintained in effect for as long as the variance is used to achieve compliance with the RSRs, except this amount may be adjusted in accordance with subdivision (4) of this subsection.

(2) One or more of the following instruments, and no others, shall be used to satisfy the financial assurance requirements of this subsection:

(A) Trust Agreement/Fund;

(B) Irrevocable Standby Letter of Credit;

(C) Payment of Funds in Cash as directed by the commissioner; or

(D) Certificate of Insurance.

(3) The wording of any instrument used to satisfy the requirements of this subsection shall be identical to the language prescribed by the commissioner, which language shall be posted on the Department's internet website. In addition, an entity cannot issue an instrument used to satisfy the

requirements of this subsection unless such entity satisfies the following requirements, as applicable:

(A) Any trustee shall be an entity with authorization to act as a trustee and whose trust operations are regulated and examined by a federal or state agency;

(B) Any surety issuing a bond shall be among those listed as acceptable sureties on federal bonds in Circular 570 of the U.S. Department of Treasury;

(C) Any institution issuing a letter of credit shall be an entity that has the authority to issue letters of credit and whose letter of credit operations are regulated and examined by a federal or state agency; and

(D) Any insurer shall be licensed to transact the business of insurance, or eligible to provide insurance as an excess or surplus lines insurer, in one or more states.

(4) The amount of the financial assurance established pursuant to this subsection:

(A) Shall be adjusted for inflation at each five-year interval from the anniversary date of the establishment of the financial instrument. The adjustment shall be made by using an inflation factor derived from the most recent Implicit Price Deflator for Gross National Product published by the U.S. Department of Commerce in its “*Survey of Current Business*” and by multiplying the latest adjusted surety estimate for the site by that five-year inflation factor; and

(B) May be adjusted, subject to the discretion and written approval of the commissioner, to reflect any recalculation of the costs of operation, maintenance, inspection, monitoring, reporting, and other reasonably anticipated repairs and contingencies, in current dollars. Any request for an adjustment pursuant to this subparagraph shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs.

(5) The requirements of this subsection shall not apply when:

(A) The entity responsible for remediation is a municipality or an agency or political administrative subdivision of the state or federal government; or

(B) The amount established under subparagraph (C) of subdivision (1) of this subsection is less than \$10,000, unless the commissioner requires compliance with this subsection as a condition of approving the engineered control or technical impracticability variance.

[(f)](g) Use of Form Prescribed by the Commissioner[.]

(1) Any [person requesting] submittal to the commissioner under the RSRs, including but not limited to, a request for a variance [or any other], approval [by the Commissioner, or submitting any required notice to the Commissioner, pursuant to sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies], notice, financial assurance, or EUR shall [submit such request or notice] be submitted in writing on a form [as may be] prescribed by the [Commissioner] commissioner. A form prescribed by the commissioner may require the following information:

(A) A description of the subject release;

(B) A description of the distribution and concentration of substances in soil and groundwater resulting from the subject release;

(C) The general characteristics of soil in the vicinity of the subject release area;

(D) A map showing the extent of all release areas on a parcel and the subject release area, including all sample locations;

(E) A map showing the extent of the subject groundwater plume and the concentration of substances in such plume;

(F) The tabulated analytical results of all laboratory analyses of soil and groundwater at the subject release area;

(G) A detailed justification for any variance or approval requested;

(H) Any information specifically required by the RSRs;

(I) A signed certification by the person submitting the form and, if provided on the form,

certification by an LEP; and

(J) Any other information deemed necessary by the commissioner.

(2) If an electronic system is available for any submission identified in subdivision (1) of this subsection, such submittal shall be made pursuant to the instructions prescribed by the commissioner for the use of such electronic system.

(h) General Requirements for Analytical Data

(1) Analytical Data Quality and Usability

(A) With respect to analytical data, the following shall apply:

(i) All analytical data used to comply with the RSRs shall be scientifically valid and defensible, with a level of precision, accuracy, and sensitivity commensurate with its intended use. All analytical data submitted shall include an analytical data quality assessment and data usability evaluation prepared by individuals qualified to make such assessment or evaluation; and

(ii) If the commissioner determines that analytical data is not scientifically valid and defensible, or not of a sufficient level of precision, accuracy, and sensitivity to support the intended use of the data, the commissioner shall identify in writing the reasons for such conclusions and such data shall not be relied upon to demonstrate compliance with the RSRs.

(B) The commissioner may specify, by posting on the Department's internet website, methods or protocols to ensure that analytical data is of known and documented quality, including but not limited to:

(i) RCPs for laboratory quality assurance and quality control measures or analytical methods for the evaluation of soil, sediment, groundwater, air, or soil vapor;

(ii) RCPs to be followed when establishing laboratory reporting limits; and

(iii) Methods and protocols for assessing data quality and evaluating data usability which can be used to determine whether data is scientifically valid and defensible, with a level of precision, accuracy, and sensitivity commensurate with its intended use.

(C) If an analytical data quality assessment or usability evaluation is conducted using a method or protocol other than the methods and protocols prescribed by the commissioner pursuant to this subdivision, such methods and protocols shall be documented and submitted for the commissioner's review and evaluation. If the commissioner determines that such method or protocol is not scientifically valid and defensible, or not of a sufficient level of precision, accuracy, and sensitivity to support the intended use of the data, the commissioner shall identify in writing the reasons for such conclusions and such data shall not be relied upon to demonstrate compliance with the RSRs.

(2) Laboratory Reporting Limit Requirements

The laboratory reporting limit for the analysis of all samples used to comply with the RSRs shall:

(A) Be established at a concentration which is less than the applicable criteria, unless matrix interference or instrument limitations cannot be overcome by taking the additional actions listed in subdivisions (3) and (4) of this subsection;

(B) Not be artificially raised or lowered; and

(C) (i) Be equivalent to the concentration of the lowest standard used to calibrate the instrument actually analyzing a sample, provided such instrument has been calibrated in accordance with a method specified in an RCP or otherwise approved by the commissioner after consultation with the Commissioner of Public Health; or

(ii) Be equivalent to the concentration of a low-level reporting standard, as specified in an RCP or otherwise approved by the commissioner after consultation with the Commissioner of Public Health.

(3) Matrix Interference

(A) When analyzing a sample, if due to matrix interference the laboratory reporting limit for a substance is greater than the applicable RSR criteria for such substance, additional procedures, including but not limited to, sample preparation procedures or alternative analytical methods shall be

evaluated to determine whether the use of such procedures or methods will enable a laboratory reporting limit equal to or less than the applicable RSR criteria for such substance to be consistently and accurately achieved.

(B) In the circumstances described in subparagraph (A) of this subdivision, at a minimum, the following procedures or methods shall be evaluated in determining whether a laboratory reporting limit less than or equal to the applicable RSR criteria can be achieved:

(i) “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.” SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460; or

(ii) Other analytical methods or procedures either approved in writing by EPA or, after consultation with the Commissioner of Public Health, approved in writing by the commissioner.

(C) (i) If pursuant to subparagraph (B) of this subdivision, a procedure or method is identified that will consistently and accurately achieve a laboratory reporting limit equal to or less than the applicable RSR criteria, the sample shall be re-analyzed for the subject substance using such procedure or method.

(ii) If after re-analysis the matrix interference is overcome and the lowest laboratory reporting limit for a substance that can be consistently and accurately achieved is now equal to or less than the applicable RSR criteria, the analytical results from such re-analysis can be used for the purpose of determining compliance with the RSRs.

(D) (i) If despite taking the actions to overcome matrix interference specified in subparagraphs (B) and (C) of this subdivision, a laboratory reporting limit less than or equal to the applicable RSR criteria cannot be consistently and accurately achieved, a report detailing the measures taken to overcome such matrix interference shall be submitted in writing to the commissioner. This report shall include, at a minimum, a description of the measures taken under subparagraphs (B) and (C) of this subdivision as well as the lowest achievable laboratory reporting limit consistently and accurately achievable under subparagraph (C)(i) of this subdivision.

(ii) The commissioner shall use the report submitted pursuant to clause (i) of this subparagraph to determine the lowest laboratory reporting limit for such substance that can be consistently and accurately achieved. If the commissioner determines that such laboratory reporting limit is still greater than the applicable RSR criteria, the commissioner may determine that compliance with the RSRs will be achieved when such laboratory substance has been remediated to such reporting limit. Any such determination by the commissioner shall be in writing and shall include the reasons for such determination.

(4) Instrument Limitations

(A) When analyzing a sample, if due to instrument limitations the laboratory reporting limit for a substance is greater than the applicable RSR criteria for such substance, alternative analytical methods or alternative instrumentation shall be evaluated to determine whether the use of such procedures or methods will enable a laboratory reporting limit equal to or less than the applicable RSR criteria for such substance to be consistently and accurately achieved.

(B) In the circumstances described in subparagraph (A) of this subdivision, at a minimum, the following procedures or methods shall be evaluated in determining whether a laboratory reporting limit less than or equal to the applicable RSR criteria can be achieved:

(i) “Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.” SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460; or

(ii) Other analytical methods or instruments either approved in writing by EPA or, after consultation with the Commissioner of Public Health, approved in writing by the commissioner.

(C) (i) If pursuant to subparagraph (B) of this subdivision, a method or instrument is identified that will consistently and accurately achieve a laboratory reporting limit equal to or less than the applicable RSR criteria, the sample shall be re-analyzed for the subject substance using such method

or instrument.

(ii) If after re-analysis the instrument limitation is overcome and the lowest laboratory reporting limit for a substance that can be consistently and accurately achieved is now equal to or less than the applicable RSR criteria, the analytical results from such re-analysis can be used for the purpose of determining compliance with the RSRs.

(D) (i) If despite taking the actions to overcome instrument limitations specified in subparagraphs (B) and (C) of this subdivision, a laboratory reporting limit less than or equal to the applicable RSR criteria cannot be consistently and accurately achieved, a report detailing the measures taken to overcome such instrument limitations shall be submitted in writing to the commissioner. This report shall include, at a minimum, a description of the measures taken under subparagraphs (B) and (C) of this subdivision as well as the lowest achievable laboratory reporting limit consistently and accurately achievable under subparagraph (C)(i) of this subdivision.

(ii) The commissioner shall use the report submitted pursuant to clause (i) of this subparagraph to determine the lowest laboratory reporting limit for such substance that can be consistently and accurately achieved. If the commissioner determines that such laboratory reporting limit is still greater than the applicable RSR criteria, the commissioner may determine that compliance with the RSRs will be achieved when such substance has been remediated to such laboratory reporting limit. Any such determination by the commissioner shall be in writing and shall include the reasons for such determination.

[(g)](i) [Remediation of Soils Polluted with Lead.] Applicability of Remediation to Volatilization Criteria

[Soil polluted with lead may be remediated to a concentration of 500 milligrams per kilogram in compliance with Section 22a-133k-2(b) provided]

(1) [Prior to the effective date of this subsection] Notwithstanding only sections 22a-133k-3(a) and 22a-133-3(c) of the RSRs, volatile organic substances in groundwater maybe remediated in accordance with subparagraph (A) or (B) of this subdivision, provided that all requirements of subdivision (2) of this subsection have been met:

(A) [Such remediation has been initiated;] Volatilization criteria applying only for groundwater within fifteen (15) feet of the ground surface or the lowest portion of a building; or

(B) [A remedial action plan has been completed for such release area; and] Applicable groundwater volatilization criteria as listed in the following table.

<u>Volatile Substance</u>	<u>Residential Volatilization Criteria for Ground water in µg/L (ppb)</u>	<u>Industrial/Commercial Volatilization Criteria for Ground water in µg/L (ppb)</u>
<u>Acetone</u>	<u>50,000</u>	<u>50,000</u>
<u>Benzene</u>	<u>215</u>	<u>530</u>
<u>Bromoform</u>	<u>920</u>	<u>3,800</u>
<u>2-Butanone (MEK)</u>	<u>50,000</u>	<u>50,000</u>
<u>Carbon Tetrachloride</u>	<u>16</u>	<u>40</u>
<u>Chlorobenzene</u>	<u>1,800</u>	<u>6,150</u>
<u>Chloroform</u>	<u>287</u>	<u>710</u>
<u>1,2-Dichlorobenzene</u>	<u>30,500</u>	<u>50,000</u>
<u>1,3-Dichlorobenzene</u>	<u>24,200</u>	<u>50,000</u>
<u>1,4-Dichlorobenzene</u>	<u>50,000</u>	<u>50,000</u>
<u>1,1-Dichloroethane</u>	<u>34,600</u>	<u>50,000</u>

<u>Volatile Substance</u>	<u>Residential Volatilization Criteria for Ground water in µg/L (ppb)</u>	<u>Industrial/Commercial Volatilization Criteria for Ground water in µg/L (ppb)</u>
<u>1,2-Dichloroethane</u>	<u>21</u>	<u>90</u>
<u>1,1-Dichloroethylene</u>	<u>1</u>	<u>6</u>
<u>1,2-Dichloropropane</u>	<u>14</u>	<u>60</u>
<u>1,3-Dichloropropene</u>	<u>6</u>	<u>25</u>
<u>Ethyl benzene</u>	<u>50,000</u>	<u>50,000</u>
<u>Ethylene dibromide (EDB)</u>	<u>4</u>	<u>16</u>
<u>Methyl-tert-butyl-ether</u>	<u>50,000</u>	<u>50,000</u>
<u>Methyl isobutyl ketone</u>	<u>50,000</u>	<u>50,000</u>
<u>Methylene chloride</u>	<u>50,000</u>	<u>50,000</u>
<u>Styrene</u>	<u>580</u>	<u>2,065</u>
<u>1,1,1,2-Tetrachloroethane</u>	<u>12</u>	<u>50</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>23</u>	<u>100</u>
<u>Tetrachloroethylene</u>	<u>1,500</u>	<u>3,820</u>
<u>Toluene</u>	<u>23,500</u>	<u>50,000</u>
<u>1,1,1-Trichloroethane</u>	<u>20,400</u>	<u>50,000</u>
<u>1,1,2-Trichloroethane</u>	<u>8,000</u>	<u>19,600</u>
<u>Trichloroethylene</u>	<u>219</u>	<u>540</u>
<u>Vinyl chloride</u>	<u>2</u>	<u>2</u>
<u>Xylenes</u>	<u>21,300</u>	<u>50,000</u>

(2) [On or before twenty-four months after the effective date of this subsection such remediation has been completed.]

(A) Prior to *{insert the effective date of these regulations}*:

(i) Remediation of such volatile organic substances has already been initiated or an LEP has determined that no remediation of such substances is required and such determination has been documented in a Remedial Action Plan already submitted to the commissioner; and

(ii) If required, public notice of such remediation has been published, pursuant to section 22a-133k-1(d) of the RSRs, or any other provision of the Connecticut General Statutes;

(B) On or before *{insert date that is twenty-four months after the effective date of these regulations}*, remediation of such volatile organic substances has been completed, sufficient to support an LEP's verification, including an LEP's interim verification as those terms are defined in sections 22a-134 (19) and (28) of the Connecticut General Statutes, or when required by the commissioner, the review and approval of the remediation by the commissioner;

(C) Documentation demonstrating compliance with this subsection is submitted to the commissioner prior to any deadline set forth in section 22a-134a(g)(1)(B) or section 22a-134a(g)(1)(C), as applicable, the deadline in any order issued by the commissioner, or *{insert date five years after the effective date of these regulations}*, whichever comes first; and

(D) Compliance with all other requirements in the RSRs regarding volatile organic substances in groundwater has been achieved.

Sec. 22a-133k-2. Remediation Standards for [soil remediation] Soil**(a) [General.]Soil Criteria**

Unless otherwise specified in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] the RSRs, polluted soil at a release area shall be remediated [to a] so that the concentration [which meets] of a substance in such soil is equal to or less than:

(1) [(A) the] The direct exposure criteria [set forth in subsection (b) of this section or alternative direct exposure criteria established in accordance with subdivision (2) or subdivision (7) of subsection (d) of this section;] and [(B)] the pollutant mobility criteria [set forth in subsection (c) of this section or alternative pollutant mobility criteria established in accordance with subdivision (3) or (5) of subsection (d) of this section]; or

(2) [the] The background concentration for soil [provided notice has been submitted to the Commissioner which notice shall be submitted on a form furnished by the Commissioner and shall include a brief description of the subject release area and of the general characteristics of soils in the vicinity of such release area; a map showing the location of such release area, and based on reasonable inquiry of other release areas in the vicinity thereof, and of all soil samples taken for the purpose of characterizing background concentration for soil; and the results of all laboratory analyses of such samples].

(b) Direct Exposure Criteria[.]**(1) Residential Direct Exposure Criteria**

Except as otherwise [provided] specified in [this paragraph] the RSRs, polluted soil at a release area shall be remediated [to at least] so that [concentration at which] the concentrations of substances in such soil are equal to or less than the residential direct exposure criteria [for each substance is met].

(2) Use of Industrial/Commercial Direct Exposure Criteria

(A) [Polluted] Except for soil polluted with PCBs, polluted soil at a release area may be remediated [to a concentration at which] so that the concentrations of substances in such soil are equal to or less than the industrial/commercial direct exposure criteria [for each substance except PCB is met if] provided that:

(i) The subject area is not currently used for any residential activity;

(ii) [access] Access to the parcel containing such release area is limited to individuals working at or [people] temporarily visiting the subject parcel for industrial/commercial activity; and

(iii) [an environmental land use restriction] An EUR is in effect [with respect to such parcel, or to the portion of such parcel containing such release area] for the subject area, which [environmental land use] restriction [ensures] shall:

(I) [that the parcel or restricted portion thereof is not used for any] Prohibit residential activity [in the future and that any future use of such parcel or restricted portion thereof is limited to an industrial or commercial activity]; and

(II) Enumerate and require compliance with clause (ii) of this subparagraph.

(B) Soil polluted with [PCB] PCBs at a release area may be remediated [to a concentration at which] so that the concentration of PCBs in such soil is equal to or less than the industrial/commercial direct exposure criteria for [PCB is met if] PCBs, provided that:

(i) The subject area is not currently used for any residential activity;

(ii) The parcel on which PCBs are present is used in accordance with title 40 CFR Part 761, including but not limited to, those provisions of 40 CFR Part 761 regarding the requirement for high-occupancy areas;

(iii) [the] The parcel upon which such release area is located is [(i)] an “outdoor electrical substation,” as defined in 40 CFR 761.123[;], or [(ii)] an “other restricted access non-substation

location,” as defined in [said section] 40 CFR 761.123; and

(iv) [an environmental land use restriction] An ELUR is in effect [with respect to such parcel, or to the portion of such parcel containing such release area] for the subject area, which [environmental land use] restriction [ensures] shall:

(I) [that the parcel or restricted portion thereof is not used for any] Prohibit residential activity [in the future and that any future use of such parcel or restricted portion thereof is limited to an industrial or commercial activity]; and

(II) Enumerate and require compliance with clauses (ii) and (iii) of this subparagraph.

(3) Conditional Exemptions for Inaccessible Soil

The provisions of this subdivision do not apply to soil polluted with PCBs.

(A) [The] Soil at a release area that is fifteen feet or more below the ground surface is not required to be remediated to the direct exposure criteria [for substances other than PCB].

(B) [do not apply to inaccessible soil at a release area provided that if such inaccessible soil is less than 15 feet below the ground surface] Inaccessible soil at a release area, is not required to be remediated to the direct exposure criteria, provided that an [environmental land use restriction] EUR is in effect [with respect to the subject parcel or to the portion of such parcel containing such release area] for the subject area, which [environmental land use] restriction [ensures that] shall:

(i) [such soils will not be exposed] Prohibit exposure to inaccessible soil, including but not limited to, as a result of excavation, demolition [or], other intrusive activities [and that], or natural occurrences;

(ii) Require that if soil is used to render polluted soil inaccessible, such soil is maintained and immediately replaced, as needed, to maintain the 4 feet of soil cover and topography of the ground surface; and

(iii) Require, as applicable, that:

(I) [any pavement which is necessary to render such soil inaccessible] Bituminous or reinforced concrete that renders the soil inaccessible is maintained in good condition [unless and until such restriction is released in accordance with said section 22a-133q-1], free of gaps or cracks that could expose such soil;

(II) A building that is used to render soil inaccessible shall consist of a roof, exterior walls, and a concrete floor, maintained in good condition, free of gaps or cracks that could expose such soil and such building shall not be removed; or

(III) Provided that written notice is submitted to the commissioner, a permanent structure that renders the soil inaccessible, shall be maintained in good condition to the extent required to prevent exposure of such soil and shall not be removed.

(4) Conditional Exemption for Inaccessible Soil Polluted with PCBs

(A) Unless [an] alternative [criterion has] criteria have been approved in accordance with [subsection] section 22a-133k-2(d)[(7)](2) of the RSRs. Inaccessible soil polluted with [PCB] PCBs may be remediated to the concentrations specified in subparagraph (B) of this subdivision, provided that an ELUR is in effect for the subject area, which restriction shall:

(i) Prohibit exposure to such inaccessible soil, including but not limited to, as a result of excavation, demolition, other intrusive activities, or natural occurrences;

(ii) Prohibit residential activity;

(iii) Require that if soil is used to render polluted soil inaccessible, that such soil used to render polluted soil inaccessible is maintained and immediately replaced, as needed, to maintain the elevation and topography of the ground surface; and

(iv) Require, as applicable, that:

(I) Bituminous or reinforced concrete that renders the soil inaccessible is maintained in good condition, free of gaps or cracks that could expose such soil;

(II) A building that is used to render soil inaccessible shall consist of a roof, exterior walls, and a concrete floor, maintained in good condition, free of gaps or cracks that could expose such soil and such building shall not be removed; or

(III) Provided that written notice is submitted to the commissioner, a permanent structure approved in writing by the commissioner that renders the soil inaccessible shall be maintained in good condition to the extent required to prevent exposure of such soil and shall not be removed.

(B) Provided the requirements of subparagraph (A) of this subdivision are met, inaccessible soil at a release area polluted with PCBs may be remediated so that the concentrations of PCBs in such soil are equal to or less than:

(i) [a concentration of] 10 ppm [PCB] PCBs by dry weight; and

(ii) [provided that (A)] 25 ppm PCBs by dry weight if such inaccessible soil is located on [a parcel which is] an “other restricted access (non-substation) location“ or an “outdoor electrical substation” as those terms are defined in [said section] 40 CFR 761.123, [such soil may be remediated to a concentration of 25 ppm PCB by weight, or (B) if such inaccessible soil is located on a parcel which is an outdoor electrical substation as defined in 40 CFR 761.123, such soil may be remediated to a concentration of 25 ppm PCB by weight, or if a label or notice is visibly placed in the area in accordance with 40 CFR Part 761, to a concentration of 50 ppm PCB by weight] provided that PCBs may be remediated to 50 ppm by dry weight at an outdoor electric substation if a label or notice is visibly placed in the area in accordance with 40 CFR 761.125(c)(2).

[(4)](5) Conditional Exemption for Incidental Sources

[The direct exposure criteria contained in subsection (b) of this section do not apply to] Soil at a release area polluted with metals, petroleum hydrocarbons, or semi-volatile organic substances [in soil] is not required to be remediated to the direct exposure criteria for those substances, provided such pollution is the result of:

(A) An incidental release due to the normal operation of motor vehicles, not including refueling, repair or maintenance of a motor vehicle; or

(B) Normal paving and maintenance of a consolidated bituminous concrete surface, provided such bituminous concrete surface has been maintained for its intended purpose.

(6) Conditional Exemption for Soil Polluted with Pesticides

Soil polluted with pesticides at a release area as a result of the application of pesticides is not required to be remediated to the direct exposure criteria for such pesticides, provided that a determination has been made that such pesticides are present solely as a result of the application of pesticides and:

(A) If the release area is used for residential activity:

(i) Protective measures are developed, implemented, and maintained to prevent human exposure to soil polluted with pesticides that exceeds residential direct exposure criteria. At a minimum, such measures shall consist of:

(I) Blending existing soil so that the concentration of substances for such pesticides in the top one foot of soil are equal to or less than the direct exposure criteria, except for the area around existing mature trees;

(II) Covering soil with pavement, hardscape, buildings, or permanent structures; or

(III) Growing dense or vexatious vegetation on steep slopes to minimize the potential for direct exposure and erosion; and

(ii) An EUR is in effect for the subject area, which restriction shall:

(I) Identify the nature and extent of soil polluted with pesticides above residential direct exposure criteria and serve as notice of such polluted soil; and

(II) Enumerate and require compliance with clause (i) of this subparagraph.

(B) If the release area is used for industrial/commercial activity:

(i) A soil management plan shall be developed, implemented, and maintained which plan shall include protective measures and ensure, at a minimum that any soil that exceeds the industrial/commercial direct exposure criteria are not exposed, including but not limited to, as a result of excavation, demolition, or other activities and that any such soil is managed, restored, or disposed in a manner that is protective of human health and the environment and prevents human exposure to such soil, except that such soil management plan need not apply to any portion of a release area that is currently used for raising crops where pesticides are used; and

(ii) An EUR is in effect for the subject area, which restriction shall:

(I) Prohibit residential activity; and

(II) Enumerate and require compliance with clause (i) of this subparagraph.

[(5)](7) Direct Exposure Criteria for Additional Polluting Substances

(A) [With respect to a substance] Substances at a particular release area, for which [a] direct exposure [criterion is] criteria are not specified in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may, after consultation with the Commissioner of Public Health, approve in writing a direct exposure criterion to apply to such substance at a particular release area. Any person requesting approval of a direct exposure criterion for such substance] Appendix A of the RSRs shall be remediated to background concentration or to criteria obtained pursuant to this subdivision. A request under this subdivision shall [submit] be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) [a] A proposed risk-based direct exposure [concentration for such substance] criterion calculated in accordance with [subparagraph (B) or (C) of this subdivision as applicable, and] Appendix G of the RSRs, for each substance in such request;

(ii) [the analytical detection limit] The laboratory reporting limit for [such] each substance [. Before approving a direct exposure criterion the Commissioner shall consider the proposed risk-based direct exposure concentration for such substance, the analytical detection limit for such substance,]; and

(iii) [any] Any information about the health effects [such] each substance may cause due to exposure pathways not accounted for in the [proposed] risk-based direct exposure[, and any other information that the Commissioner reasonably deems necessary] criterion proposed under clause (i) of this subparagraph.

(B) [The proposed residential risk-based direct exposure concentration shall be calculated using the following equations:] The commissioner may approve or deny in writing a request made under subparagraph (A) of this subdivision. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the requirements of this subdivision have been satisfied and that the proposed direct exposure criteria will be protective of human health and the environment.

[(i)] [For carcinogenic substances:

$$DEC_{RB} = \left[\frac{Risk}{CSF} \right] \div \left[\left[\frac{(IR_C \times ED_C \times EF \times CF)}{(BW_C \times AT)} \right] + \left[\frac{(IR_A \times ED_A \times EF \times CF)}{(BW_A \times AT)} \right] \right]$$

]

[(ii)] [For non-carcinogenic substances:

$$DEC_{RB} = [RFD \times HI] \div \left[\left[\frac{(IR_C \times ED_C \times EF \times CF)}{(BW_C \times AT_C)} \right] + \left[\frac{(IR_A \times ED_A \times EF \times CF)}{(BW_A \times AT_A)} \right] \right]$$

]

[(iii)] [The abbreviations used in subparagraphs (i) and (ii) shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Term	Description	Units	Value
DEC _{RB}	Risk-based Direct Exposure Criterion	mg/kg	calculated
Risk	Target Cancer Risk Level	Unitless	1.0E-06
HI	Hazard Index	Unitless	1.0
CSF	Cancer slope Factor	(mg/kg-day) ⁻¹	substance-specific
RFD	Reference Dose	mg/kg-day	substance-specific
IR _C	Ingestion Rate, Child	mg/day	200
IR _A	Ingestion Rate, Adult	mg/day	100
EF	Exposure Frequency	days/year	365
ED _C	Exposure Duration, Child	Years	6
ED _A	Exposure Duration, Adult	Years	24
CF	Conversion Factor	kg/mg	0.000001
BW _C	Body Weight, Child	Kg	15
BW _A	Body Weight, Adult	Kg	70
AT	Averaging Time, for carcinogens	Days	25550
AT _C	Averaging Time, Child for non-carcinogens	Days	2190
AT _A	Averaging Time, Adult for non-carcinogens	Days	8760

]

(C) [The proposed industrial/commercial risk-based direct exposure concentration shall be calculated using the following equations:] Unless prohibited in writing by the commissioner, criteria approved by the commissioner pursuant to subparagraph (A) of this subdivision, may be the subject of a request for alternative criteria under section 22a-133k-2(d)(2)(A) of the RSRs.

[(i)] [For carcinogenic substances:

$$DEC_{RB} = \left[\frac{Risk}{CSF} \right] \times \left[\frac{BW \times AT}{IR \times ED \times EF \times CF} \right]$$

[(ii)] [For non-carcinogenic substances:

$$DEC_{RB} = [RFD \times HI] \times \left[\frac{BW \times AT}{IR \times EF \times ED \times CF} \right]$$

[(iii)] [The abbreviations used in subparagraphs (i) and (ii) shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Term	Description	Units	Value
DEC _{RB}	Risk-based Direct Exposure Criterion	mg/kg	calculated
Risk	Target Cancer Risk Level	Unitless	1.0E-06
HI	Hazard Index	Unitless	1.0
CSF	Cancer slope Factor	(mg/kg-day) ⁻¹	substance-specific
RFD	Reference Dose	mg/kg-day	substance-specific
IR	Ingestion Rate	mg/day	50
EF	Exposure Frequency	days/year	250
ED	Exposure Duration	Years	25
CF	Conversion Factor	kg/mg	0.000001
BW	Body Weight	Kg	70
AT	Averaging Time, for carcinogens	Days	25550
AT _A	Averaging Time, Adult for non-carcinogens	Days	9125

]

(c) **Pollutant Mobility Criteria.**

(1) [General.] Pollutant Mobility Criteria

(A) [A substance, other than an inorganic substance or PCB, in soil above the seasonal low water table, or above the seasonal high water table if (i) remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution or (ii) the subject soil is located in a GB area, shall be remediated to at least that concentration at which the results of a mass analysis of such soil for such substance does not exceed the pollutant mobility criterion applicable to the ground-water classification of the area at which such soil is located, except that in the circumstances identified in subdivision (2) of this subsection, remediation to achieve compliance with the pollutant mobility criteria may be conducted in accordance with the requirements established in said subdivision (2).] Except as otherwise specified in the RSRs, polluted soil at a release area located in a GA area shall be remediated to the seasonal low water table; whereas polluted soil at a release area located in a GB area shall be remediated to the seasonal high water table. All such polluted soil shall be remediated so that the concentrations of substances in such soil are equal to or less than the applicable pollutant mobility criteria, as determined using:

(i) Mass analysis for such substances, other than inorganic substances and PCBs; and

(ii) TCLP or SPLP analysis expressed in mg/L, or mass analysis in mg/kg divided by twenty, for inorganic substances and PCBs.

(B) [An inorganic substance or PCB in soil above the seasonal low water table, or above the seasonal high water table if (i) remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution or (ii) the subject

soil is located in a GB area, shall be remediated to at least that concentration at which the results of a TCLP or SPLP analysis of such soil for such substance does not exceed the pollutant mobility criterion applicable to the ground-water classification of the area at which such soil is located, except that in the circumstances identified in subdivision (2) of this subsection, remediation to achieve compliance with the pollutant mobility criteria may be conducted in accordance with the requirements established in said subdivision (2)] In GA area, if it is determined that remediation to the seasonal low water table is technically impracticable or would not result in the permanent elimination of a source of pollution, this subsection may apply to polluted soil above the seasonal high water table.

(2) [Specific Circumstances] Optional Criteria for Polluted Soil in a GA Area

(A) Polluted [Soils] Soil in a GA Area[.]

[A] Substances in polluted soil in a GA area [that is polluted with a substance which soil is at or above the seasonal low water table, or at or above the seasonal high water table if remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution,] may be remediated to [at least that] a concentration [at which] equal to or less than the groundwater protection criteria for such substance based upon the results of a TCLP or SPLP analysis [of such soil for such substance do not exceed the ground-water protection criterion for such substance] determined in accordance with subparagraph (A)(ii) of this subdivision.

(B) [Soils with Volatile Organic Substances] Polluted Soil in a GA [area.] Area Except, for Soil Polluted with PCBs and ETPH

(i) [A] The criteria in this clause may only be used if the requirements in clauses (ii) and (iii) of this subparagraph are satisfied. Except for soil polluted with PCBs and ETPH, polluted soil in a GA area [that is polluted with a volatile organic substance which soil is at or above the seasonal low water table, or at or above the seasonal high water table if remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution,] may be remediated to a concentration at which the results of either:

(I) [to at least that concentration at which the results of a] TCLP or SPLP analysis [of such soil] for such substance [do not exceed] in soil, is equal to or less than the ground[-]water protection [criterion for such substance] criteria:

(a)[multiplied] Multiplied by ten; or

(b)Multiplied by an alternative dilution or dilution and attenuation factor, approved in writing by the commissioner in accordance with section 22a-133k-2(d)(3)(B) of the RSRs; or

(II) [the results of a mass] Mass analysis [of such soil] for such substance [do not exceed] in soil, is equal to or less than the applicable pollutant mobility [criterion for such substances] criteria in Appendix B of the RSRs or approved in writing by the commissioner in accordance with section 22a-133k-2(c)(6) of the RSRs:

(a)[multiplied] Multiplied by ten; or

(b)Multiplied by an alternative dilution or dilution and attenuation factor approved in writing by the [Commissioner] commissioner in accordance with [subdivision (4) of subsection (d) of this section,] section 22a-133k-2(d)(3)(B) of the RSRs.

(ii) Conditions at the release area comply with the following requirements:

(I) [provided no non-aqueous phase liquids are] NAPL is not present [in the subject release area] as determined in accordance with subdivision [(3)](4) of this subsection[.];

(II) [the] The water table is at least fifteen feet above the surface of the bedrock; and

(III) [the] The downward vertical flow velocity of groundwater is [not greater] equal to or less than the horizontal flow velocity [, and:].

(i)(iii) Conditions at the release area comply with one of either subclause (I), (II), or (III) of this clause:

(I)

(a) [(i) (aa) a] A public water supply distribution system is available within [200] two hundred feet of the [subject] parcel on which the release area is located, within two hundred feet of all adjacent parcels, and within two hundred feet of any parcel within the areal extent of the ground[-]water plume [caused by] from the subject release area[,];

(b) [(bb) the] The groundwater within the areal extent of [such] the ground[-]water plume from the subject release area is not used for drinking water[,];

(c) [(cc) no] No public or private water supply wells exist within [500] five hundred feet of the subject release area[,]; and

(d) [(dd) the] The ground[]water affected by the subject release area is not a potential public water supply resource or in an aquifer protection area; [or]

(II)

(a) [(ii) (aa) the] The concentration of any [volatile organic] substance in [a] the ground[-]water plume from the subject release area and within seventy-five feet of the nearest downgradient parcel boundary [does not exceed] is equal to or less than the ground[-]water protection [criterion,] criteria; and

(b) [(bb) except for seasonal variation, the areal extent of volatile organic substances in the ground-water plume not increasing over time and the concentration of any volatile organic substance in the ground-water plume is not increasing, except as a result of natural attenuation, at any point over time and the concentration of any volatile organic substance in the ground-water plume is not increasing, except as a result of natural attenuation, at any point over time and (cc) notice of such condition is provided to the Commissioner on a form furnished by the Commissioner, which notice shall include: a brief description of the release area; a brief description of the distribution and concentration of volatile organic substances in soil and ground water; a map showing the location of the release area, and based on reasonable inquiry all other volatile organic substance release areas in the vicinity of the subject release area, all ground-water and soil monitoring points, and the areal extent of the volatile organic substance ground-water plume; and the results of all laboratory analyses conducted to determine whether the requirements of this subparagraph have been met] The groundwater plume resulting from the subject release is a diminishing state groundwater plume; or

(III)

(a) [(iii) (aa) the] The concentration of any [volatile organic] substance within [such] the ground[-]water plume [does not exceed] from the subject release area is equal to or less than the ground[-]water protection [criterion] criteria for such substance at a location downgradient of the subject release area, on the subject parcel, and within [25] twenty-five feet of such release area[,]; and

[(bb) notice of such condition is provided to the Commissioner on a form furnished by the Commissioner, which notice shall include: a brief description of the release area; a brief description of the distribution and concentration of volatile organic substances in soil and ground water; a map showing the location of the release area, and based on reasonable inquiry all other volatile organic substance release areas in the vicinity of the subject release area, and all ground-water and soil monitoring points; and the results of all laboratory analyses conducted to determine whether the requirements of this subparagraph have been met]

(b) The groundwater plume resulting from the subject release is a diminishing state groundwater plume.

(iv) Written notice of the use of optional criteria calculated by an LEP under this subparagraph shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs.

[(C)] [Inorganic, semi-volatile, PCB or pesticide contamination in a GA area.]

[A soil in a GA area that is polluted with inorganic substances, semi-volatile substances, PCB or pesticides, which soil is at or above the seasonal low water table, or at or above the seasonal high

water table if remediation to the seasonal low water table is not technically practicable or would not result in the permanent elimination of a source of pollution, may be remediated to a level at which (i)(aa) the results of a TCLP or SPLP analysis of such soil for such substance do not exceed the ground-water protection criterion for such substance multiplied by ten or by an alternative dilution or dilution and attenuation factor approved by the Commissioner in accordance with subdivision (4) of subsection (d) of this section or (bb) the results of a mass analysis of such soil for a substance do not exceed the pollutant mobility criterion for such substance multiplied by ten or by an alternative dilution or dilution and attenuation factor approved by the Commissioner in accordance with subdivision (4) of subsection (d) of this section; provided (ii) (aa) the release area and any portion thereof is located at least twenty-five feet from the nearest legal boundary of the parcel in the downgradient direction, (bb) no non-aqueous phase liquids are present in the release area as determined in accordance with subdivision (3) of this subsection, and (cc) the water table is at least fifteen feet above the surface of the bedrock.]

(3) Optional Criteria for Polluted Soil in a GB Area

(A) [(D)] Polluted [Soils] Soil in a GB [area.] Area

[A substance in soil above the seasonal high water table] Provided that NAPL is not present in the release area above the seasonal high water table, as determined in accordance with subdivision (4) of this subsection, substances in soil in a GB area may be remediated to [a level] a concentration at which the results of a TCLP or SPLP analysis of [such soil does not exceed] each substance is equal to or less than the ground[-]water protection [criterion for any such substance] criteria:

(i) [(aa) multiplied] Multiplied by [10] ten[,];

(ii) [(bb) multiplied] Multiplied by the ratio of the summation of the [areas] downgradient area and upgradient [of the release] area compared to the release area, provided that such ratio [does not exceed] is equal to or less than five hundred [500,]; or

(iii) [(cc) or multiplied] Multiplied by an alternative dilution or dilution and attenuation factor approved in writing by the [Commissioner] commissioner in accordance with [subdivision (5) of subsection (d) of this section (ii) provided non-aqueous phase liquids are not present in such soil as determined in accordance with subdivision (3) of this subsection] section 22a-133k-2(d)(3) of the RSRs.

(B) [(E) Site specific dilution] Optional Criteria Based Upon Release-Specific Dilution in a GB [area.] Area

(i) [A substance in a soil at or above the seasonal high water table] The criteria in this clause may only be used if the requirements in clauses (ii) and (iii) of this subparagraph are satisfied. Except for soil polluted with PCBs, substances in soil in a GB area [where the background concentration for ground water for such substance is less than the applicable ground-water protection criterion,] may be remediated [to a level at which] to a concentration at which the results of either:

(I) [a mass] Mass analysis [of such soil] for [a] each substance [do not exceed] is equal to or less than the pollutant mobility [criterion] criteria applicable to such substance in a GA area multiplied by a [site] release-specific dilution factor calculated in accordance with clause [(ii)](iv) of this subparagraph[,]; or

(II) [the results of a] TCLP or SPLP analysis [of such soil] for [a] each substance [do not exceed] is equal to or less than the ground[-]water protection criterion for such substance multiplied by a [site] release-specific dilution factor calculated in accordance with clause [(ii)](iv) of this subparagraph[, provided].

(ii) Conditions at the subject release area comply with the following requirements:

(I) [(aa) no non aqueous phase liquids are] NAPL is not present [in such soil] above the seasonal high water table as determined in accordance with subdivision [(3)](4) of this subsection [(bb) notice has been submitted to the Commissioner in accordance with clause (iii) of this subparagraph]; [and]

(II) [(cc) the] The water table [in the release area] is at least fifteen feet above the surface of the bedrock; [and]

(III) [the] The downward [ground water] vertical flow velocity of groundwater is [not greater] equal to or less than the [ground water] horizontal flow velocity[.]; and

(IV) For each substance in groundwater, the background concentration is equal to or less than the groundwater protection criteria.

(iii) Written notice of the use of optional criteria calculated by an LEP under this subparagraph shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs and shall also include the calculation in subclause (iv) of this subparagraph, value and basis of terms, and the till infiltration rate and dilution factor from the following table, based on the geologic material and infiltration rate.

<u>Geologic Material</u>	<u>Infiltration Rate (feet/year)</u>
<u>Stratified Drift</u>	<u>2.0</u>
<u>Till</u>	<u>0.5 - 1.0</u>
<u>Lacustrine Deposits</u>	<u>0.4</u>

(iv) [(ii) For the purpose of clause (i) of this subparagraph, the site] The release-specific dilution factor referred to in clause (i) of this subparagraph, shall be calculated using the following formula, and the value of terms referred to in clause (i) of this subparagraph shall be calculated using the following formula: [DF = (1 + (Kid/IL))(1-F_{adj}), where:]

[DF = site-specific dilution factor]

[K = hydraulic conductivity, in feet per year, of the unconsolidated aquifer underlying the release area]

[i = horizontal hydraulic gradient in feet per feet]

[d = 15 feet]

[I = infiltration rate in feet per year as specified in subparagraph (iv) of this subparagraph]

[L = length in feet of the release area parallel to the direction of ground-water flow]

[F_{adj} = background concentration for ground water divided by the ground-water protection criterion for the subject substance, or, where the background concentration for ground water cannot be quantified, 1/2 the minimum detection limit for the subject substance divided by the ground-water protection criterion for the subject substance.]

$$DF = \left(1 + \left(\frac{Kid}{IL}\right)\right)(1 - F_{adj})$$

<u>Term</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>DF</u>	<u>Release-specific dilution factor</u>	<u>substance-specific</u>	<u>unitless</u>
<u>K</u>	<u>Hydraulic conductivity of the unconsolidated aquifer underlying the release area</u>	<u>calculated</u>	<u>ft/year</u>
<u>i</u>	<u>Horizontal hydraulic gradient</u>	<u>calculated</u>	<u>ft/ft</u>
<u>d</u>	<u>Aquifer mixing zone default value of 3 feet or a release-specific value calculated using:</u>	<u>3, or as otherwise calculated</u>	<u>ft</u>

Term	Description	Value	Units
	$d = (0.0112L^2)^{0.5} + d_{\alpha}[1 - e^{(-\frac{LI}{Kd_{\alpha}})}]$		
d_{α}	Aquifer thickness	as determined from boring logs	ft
I	Infiltration rate, as identified in section 22a-133k-2(c)(3)(B)(iii)(IV) of the RSRs	calculated	ft/year
L	Length of the release area parallel to the direction of groundwater flow	as measured	ft
F_{adj}	Background concentration for groundwater divided by the groundwater protection criteria for the subject substance or, where the background concentration for groundwater cannot be quantified, one half the laboratory reporting limit for the subject substance divided by the groundwater protection criteria for the subject substance	calculated	ug/L

[(iii) A notice submitted pursuant to clause (i) of this subparagraph shall be submitted on a form prescribed and provided by the Commissioner and shall include: a brief description of the release area and the general characteristics of soils in the vicinity of the release area; a map showing the location of the release area, and based on reasonable inquiry other release areas in the vicinity containing the substance for which the site-specific dilution factor is calculated, and all monitoring points; if applicable, justification for use of a till infiltration rate other than 0.5 feet per year, and the results of all the laboratory analyses and field analyses used to determine the (aa) parameters of the equation in clause (ii) of this subparagraph and (bb) identification of geologic material for the purposes of choosing an infiltration rate in accordance with clause (iv) of this subparagraph.]

[(iv)

	Geologic Material	Infiltration Rate (feet/year)
	Stratified Drift	2.0
	Till	0.5 - 1.0
	Lacustrine Deposits	0.4

]

[(3)](4) Determining the Presence of [Non-aqueous Phase Liquids] NAPL in Soil[.]

For the purpose of this subsection, the presence of [non-aqueous phase liquids] NAPL in soil shall be determined using either:

(A) [the] The following equation where the variables in the equation are assigned the values in the Table following this equation: [$C_{nap} = (S/2\rho_b)(K_d\rho_b + \theta_w + H'\theta_a)$, where:]

$$C_{NAP} = (S/2\rho_b)(K_d\rho_b + \theta_w + H'\theta_a)$$

[C_{nap} = the concentration of an organic substance at which or above which such substance may be present in a non-aqueous phase]

[S = the effective solubility]

[ρ_b = dry soil bulk density]

[K_d = soil-water partition coefficient, which may be approximated by $K_{OC} * f_{OC}$]

[K_{OC} = soil organic carbon-water partition coefficient]

[f_{OC} = fraction organic carbon of soil]

[θ_w = water-filled soil porosity (L_{water}/L_{soil})]

[θ_a = air-filled soil porosity (L_{air}/L_{soil})]

[H' = Henry's law constant (dimensionless)]

[H = Henry's law constant (atm-m³/mol)]

[The terms defined above shall be assigned the following values:]

Terms	Description	Value	Units
C_{NAP}	<u>Concentration of an organic substance at which or above which such substance may be present in a non-aqueous phase</u>	calculated	mg/kg
S	<u>Effective solubility</u>	substance-specific [chemical-specific]	mg/L
ρ_b	<u>Dry soil bulk density</u>	1.5 or the lowest value measured at the subject release area	kg/L
K_d	<u>Soil-water partition coefficient, which is calculated using</u> $K_d = K_{OC} * f_{OC}$	calculated	L/kg
K_{OC}	<u>Soil organic carbon-water partition coefficient</u>	substance-specific [chemical-specific]	L/kg
f_{OC}	<u>Fraction organic carbon of soil</u>	0.006 or the lowest value measured at the subject release area	g/g
θ_w	<u>Water-filled soil porosity L_{water}/L_{soil}</u>	0.15 for unsaturated soil or 0.43 for saturated soil	L_{water}/L_{soil}
θ_a	<u>Air-filled soil porosity L_{air}/L_{soil}</u>	0.28 for unsaturated soil or 0.0 for saturated soil	L_{air}/L_{soil}
H'	<u>Henry's law constant (dimensionless)</u>	$H \times 41$ where 41 is a conversion factor	unitless
H	<u>Henry's law constant</u>	substance-specific [chemical-specific]	atm-m ³ /mol

(B) The commissioner may approve or deny in writing a request for an alternative to the equation in subparagraph (A) of this subdivision to determine the presence of NAPL in soil. Such proposed alternative methods may be based upon emerging technologies and approaches for which guidance, a standard, or an industrial code has been published by a regulatory agency, governmental advisory group, or other recognized professional organization. A request under this subdivision shall be submitted to the commissioner on a form prescribed by the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include any other information that the commissioner deems necessary to evaluate such request. Any approval by the commissioner may specify conditions necessary to protect human health and the environment.

[(4)](5) Conditional Exemptions[.] to Pollutant Mobility Criteria

(A) Environmentally Isolated Soil

[The pollutant mobility criteria do not apply to environmentally isolated soil] Polluted soil at a release area above the seasonal high water table is not required to be remediated to the pollutant mobility criteria, provided that:

(i) Such soil does not contain substances that are a continuing source of pollution;

(ii) Regardless of groundwater classification, if such soil contains volatile organic substances in excess of GA area pollutant mobility criteria, the concentrations of such substances have been reduced or immobilized to the maximum extent prudent; and

(iii) [an environmental land use restriction] An EUR is in effect [with respect to the parcel, or portion thereof, containing such soil which environmental land use restriction ensures that soil will not be exposed to infiltration of soil water due to, among other things, demolition of the building.] for the subject area, which restriction shall:

(I) Prohibit infiltration of liquid into such soil;

(II) Enumerate and require compliance with clause (i) and, if applicable, clause (ii) of this subparagraph; and

(III) Require, as applicable, that:

(a) A building that renders soil environmentally isolated consists of a roof and structural walls that prevent infiltration of liquid into the soil beneath the building footprint, and removal of such building is prohibited; or

(b) A permanent structure that renders soil environmentally isolated has been approved in writing by the commissioner and prevents infiltration of liquid into the soil beneath the structure's footprint, and removal of such structure is prohibited;

(B) Polluted Material

(i) [The pollutant mobility criteria do not apply to polluted fill of on a parcel if: (i) such fill is polluted only with coal ash, wood ash, coal fragments, asphalt paving fragments, or any combination thereof;] Polluted material at a release area is not required to be remediated to the pollutant mobility criteria, provided that:

(I) The pollutant mobility criteria in such polluted material is exceeded solely as a result of the presence of coal ash, wood ash, coal fragments, coal slag, coal clinkers, asphalt paving fragments, or any combination thereof;

(II) [(ii) such fill] Such polluted material is not polluted with any volatile organic [substance which exceeds an] substances that exceed the applicable pollutant mobility [criterion] criteria.

(III) Such polluted material does not exceed the applicable soil vapor volatilization criteria, or if it does, all such polluted material is under a building in accordance with section 22a-133k-3(c)(3) of the RSRs, a permanent structure approved in writing by the commissioner, or an engineered control in compliance with section 22a-133k-2(f)(2)(B) of the RSRs;

(IV) [(iii) the concentration of each substance in any such fill is consistent with the requirements established in subsection (b) of this section] Such polluted material has achieved compliance with the direct exposure criteria in section 22a-133k-2(b) of the RSRs;

(V) [(iv) such substance] Such polluted material is not affecting and will not affect the quality of an existing [or] use of groundwater, including but not limited to, a potential public water supply resource or an [existing private drinking water supply] aquifer protection area;

(VI) [(v) a] A public water supply distribution system is available within [200] two hundred feet of [such] the parcel on which polluted material is located and within two hundred feet of all parcels adjacent thereto; and

(VII) [(vi) the] The placement of the polluted material used as fill was not prohibited by law at the time of placement.

(ii) This subparagraph shall apply only to polluted materials identified in clause (i) of this subparagraph and releases from such materials. It shall not apply to releases that are not from

polluted materials, even if such releases are in the same location as the polluted materials identified in clause (i) of this subparagraph.

(C) Soil Subject to Infiltration

[The pollutant mobility criteria do not apply to substances, other than volatile substances, in soil at a release area] Polluted soil at a release area polluted with substances, other than volatile organic substances, that exceed DEC or PMC is not required to be remediated to the pollutant mobility criteria, provided that at such release area:

(i) [(I) Is located in an area in which at least eighty] Eighty percent or more of the mass of the substances remaining at the release area has been subject to infiltration[, and];

(ii) Infiltration was not obstructed by anthropogenic features, for [a minimum of] at least five years; [or (II) Has been determined by the Commissioner, in writing, to have been subject to sufficient infiltration of precipitation such that the concentration of the substance and the areal extent of the ground-water plume will not likely increase if any obstruction to infiltration is removed in the future; and]

(iii) Groundwater monitoring complies with the requirements of section 22a-133k-3(h)(1) of the RSRs; and

[(ii)](iv) The laboratory analytical results [of four consecutive quarterly samples of] for all groundwater [for such substance] sample events collected as specified in section 22a-133k-3(h)(3) of the RSRs are equal to or less than the following:

(I) For a GA area, [or for] an aquifer protection area, or [other] ground[-]water area used as a source [of] for either a private or public drinking water supply located in a GB area, [are all less than the surface water protection criterion and] the ground[]water protection [criterion] criteria and the surface water protection criteria or, if applicable, the water quality criteria; or

(II) For a GB area, [are all less than] other than a GB area specified in subclause (I) of this clause, the surface[-] water protection [criterion; and (iii) The ground-water sampling locations are representative of the areal extent of the ground-water plume and the areal extent of such ground-water plume which exceeds an applicable remedial criterion is not increasing over time; (iv) Except for seasonal variations, the concentration of the subject substance is not increasing at any point over time; and (v) The ground-water samples are collected at locations where ground water is most likely to have been impacted by such substance from the release area] criteria or, if applicable, the water quality criteria.

(D) Conditional Exemption for Incidental Sources

[The pollutant mobility criteria do not apply to] Soil at a release area polluted with metals, petroleum hydrocarbons, or semi-volatile organic substances [in soil] is not required to be remediated to the pollutant mobility criteria, provided such pollution is the result of:

(i) [(A)] An incidental release due to the normal operation of motor vehicles, not including refueling, repair or maintenance of a motor vehicle; or

(ii) [(B)] Normal paving and maintenance of a consolidated bituminous concrete surface provided such bituminous concrete surface has been maintained for its intended purpose.

(E) Conditional Exemption for Soil Polluted with Pesticides

Soil polluted with pesticides at a release area as a result of the application of pesticides at such release area is not required to be remediated to the pollutant mobility criteria, provided that a determination has been made that such pesticides are present solely as a result of the application of pesticides and:

(i) Compliance with the direct exposure criteria or the requirements in section 22a-133k-2(b)(6) of the RSRs has been achieved; and

(ii) Compliance with the groundwater standards specified in section 22a-133k-3(a) of the RSRs or the requirements of section 22a-133k-3(g) of the RSRs has been achieved.

[(5)](6) Pollutant Mobility Criteria for Additional Polluting Substances[.]

(A) [With respect to any substance] Substances at a particular release area for which [a] pollutant mobility [criterion is] criteria are not specified in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve a pollutant mobility criterion, a dilution or dilution and attenuation factor, and a] Appendix B of the RSRs shall be remediated to background concentration or to criteria obtained pursuant to this subdivision. A request under this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) A proposed risk-based pollutant mobility criteria for each substance calculated in accordance with Appendix G of the RSRs, as applicable to the groundwater classification of the release area;

(ii) A method for determining compliance with [such criterion to apply to such substance at a particular release area, provided the Commissioner finds] each criteria;

(iii) The laboratory reporting limit for each substance; and

(iv) [that such criterion] Any information demonstrating whether a proposed criteria will ensure that soil water at such release area does not exceed[.];

(I) [in] In a GA area, the ground[-]water protection [criterion,] criteria; or

(II) [in] In a GB area, the ground[-]water protection [criterion] criteria multiplied by a dilution factor of [10] ten.

(B) The commissioner may approve or deny in writing a request made under subparagraph (A) of this subdivision. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the requirements of this subdivision have been satisfied and that the proposed pollutant mobility criteria will be protective of human health and the environment.

(C) Unless prohibited in writing by the commissioner, criteria approved by the commissioner pursuant to subparagraph (A) of this subdivision, may be the subject of a request for alternative criteria under section 22a-133k-2(d)(3)(A) of the RSRs.

(d) Alternative Soil Criteria[.] and Alternative Dilution or Dilution Attenuation Factor

(1) [Requests] Information Required in a Request for Approval of Alternative Soil Criteria[.]

A request for approval of the alternative direct exposure criteria or alternative pollutant mobility criteria at a particular release area may be submitted to the commissioner under this subsection. Any such request shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, including any additional information specified in subdivisions (2) or (3) of this subsection, as applicable, and shall also include:

(A) [Any person requesting that the Commissioner approve an alternative criterion applicable to a particular release area] shall submit: the name and address of the owner of the parcel at which such release area is located; the address of such release area and a brief description of its location; a detailed description of such release area; and a map at a scale of not less than 1:1200 showing the location of all release areas on such parcel, the subject release area, and describing the concentration and distribution of all substances in the soil of the subject release area, including but not limited to the substance for which an alternative criterion is sought; a detailed written report describing the justification for the proposed alternative criterion; and any other information the Commissioner reasonably deems necessary to evaluate such request.] A detailed description of any other release area located on the same parcel as the subject release area and whether such other release area is affected or potentially affected by the subject release area, or is affecting or may potentially affect the subject release area; and

(B) [Any person requesting that the Commissioner approve an alternative pollutant mobility criterion or an alternative dilution or dilution attenuation factor shall submit, in addition to the information required by subparagraph (A) of this subdivision, a detailed description of any other release area located on the same parcel as the subject release area and which other release area (i) is

affected or potentially affected by the subject release area or (ii) is affecting or potentially may affect the subject release area;] When an EUR is required under this subsection, the acknowledgement and consent of the owner of the subject area to such alternative direct exposure criteria.

[(C)] [Any person requesting that the Commissioner approve an alternative direct exposure criterion shall submit, in addition to the information required by subparagraph (A) of this subdivision, a detailed description of any other release area located on the same parcel as the subject release area.]

(2) Commissioner Approval of Alternative Release-Specific Direct Exposure Criteria.

With respect to a substance, except [PCB] PCBs, for which [a] direct exposure [criterion is] criteria are specified in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] Appendix A of the RSRs or approved in writing by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs, the [Commissioner] commissioner may approve or deny in writing a request for an alternative release-specific direct exposure [criterion and] criteria or an alternative method for determining compliance with such [criterion provided it is demonstrated to the satisfaction of the Commissioner, after consultation with the Commissioner of Public Health that the application of such alternative criterion at the subject release area will protect human health and the environment from the risks associated with direct exposure to polluted soil by ensuring that] criteria.

(A) For substances in soil at a release area, no request shall be approved unless it is demonstrated to the commissioner's satisfaction that:

(i) The application of such alternative direct exposure criteria or method of compliance will protect human health and the environment from the risks associated with direct exposure to polluted soil;

(ii) [the] The concentration of each carcinogenic substance in such soil [does not exceed] is equal to or less than a 1×10^{-6} excess lifetime cancer risk level and the concentration of each non-carcinogenic substance in such soil does not exceed a hazard index of 1; [or]

(iii) [(B) for] For a release area polluted with [multiple] ten or more carcinogenic substances, the cumulative excess lifetime cancer risk for all carcinogenic substances in such soil with the same target organ [does not exceed] is equal to or less than 1×10^{-5} [,]; and

(iv) For a release area polluted with ten or more non-carcinogenic substances, the cumulative hazard index [does not exceed] is equal to or less than 1 for non-carcinogenic substances in such soil with the same target organ.

(B) [Any person requesting] A request for approval of [an alternative] direct exposure [criterion] criteria or method of compliance shall [submit to the Commissioner and the Commissioner of Public Health] include a risk assessment prepared in accordance with the most recent EPA Risk Assessment Guidance for Superfund, or other risk assessment method approved by the [Commissioner in consultation with the Commissioner of Public Health, and shall submit any additional information specified by the Commissioner or the Commissioner of Public Health] commissioner.

(C) Any approval of the commissioner under this subdivision may require that an EUR is or will be in effect for the subject area, which restriction shall enumerate and require compliance with any conditions specified by the commissioner when issuing such approval.

(3) Commissioner Approval of Alternative Release-Specific Pollutant Mobility Criteria [for GA Areas.]

(A) Alternative Release-Specific Pollutant Mobility Criteria

With respect to [a substance occurring at a release area located in a GA area, and] for which [substance a] pollutant mobility [criterion is] criteria are specified in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] Appendix B of the RSRs or approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs, the [Commissioner] commissioner may approve or deny in writing a request for an alternative release-specific pollutant

mobility [criterion and] criteria or an alternative method for determining compliance with such [criterion provided it is demonstrated] criteria. No request shall be approved unless it is demonstrated to the [Commissioner's] commissioner's satisfaction that the application of such [alternative criterion at the subject release area will ensure] alternatives:

(i) For a substance in soil located in a GA area, will ensure that soil water at such release area [will not exceed] is equal to or less than the ground[-]water protection [criterion] criteria for such substance[.]; or

(ii) For a substance in soil located in a GB area, will ensure that the groundwater plume, after dilution resulting from infiltration on the parcel, is equal to or less than the groundwater protection criteria for such substance.

(B) Alternative Release-Specific Dilution or Dilution Attenuation Factor [for GA Areas.]

With respect to [a substance occurring at a release area located in a GA area, and] substances for which [substance a] pollutant mobility [criterion is] criteria are specified in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] Appendix B of the RSRs or approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs, the [Commissioner] commissioner may approve or deny in writing a request for an alternative release-specific dilution or dilution attenuation factor[, provided that it is demonstrated]. No request shall be approved unless it is demonstrated to the [Commissioner's] commissioner's satisfaction that the application of such dilution attenuation factor [will ensure]:

(i) For a substance in soil located in a GA area, will ensure that [such] the release area will not degrade ground[-]water quality and thereby prevent the achievement of the [applicable] ground[-]water [remediation standards] criteria or background concentration, in accordance with section 22a-133k-3 of the RSRs; or

(ii) For a substance in soil located in a GB area, will ensure that the soil water at the release area will not cause the groundwater at the nearest downgradient parcel boundary to exceed the groundwater protection criteria for each substance.

(C) Condition for Approval

For any request for approval of alternative pollutant mobility criteria or alternative dilution or dilution attenuation factor specified in this subdivision, alternative groundwater criteria shall not be used for the same substance for which alternative soil criteria is requested.

(4) LEP Calculation and Use of Alternative Release-Specific Pollutant Mobility Criteria

With respect to substances for which pollutant mobility criteria are specified in Appendix B of the RSRs, alternative release-specific pollutant mobility criteria for a particular release area may be calculated by an LEP in accordance with Appendix H of the RSRs and used at a release area, provided that:

(A) The calculated alternative pollutant mobility criteria shall not exceed 1,000 mg/kg in a GA area or 10,000 mg/kg in a GB area;

(B) All representative laboratory analytical results of groundwater samples used to determine compliance with any such alternative criteria shall be conducted in accordance with section 22a-133k-3(h) of the RSRs. Alternative criteria under this subdivision shall not be used if any groundwater sample results are equal to or greater than:

(i) The groundwater protection criteria in Appendix C of the RSRs, if the subject release area is in a GA area, an aquifer protection area, or an area where groundwater is used as a source of either private or public drinking water supply;

(ii) Either the surface water protection criteria in Appendix D of the RSRs or, if required under section 22a-133k-3(a)(3) of the RSRs, the water quality criteria; and

(iii) The volatilization criteria in Appendix E of the RSRs; and

(C) Notice of the use and derivation of the calculated criteria is submitted to the commissioner in

accordance with section 22a-133k-1(g) of the RSRs.

[(5)] [Alternative Pollutant Mobility Criteria for GB Areas.]

[With respect to a substance occurring at a release area located in a GB area, and for which substance a pollutant mobility criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative pollutant mobility criterion and an alternative method for determining compliance with such criterion at such release area, provided it is demonstrated to the Commissioner's satisfaction that the application of such criterion will ensure that soil water at the release area, after dilution with ground water derived from infiltration on the parcel, will not exceed the ground-water protection criterion for such substance.]

[(6)] [Alternative Dilution or Dilution Attenuation Factor for GB Areas.]

[With respect to a substance occurring at a release area located in a GB area, and for which substance a pollutant mobility criterion is specified in sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, the Commissioner may approve an alternative dilution or dilution attenuation factor, provided that it is demonstrated to the Commissioner's satisfaction that application of such alternative dilution or dilution attenuation factor will ensure that the soil water at such release area will not cause the ground water at the nearest downgradient property boundary to exceed the ground-water protection criterion for such substance.]

[(7)] [Alternative Direct Exposure Criterion for PCB.]

[The Commissioner may approve an alternative direct exposure criterion for PCB including an alternative direct exposure criterion for an inaccessible soil polluted with PCB, and an alternative method for determining compliance with such criterion, provided it is demonstrated to the satisfaction of the Commissioner after consultation with the Commissioner of Public Health that the application of such alternative criterion at the subject release area will protect human health and the environment from the risks associated with direct exposure to soil polluted with PCB and is consistent with 40 CFR Part 761 and with the "Guide on Remedial Actions at Superfund Sites with PCB Contamination" (EPA Directive 9355.4-01, August 1990).]

(e) [Applying] Determining Compliance with the [Direct Exposure and Pollutant Mobility] Soil Criteria[.]

(1) Direct Exposure Criteria

Unless an alternative method for determining compliance with [a] direct exposure [criterion] criteria has been approved in writing by the [Commissioner in writing] commissioner pursuant to section 22a-133k-2(d)(2) of the RSRs, compliance with [a] direct exposure [criterion] criteria for each substance is achieved when either:

(A) [the ninety-five percent upper confidence level of the arithmetic mean of all sample results of laboratory analyses of soil from the subject release area is equal to or less than such criterion or] All laboratory analytical results of soil samples from a release area are equal to or less than the applicable direct exposure criteria; or

(B) [the results of all laboratory analyses of samples from the subject release area are equal to or less than the applicable direct exposure criterion] Except for PCBs, the ninety-five percent upper confidence level of the arithmetic mean of a statistically representative sampling data set of all laboratory analytical results for such substance from a release area, consisting of ten or more soil samples, is equal to or less than the applicable direct exposure criteria.

(2) Pollutant Mobility Criteria

Unless an alternative method for determining compliance with [a] pollutant mobility [criterion for a particular substance] criteria has been approved in writing by the [Commissioner in writing] commissioner pursuant to section 22a-133k-2(d)(3) of the RSRs, compliance with [a] pollutant mobility [criterion] criteria for [such] each substance is achieved when either:

(A) [(i) a representative sampling program consisting of not less than twenty samples of soil located above the water table has been used to characterize the distribution and concentration of such substance at the subject release area or remaining at the subject release area following remediation, and (ii) the ninety-five percent upper confidence level of the arithmetic mean of all the sample of] All laboratory [analyses] analytical results of soil samples from [the subject] a release area [for such substance is] are equal to or less than the applicable [direct exposure criterion] pollutant mobility criteria; or

(B) [(i) Except of PCBs, the ninety-five percent upper confidence level of the arithmetic mean of a statistically representative sampling [program] data set of all laboratory analytical results for such substance from a release area, consisting of [not less than twenty] ten or more soil samples [of soil] that are located above the water table [has been used to characterize the distribution and concentration of substances remaining at the subject release area following remediation and (ii) the results of all laboratory analysis of samples from the subject release area for such substances are], is equal to or less than [such] the applicable pollutant mobility criteria.

(3) Background Concentration

Compliance when remediating to the background concentration for a given substance in soil is achieved when:

(A) A representative sampling program is used to characterize the background concentration for soil that:

- (i) Of similar texture and composition;
- (ii) Outside the subject release area, yet in the general vicinity of such release area; and
- (iii) Not affected by another discrete release of the same substance, or having an effect on the concentrations of the same substance for which a background concentration is determined; and either

(B) All laboratory analytical results of soil samples from the subject release area are equal to or less than the background concentration for soil; or

(C) A statistical comparison of the background concentrations in soil to the concentrations of substances in soil from the subject release area, results in a statistically significant similarity.

[(3)] [Matrix interference effects.]

[If any applicable criterion for a substance in soil is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, the following actions shall be taken:]

[(A)] [(i)] [“Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,” SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460 shall be consulted to determine if an analytical method sufficiently sensitive to achieve the applicable analytical detection limit was used to conduct the analysis of the subject substance. If there is available an alternative analytical method which is sufficient to achieve the required analytical detection limit, appropriate for the sample matrix, and has been approved by EPA or approved in writing by the Commissioner, the subject soil shall be re-analyzed for the subject substance using such alternative method.]

[(ii)] [If a sample has been analyzed by one or more analytical methods in accordance with subparagraph (A)(i) of this subdivision and the applicable analytical detection limit has not been achieved due to matrix interference effects, such method(s) shall be modified in order to compensate for such interferences, in accordance with analytical procedures specified by EPA within the scope of the analytical method.]

[(B)] [If, after re-analyzing the subject soil and attempting to compensate for matrix interference effects in accordance with to subparagraph (A) of this subdivision, any applicable criterion for a substance in soil is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, compliance with such

criterion shall be achieved when such soil has been remediated to the lowest concentration for such substance which can be consistently and accurately quantified without matrix interference effects.]

[(C)] [A detailed summary of all measures taken to overcome matrix interference effects and a determination of the lowest alternative quantification level applicable to the analysis of such substance shall be prepared and, if requested by the Commissioner in writing, shall be submitted to the Commissioner for his review and approval.]

(f) **Soil Criteria Variances[.]**

(1) **Widespread Polluted Fill[.] Variance**

(A) **Eligibility**

[The Commissioner may grant a variance from any of the requirements of subsection (c) of this section upon the written request of the owner of the subject parcel if the Commissioner determines that (A) geographically extensive polluted fill is present at such parcel and at other parcels in the vicinity of the subject parcel; (B)] Geographically-extensive polluted fill present at a parcel may be eligible for a variance from compliance with the pollutant mobility criteria in accordance with subparagraph (B) or (C) of this subdivision, provided that:

(i) [such] The fill for [is not polluted with] which a variance is sought does not contain volatile organic substances in excess of pollutant mobility criteria;

(ii) [(C) such] Such fill is not affecting and will not affect the quality of an existing or potential public water supply resource or an existing private drinking water supply;

(iii) [(D) the concentration of] For each substance in such fill [is consistent] compliance with [subsection (b) of this] the direct exposure criteria in section 22a-133k-2(b) of the RSRs has been achieved; [and]

(iv) Any substances released into such fill subsequent to the placement of such fill that exceed the pollutant mobility criteria shall be remediated to concentrations equal to or less than the concentrations of those substances already within such fill;

(v) [(E) the] The placement of such fill was not prohibited by law at the time of placement[.];

(vi) Such fill shall remain on the parcel within the area for which such variance has been certified by an LEP in accordance with subparagraph (B) of this subdivision or approved in writing by the commissioner in accordance with subparagraph (C) of this subdivision; and

(vii) The owner of the parcel for which a variance is sought acknowledges and consents to such variance and the EUR required by subparagraph (D) of this subdivision.

(B) **LEP Certification of a Widespread Polluted Fill Variance**

A variance for widespread polluted fill in accordance with this subdivision may be certified in writing by an LEP, provided such LEP determines that a parcel complies with that the eligibility requirements in subparagraph (A) of this subdivision have been satisfied, and the LEP demonstrates that the following requirements have been satisfied:

(i) Such fill extends over an area larger than ten acres;

(ii) Such fill is located within the coastal boundary as defined in section 22a-94(b) of the Connecticut General Statutes;

(iii) Such fill is located within a GB area;

(iv) Such fill is not located within the drainage basin of a Class A stream, as identified in the Water Quality Standards;

(v) Compliance with the groundwater standards in section 22a-133k-3 of the RSRs has been achieved for each substance in groundwater;

(vi) Such fill is not hazardous waste, as defined in section 22a-448 of the Connecticut General Statutes;

(vii) Except in the case of a municipality, state, or federal agency, the person requesting the variance or the owner of the parcel subject to the variance did not place the fill on the subject parcel

and is not affiliated with any person responsible for such placement through any direct or indirect familial relationship or any contractual, corporate, or financial relationship other than that by which such person's or such owner's interest in such parcel was conveyed or financed; and

(viii) Notice of the use of such variance shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs.

(C) Commissioner Approval of a Widespread Polluted Fill Variance

[In determining whether to grant or deny such a variance, the Commissioner may consider] The commissioner may approve or deny in writing a request for a variance under this subsection. No request shall be approved unless such request demonstrates to the commissioner's satisfaction the eligibility requirements in subparagraph (A) of this subdivision and the requirements of this subparagraph have been satisfied. A request for such variance shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) Information demonstrating that a public water supply distribution system is available to all areas between the groundwater plume and the downgradient surface water discharge area;

(ii) [the relative] The comparable cost of achieving compliance with [subsection (c) of this section,] pollutant mobility criteria without such variance;

(iii) The degree to which such fill exceeds pollutant mobility criteria;

(iv) The extent of such fill on the subject parcel that extends below the water table;

(v) [how extensive] The three-dimensional extent of [the polluted] such fill [is, what] and the relative portions of such fill [occurs] occurring on the subject parcel[.]; and

(vi) [whether] Information demonstrating that the person requesting the variance or the owner of the parcel subject to the variance did not place such fill on the subject parcel or is not affiliated with any person responsible for [such] the placement of such fill through any direct or indirect familial relationship or any contractual, corporate or financial relationship other than that by which such person's or such owner's interest in such parcel is to be conveyed or financed.

(D) Actions Required for Maintaining a Widespread Polluted Fill Variance

(i) No later than one hundred and eighty (180) days after an LEP certifies a widespread polluted fill variance under subdivision (1)(B) of this subsection, an EUR that complies with the requirements of this subsection and the EUR regulations shall be in effect for the subject area, which restriction shall prohibit any movement or reuse of such fill in a manner that does not comply with the RSRs; or

(ii) No later than one hundred and eighty (180) days after a widespread polluted fill variance has been certified by an LEP or approved by the commissioner, a request for an ELUR or NAUL that complies with the requirements of this subsection and the EUR regulations shall be submitted to the commissioner. The EUR in effect for the subject area, shall:

(iii) Prohibit any movement or reuse of such fill in a manner that does not comply with the RSRs; and

(iv) Enumerate and require compliance with any condition imposed by the commissioner when approving a variance under this section.

(2) Engineered Control [of Polluted Soils.] Variance

(A) [Provided that an engineered control of polluted soils is implemented pursuant to subparagraphs (B) and (C) of this subsection, the requirements of subsections (a) through (e) of this section do not apply if:] Eligibility

A release area may be eligible for a variance from compliance with the direct exposure criteria, the pollutant mobility criteria, or both, under this subdivision through the use of an engineered control, provided that:

(i) [the Commissioner] The commissioner authorized the disposal of solid waste or polluted soil at the subject release area;

(ii) [the] The soil at such release area is polluted with a substance for which remediation is [not]

technically [practicable] impracticable;

(iii) [the Commissioner, in consultation with the Commissioner of Public Health,] The commissioner has determined that the removal of such substance or substances from such release area would create an unacceptable risk to human health; [or]

(iv) An LEP, pursuant to subparagraph (B) of this subsection, has determined that the cost of remediating the polluted soil at the subject release area is significantly greater than the cost of installing and maintaining an engineered control for such soil and conducting groundwater monitoring that complies with section 22a-133k-3(h) of the RSRs at the subject release area; or

(v) The commissioner, pursuant to subparagraph (C) of this subsection, has determined that the cost of remediating the polluted soil at the subject release area significantly outweighs the risk to the environment and human health if the engineered control fails, causing the mobilization of a substance in the soil or human exposure to such substance, and the cost of remediating the polluted soil at the subject release area is significantly greater than the cost of installing and maintaining an engineered control for such soil and conducting groundwater monitoring that complies with section 22a-133k-3(h) of the RSRs at the subject release area.

[(iv)] [The Commissioner has determined, after providing notice and an opportunity for a public hearing, that a proposal by the owner of the subject parcel to use an engineered control is acceptable because (aa) the cost of remediating the polluted soil at such release area is significantly greater than the cost of installing and maintaining an engineered control for such soil and conducting groundwater monitoring at such release area in accordance with subsection (g) of section 22a-133k-3, and (bb) that the significantly greater cost outweighs the risk to the environment and human health if the engineered control fails to prevent the mobilization of a substance in the soil or human exposure to such substance. The Commissioner may hold a public hearing pursuant to this section if in his discretion the public interest will be best served thereby, and he shall hold a hearing upon receipt of a petition signed by at least twenty-five persons. Notice of the subject proposal shall be provided by the owner of the subject parcel in two of the three following manners: (i) by publication in a newspaper of substantial circulation in the affected area; (ii) by placing and maintaining on the subject parcel, for at least thirty days, in a legible condition a sign which shall be not less than six feet by four feet which sign shall be clearly visible from the public highway; or (iii) by mailing notice to the owner of record of each property abutting the subject parcel at his address on the most recent grand tax list of the municipality or municipalities in which such properties are located. When notice is published or mailed, it shall include the name and address of owner of the subject parcel; the location address and/or a description of the location such parcel; a brief description of the nature of the pollution on the subject parcel; a brief description of the proposed engineered control; and a brief description of the procedures for requesting a hearing. When notice is provided by posting a sign, the sign shall include the words “Environmental remediation is proposed for this site. For further information contact...” and shall include the name and telephone number of an individual from whom any interested person may obtain information about the remediation. The owner of the subject parcel shall verify to the Commissioner in writing on a form furnished by him that notice has been given in accordance with this subsection.]

(B) LEP Certification of an Engineered Control Variance

A variance from compliance with the direct exposure criteria may be available when an engineered control is used at a release area, provided an LEP certifies to the commissioner, in accordance with section 22a-133k-1(g) of the RSRs, that the eligibility requirements of subparagraph (A) of this subdivision and the following requirements have been satisfied:

(i) The engineered control is designed and constructed and will be maintained to meet the following specifications, as applicable:

(I) For non-paved surfaces consisting of shallow-rooted vegetation, mulch, or gravel, there shall

be a minimum of one foot of material as measured from the ground surface, provided that the concentrations of any substances in such material are equal to or less than the applicable direct exposure criteria. Such material shall be underlain by a demarcation layer, unless there is a pre-existing mature lawn for a minimum of three years;

(II) For non-paved surfaces consisting of shrubbery, such shrubbery shall be underlain by a minimum of eighteen inches of material as measured from the ground surface, provided that the concentrations of any substances in such material are equal to or less than the applicable direct exposure criteria. Such material shall be underlain by a demarcation layer, unless there is pre-existing mature shrubbery;

(III) For non-paved surfaces consisting of trees, such trees shall be underlain by a minimum eighteen inches of material, provided that the concentrations of any substances in such material are equal to or less than the applicable direct exposure criteria, measured vertically from the ground surface and extending horizontally to a radius equivalent to the full extent of the tree crown when mature. Such material shall be underlain by a demarcation layer, unless there are pre-existing trees;

(IV) For non-paved surfaces consisting of hardscape, a professional engineer shall sign and seal a plan and specifications indicating that the hardscape is appropriately designed to work for its intended use, with minimal maintenance and repair for fifteen years, and is or shall be constructed with a minimum of nine inches of a combined thickness of hardscape and sub-base. Such material shall be underlain by a demarcation layer, unless such hardscape is pre-existing;

(V) For paved surfaces, a professional engineer shall sign and seal a plan and specifications indicating that the engineered control is appropriately designed for such paved surface's intended use, with minimal maintenance and repair for fifteen years, and shall be constructed with a minimum of two and one-half (2.5) inches of bituminous concrete with a minimum of six (6) inches of sub-base or a minimum of four (4) inches of reinforced concrete. In addition any bituminous concrete or reinforced concrete less than five (5) feet wide or less than five hundred (500) square feet, the surface shall be underlain by a demarcation layer, unless such paved surface is pre-existing; or:

(VI) For a ground-mounted solar array anchored by a concrete ballast, the concrete ballast for the solar array shall be underlain with a minimum of one (1) foot of material and all remaining infrastructure associated with the solar array installation shall consist of a minimum of two feet of material, provided that any substances in such are equal to or less than the applicable direct exposure criteria and all such material is underlain by a demarcation layer:

(ii) PCBs are not present in the soil in excess of the residential direct exposure criteria;

(iii) Consolidation of polluted soil under an engineered control is such that the soil does not exceed four feet above the pre-consolidation elevation;

(iv) Measures are in place to ensure that the structural integrity, function, and effectiveness of the engineered control will be maintained. Such measures shall include, without limitation:

(I) Measures to prevent storm run-on or run-off from damaging the engineered control;

(II) Inspection of the engineered control conducted semi-annually. Such inspections may be done in conjunction with and satisfy the inspection requirements in the EUR Regulations; and

(III) Repairs to correct the effects of settling, subsidence, erosion, or other damaging events or conditions no later than sixty (60) days following identification of damage to the engineered control, provided if weather prevents repairs from being made within sixty (60) days of the identification of damage, as long as temporary repairs or measures have been taken, repairs can be made as soon as the weather permits;

(v) The owner of the subject area on which such engineered control will be placed acknowledges and consents to such engineered control;

(vi) An EUR is or will be in effect for the subject area, which restriction shall:

(I) Prohibit the disturbance of the engineered control and the polluted soil; and

(II) Enumerate and require compliance with the requirements of this subparagraph, except for clauses (vii) and (viii);

(vii) A copy of the required public notice that was posted in accordance with section 22a-133k-1(d) of the RSRs; and

(viii) Calculation of the required financial assurance in accordance with section 22a-133k-1(f) of the RSRs.

[(B)](C) Commissioner Approval of an Engineered Control Variance

The commissioner may approve or deny in writing a request for a variance under this subsection. No request shall be approved unless such request demonstrates to the commissioner's satisfaction that the eligibility requirements in subparagraph (A) of this subdivision and the requirements of this subparagraph have been met. A request [to use an engineered control shall be submitted to the Commissioner in writing and] for the commissioner's approval of an engineered control variance shall be submitted in accordance with section 22a-133k-1(g) of the RSRs. Any such request shall [be accompanied by] include a demonstration of compliance with the eligibility requirements of subparagraph (A) of this subdivision and include a detailed written report and plan which [demonstrates] demonstrate that:

(i) [(I) if the] For a variance from direct exposure criteria, such engineered control is [to address exceedances of the direct exposure criteria, the proposed engineered control has been] designed, [and will be] constructed, and will be maintained, to physically isolate polluted soil from human contact with such soil;

(ii) [or (II) if the] For a variance from pollutant mobility criteria, such engineered control is [to address exceedances of the pollutant mobility criteria, the proposed engineered control has been] designed, [and will be] constructed, and will be maintained, to minimize migration of liquids through polluted soil and [have] reduce the permeability of such soil to a permeability of less than 10^{-6} cm/sec; [or, unless otherwise specified by the Commissioner in writing, to have the permeability specified in a closure plan implemented under sections 22a-209-1 et seq. of the Regulations of Connecticut State Agencies for a release area which is a lawfully authorized solid waste disposal area; and (ii) for all engineered controls, the proposed engineered control has been designed, and will be constructed to function with minimum maintenance, to promote drainage and minimize erosion of or other damage to such control, and to accommodate settling and subsidence of the underlying soil so as to maintain the control's functional integrity;]

(iii) For a variance from pollutant mobility criteria for volatile organic substances, in addition to clause (ii) of this subparagraph, such engineered control is designed, constructed, and will be maintained, to ensure that any soil vapor migrating from the subject release area complies with all applicable volatilization criteria in accordance with section 22a-133k-3(c)(3) of the RSRs;

[(iii)](iv) [(iii) plans for] In addition to the other requirements of this subparagraph, for a variance from pollutant mobility criteria, ground[-]water monitoring at the subject release area [are] is adequate to ensure that any substance migrating [therefrom] from the release area will be detected;

[(iv) plans for maintenance of the subject release area are adequate to ensure that the structural integrity, design permeability, and effectiveness of the engineered control will be maintained; such plans shall include without limitation measures to prevent run-on and run-off of storm water from eroding or otherwise damaging the engineered control and measures to repair such control to correct the effects of any settling, subsidence, erosion or other damaging events or conditions;]

[(v) an environmental land use restriction is or will be in effect with respect to the parcel at which the subject release area is located, which restriction ensures that such parcel will not be used in a manner that could disturb the engineered control or the polluted soil;]

(v) For an engineered control that includes immobilization, including but not limited to, the immobilization of NAPL, such engineered control is designed, constructed, and will be maintained,

to reduce the migration of contaminants from the subject area, achieve compliance with groundwater criteria, and reduce the permeability of such soil to a permeability of less than 10^{-6} cm/sec or if permeability is reduced by immobilization that such permeability of impacted soil is approved in writing by the Commissioner and at a minimum is adequate to immobilize contaminants in the soil to achieve compliance with applicable groundwater criteria;

[(iv)](vi) [any other information that the Commissioner reasonably deems necessary; and] All engineered controls using paved surfaces or hardscape are supported by specifications that are signed and sealed by a professional engineer and indicate that the surface and sub-base materials are suitable for the intended use and are able to function with minimal maintenance and repair for fifteen years;

(vii) [with respect to any release area subject to any of the requirements of section 22a-209-4(i) or section 22a-449(c)-100 through 110 of the Regulations of Connecticut State Agencies, all such requirements are or will be satisfied. With respect to a release area which is not subject to any such regulations, the owner of the subject parcel shall demonstrate that he or she has posted or will post a surety in a form and amount approved in writing by the Commissioner, which surety during the first year after installation of the engineered control, shall be equal to the cost of one year's maintenance and monitoring of the engineered control, and which in each subsequent year shall be increased in amount by adding an amount equal to the cost of one year's maintenance and monitoring, until the total amount of such surety is equal to the cost of five year's of maintenance and monitoring, which amount shall be maintained in effect for the next twenty-five years or for such other period as may be required by the Commissioner.] For all proposed engineered controls:

(I) Such engineered control is supported by specifications that are signed and sealed by a professional engineer and indicate that such engineered control will function with minimum maintenance, will promote drainage and minimize erosion of or other damage to such control, and will accommodate settling and subsidence of the underlying soil so as to maintain the control's functional integrity;

(II) Measures are in place to ensure that the structural integrity, function, and effectiveness of the engineered control will be maintained. Such measures shall include, without limitation:

(a) Measures that ensure the continued effectiveness of the engineered control;

(b) Measures to prevent storm run-on or run-off from damaging the engineered control;

(c) Inspections, on a schedule approved by the commissioner. Such inspections may be done in conjunction with and satisfy the inspection requirements in the EUR Regulations; and

(d) Repairs to correct the effects of any settling, subsidence, erosion or other damaging events or conditions no later than sixty (60) days following identification of damage to the engineered control provided if weather prevents repairs from being made within sixty (60) days of the identification of damage, as long as temporary repairs or measures have been taken, repairs can be made as soon as the weather permits;

(III) An EUR is or will be in effect for the subject area, which restriction shall:

(a) Prohibit any activity that could disturb either the engineered control or the polluted soil; and

(b) Except for subclauses (IV) and (V) of this clause, enumerate and require compliance with the requirements of this subparagraph, and with all conditions imposed by the commissioner when approving such variance under this subdivision;

(IV) A copy of the required public notice that was posted in accordance with section 22a-133k-1(d) of the RSRs; and

(V) Calculation of the required financial assurance in accordance with section 22a-133k-1(f) of the RSRs; and

(viii) The owner of the subject area on which such engineered control will be placed acknowledges and consents to such engineered control.

(D) Actions Required for Maintaining an Engineered Control Variance

After an engineered control has been certified by an LEP or approved by the commissioner pursuant to this subdivision, the following actions shall be taken within the timeframes prescribed:

(i) A Final Engineered Control Completion Statement shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, within one hundred and twenty (120) days from completion of construction of the engineered control. Such statement shall be accompanied by as-built drawings, signed and sealed by a professional engineer, and certified by an LEP to demonstrate that the engineered control complies with the requirements of this subdivision;

(ii) A financial assurance mechanism shall be established within one hundred and twenty (120) days of completion of construction of the engineered control. Such financial assurance shall comply with the requirements of section 22a-133k-1(f) of the RSRs; and

(iii) A request for an EUR that complies with the requirements of this subsection and the EUR regulations shall be certified by an LEP or submitted to the commissioner, as applicable within one hundred and eighty (180) days of completion of construction of the engineered control.

(E) [(C) When] If the [Commissioner] commissioner approves a request [pursuant to this subsection to use] for an engineered control [he may require that such control incorporate] variance, under this subdivision, any such approval may include any additional measures which [he] the commissioner deems [necessary] appropriate to protect human health and the environment. [Any person implementing an engineered control under this subsection shall perform all actions specified in the approved engineered control proposal including the recordation of the environmental land use restriction and posting of the surety, and any additional measures specified by the Commissioner in his approval of such plan.] Nothing in this subdivision shall preclude the [Commissioner] commissioner from taking any action [he] the commissioner deems necessary to protect human health or the environment if an approved engineered control fails [to prevent the migration of pollutants from the release area or human exposure to such pollutants].

(3) Public Roadways Variance

(A) The commissioner may grant a variance from compliance with the direct exposure criteria, the pollutant mobility criteria, or both, for polluted soil at a release area beneath an existing public roadway. Such variance, if approved, shall apply only so long as such polluted soil is beneath the public roadway. A request for such a variance shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs. Any such request shall also include a statement, in writing, from the entity that owns the public roadway, in which such entity acknowledges:

(i) Such entity's understanding of and consent to the variance requested under this subdivision;

(ii) That the polluted soil under and within the public roadway remains subject to the RSRs, including but not limited to, any conditions imposed by the commissioner when approving a variance under this subdivision; and

(iii) That if, at some future time, at least ninety (90) days before such public roadway is removed, notice of such removal shall be provided to the commissioner along with a proposed plan for the commissioner's review and approval of the investigation and remediation of all polluted soil for which a variance was obtained under this subdivision.

(B) Polluted soil at a release area is not eligible for a variance under this subdivision unless such soil is beneath an existing roadway.

(C) The commissioner may approve or deny in writing a request for a variance under this subdivision. No request shall be approved unless such request demonstrates to the commissioner's satisfaction that:

(i) The requirements of subparagraph (A) of this subdivision have been satisfied;

(ii) Removal of the polluted soil is neither feasible nor prudent; and

(iii) The granting of the variance will not endanger public health or the environment.

(D) The approval or any variance by the commissioner under this subdivision may include any

conditions that the commissioner deems necessary to protect human health and the environment.

(g) [Removal of] Non-aqueous Phase Liquids[.]

(1) [Removal of light non-aqueous phase liquids from soil and ground water shall be conducted in accordance with section 22a-449(d)-106(f) of the Regulations of Connecticut State Agencies] NAPL shall be removed to the maximum extent practicable.

(2) The commissioner may approve or deny in writing a request for a variance from the requirement to remove NAPL to the maximum extent practicable in accordance with this subsection. No request shall be approved unless such request demonstrates to the commissioner's satisfaction that the requirements of subdivision (3) of this subsection have been satisfied. A request for the approval under this subsection shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs and shall include the acknowledgement and consent of all owners of the release area containing NAPL.

(3) A release area containing NAPL is eligible for a variance under this subsection only if:

(A) [Any other non-aqueous phase liquid shall be] All NAPL for which a variance is sought has been contained or removed [from soil and ground water] to the maximum extent prudent such that:

(i) There is no migration of such NAPL;

(ii) In the circumstance where NAPL contains PCBs, such PCBs shall be remediated in compliance with 40 CFR Part 761;

(iii) Compliance with applicable groundwater criteria for groundwater impacted by such NAPL has been achieved;

(iv) Where the NAPL contains volatile organic substances located at or above the seasonal low water table and is beneath a building without mitigation in accordance with section 22a-133k-3(c)(3) of the RSRs, compliance with volatilization criteria for soil vapor in accordance with section 22a-133k-3(c)(2) of the RSRs has been achieved; and

(B) An ELUR is or will be in effect for the subject area, which restriction shall:

(i) Except for ongoing remediation, prohibit the disturbance and exposure of NAPL;

(ii) Prohibit the construction of a building over such NAPL if there is NAPL containing volatile organic substances located at or above the seasonal low water table; and

(iii) Enumerate and require compliance with subparagraph (A) of this subdivision.

(4) The requirements of this subsection shall not apply to NAPL subject to regulation under section 22a-449(d)-101 et seq. of the Regulations of Connecticut State Agencies. Any such NAPL shall remain subject to regulations under section 22a-449(d)-101 et seq. of the Regulations of Connecticut State Agencies.

(h) Use of Polluted Soil and Reuse of Treated Soil[.]

Any soil excavated from [and/] or treated at a release area during remediation shall be managed as follows:

(1) Hazardous Waste[.]

Treatment, storage, disposal and transportation of soil which is hazardous waste as defined pursuant to section [22a-449(c)] 22a-448 of the Connecticut General Statutes shall be carried out in conformance with the provisions of sections 22a-449(c)-101 [through 110] to 119, inclusive, of the Regulations of Connecticut State Agencies, and any other applicable law;

(2) Special [Wastes.] Waste

In accordance with section 22a-209-8 of the Regulations of Connecticut State Agencies, the [Commissioner] commissioner may authorize polluted soil, which is not hazardous waste as defined pursuant to section 22a-448 of the Connecticut General Statutes, to be disposed of as special wastes as defined in section 22a-209-1 of the Regulations of Connecticut State Agencies.

(3) Polluted [soil.] Soil

[Polluted soil from a release area may be treated to achieve concentrations of substances that do

not exceed either the applicable direct exposure criteria or pollutant mobility criteria. After such treatment, such soil may be reused on the parcel from which it was excavated or on another parcel approved by the Commissioner, provided that such reuse is consistent with all other provisions of sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies and:] To be reused in any manner, polluted soil shall comply with all requirements of the RSRs, shall not be placed below the water table, shall not be placed in an area subject to erosion, and shall comply with the requirements in subparagraph (A), (B) or (C) of this subdivision. Prior to the reuse of such soil, a notice or request for the reuse of such soil pursuant to subparagraph (A), (B) or (C) of this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs. Any such notice or request shall also include a map showing the proposed location and depth of the placement of such soil, and shall also demonstrate compliance with subparagraph (A), (B), or (C) of this subdivision. The commissioner may approve or deny in writing any request submitted pursuant to subparagraph (B) or (C) of this subdivision. No request shall be approved unless such request demonstrates to the commissioner's satisfaction, compliance with the requirements of subparagraph (B) or (C) of this subdivision, as applicable, and that the proposed reuse of soil is protective of human health and the environment.

(A) [Prior to reuse, a map showing the location and depth of proposed placement of such soil is submitted to the Commissioner;] Polluted soil from a release area may be reused on the same parcel from which it was excavated by providing notice to the commissioner only if such soil to be reused:

(i) (I) If the soil to be reused is polluted with substances at concentrations that are all equal to or less than the applicable direct exposure criteria in Appendix A of the RSRs or criteria otherwise approved by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs and the applicable pollutant mobility criteria in Appendix B of the RSRs or approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs it may be reused at any location on such parcel; or

(II) If the concentration of any substance in such soil exceeds the GA area pollutant mobility criteria in Appendix B of the RSRs or criteria otherwise approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs, such soil may be reused only in a GB area and placed over soil and groundwater that has already been affected by a release; and

(ii) Any soil to be reused is not placed under a building, if the polluted soil contains volatile organic substances, other than volatile petroleum substances; and

(iii) Any soil to be reused does not contain PCBs.

(B) [Such soil is not placed below the water table;] Polluted soil from a release area may be reused on the same parcel from which it was excavated, on a different parcel affected by the same release, or on an abutting parcel affected by a release of similar substances, only in the following circumstances:

(i) (I) If the polluted soil exceeds the direct exposure criteria or the pollutant mobility criteria applicable to the location on the parcel where the polluted soil will be reused or relocated, such polluted soil shall be rendered inaccessible pursuant to section 22a-133k-2(b)(3) of the RSRs, environmentally isolated pursuant to section 22a-133k-2(c)(5)(A) of the RSRs, or is subject to an engineered control pursuant to section 22a-133k-2(f)(2) of the RSRs;

(II) If the polluted soil contains volatile organic substances, other than volatile petroleum substances, that are greater than the GA area pollutant mobility criteria in Appendix B of the RSRs or criteria otherwise approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs. If such polluted soil is placed under a building that overlies a release area that has already been affected by a release of volatile organic substances, the requirements of section 22a-133k-3(c)(3) of the RSRs shall apply; or

(III) Is reused in accordance with section 22a-467 of the Connecticut General Statutes and complies with section 22a-133k-2(f)(2) of the RSRs, if the polluted soil is polluted with PCB; and

(ii) Prior to any reuse on an abutting parcel affected by the same release, or on a different parcel

affected by a release of similar substances, written approval from the Commissioner is required.

(C) [Such soil is not placed in an area subject to erosion; and] Polluted soil from a release area may be reused on a parcel other than the parcel for which the polluted soil was excavated, only if prior to any reuse, the commissioner approves such reuse in writing and such soil to be reused:

(i) Is polluted with substances at concentrations equal to or less than the applicable direct exposure criteria in Appendix A of the RSRs or criteria otherwise approved by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs and the applicable pollutant mobility criteria in Appendix B of the RSRs or criteria otherwise approved by the commissioner pursuant to section 22a-133k-2(c)(6) of the RSRs for the location on the parcel where the polluted soil will be relocated;

(ii) Is placed over soil and groundwater which has already been affected by a release of similar substances; and

(iii) Either;

[D] Any such soil in which the concentration of any substance exceeds the pollutant mobility criteria applicable to a GA area is not placed over soil and ground water which have not been affected by a release at the parcel at which placement is proposed; and]

[E] For soils polluted with PCB, the Commissioner has issued a written approval in accordance with by section 22a-467 of the General Statutes]

(I) The cumulative depth of all reused polluted soil from all other parcels does not exceed four feet above the pre-remedial grade; or

(II) The cumulative depth of all reused polluted soil from all other parcels does not exceed ten feet, provided that:

(a) The depth greater than four feet is required for redevelopment purposes;

(b) All slopes are created to prevent erosion; and

(c) Any other information deemed necessary by the commissioner to evaluate the need for the greater depth of reused polluted soil.

(4) Natural Soil[.]

Polluted soil may be used at any parcel of land if [after treatment of such soil to reduce or remove substances]:

(A) [any naturally-occurring] Any substance is present therein in concentrations not exceeding [background concentration for] naturally-occurring conditions in soil [of such substance] at the release area from which such soil is removed; and

(B) [no] No other substance is detectable in such soil at a concentration greater than its [analytical detection limit] laboratory reporting limit.

(5) Polluted Soil Containing Pesticides

Notwithstanding subdivision (3) of this subsection, the commissioner may approve or deny in writing a request for agricultural reuse of soil containing pesticides excavated on one parcel for reuse on another parcel. Any request regarding the reuse of soil under this subdivision shall be made to the commissioner in accordance with section 22a-133k-1(g) of the RSRs and, if soil is being reused on a parcel different from the parcel from which it was excavated, shall include the acknowledgement and consent of the owner of the parcel receiving such soil. No reuse shall be approved under this subdivision unless the request for reuse demonstrates to the commissioner's satisfaction that:

(A) The concentration of substances in soil to be reused is equal to or less than the direct exposure criteria and the pollutant mobility criteria for all substances, other than pesticides;

(B) Such soil to be reused is excavated only from the A Soil Horizon;

(C) Such soil is reused only at current agricultural properties;

(D) Such pesticides in the soil to be reused are the result of the application of pesticides in accordance with accepted practices at the time of application; and

(E) Such reuse is protective of human health and the environment.

(i) Additional [remediation] Remediation of [soil.] Polluted Soil

Nothing in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] the RSRs shall preclude the [Commissioner] commissioner from taking any action necessary to prevent or abate pollution or to prevent or abate any threat to human health or the environment, including without limitation:

(1) Ecological Risk Assessment and Remediation

At any location at which, despite remediation in accordance with [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] the RSRs, the [Commissioner] commissioner determines that there is a potential ecological risk [he], the commissioner may require that an ecological risk assessment be conducted [in accordance with EPA/630/R-92/001, February 1992, “Framework For Ecological Risk Assessment”] and that additional remediation be conducted to mitigate any risks identified in such assessment;

(2) Aquatic Life Assessment and Remediation

At any location at which polluted soil has eroded into a surface[-] water body, the [Commissioner] commissioner may require that the effect of such polluted soil on aquatic life be assessed and that remediation to protect or restore aquatic life and surface water quality from the effects of such polluted [soils] soil be undertaken; or

(3) Multiple Polluting Substances

At any [release area or parcel] location at which there is polluted soil containing multiple polluting substances, the [Commissioner] commissioner may require additional remediation to ensure that the risk posed by such substances does not exceed:

(A) [a] A cumulative excess lifetime cancer risk of 10^{-5} for ten or more carcinogenic substances with the same target organ; and

(B) [a] A cumulative hazard index of 1 for non-carcinogenic substances with the same target organ.

Sec. 22a-133k-3. Remediation Standards for Ground[-]water [remediation standards]**(a) [General.] Groundwater Criteria**

Unless otherwise specified in the RSRs, all substances in groundwater from a release shall be remediated to comply with the following, as applicable:

(1) Groundwater in a GA Area

Remediation of [a] substances in ground[-]water [plume] in a GA area, including the portion of a groundwater plume migrating from a GB area into a GA area, shall result in the [attainment of] reduction of each substance to a concentration equal to or less than:

(A) [the requirements concerning surface] The background concentration, except as provided in section 22a-133k-3(d) of the RSRs, concerning groundwater protection criteria;

(B) Surface water protection [set forth in subsection (b) of this section and the requirements concerning volatilization set forth in subsection (c) of this section; or (B) the background concentrations for ground water for each substance in such plume] criteria or background concentration; and

(C) Volatilization criteria.

(2) [Remediation of a ground-water plume in a GA area shall also result in the reduction of each substance therein to a concentration equal to or less than the background concentration for ground water of such substance, except as provided in subsection (d) of this section.] Groundwater in a GB Area

Except for any portion of a groundwater plume migrating from a GB area into a GA area that is subject to the requirements of subdivision (1) of this subsection, remediation of substances in groundwater in a GB area shall result in the reduction of each substance to a concentration equal to or

less than:

- (A) (i) The surface water protection criteria and volatilization criteria; or
- (ii) The background concentration; and

(B) The groundwater protection criteria, where the existing use of groundwater is for drinking or other purposes, until the use of such groundwater for drinking or other purposes is permanently discontinued.

(3) [Remediation of a ground-water plume in a GB area shall also result in the reduction of each substance therein to a concentration such that such ground-water plume does not interfere with any existing use of the ground water.] Groundwater Plume Discharging to a Low-Dilution Surface Water Body

(A) Remediation of substances in groundwater shall result in the reduction of each substance to a concentration equal to or less than the criteria set forth in subparagraph (B) of this subdivision where such plume discharges to:

- (i) A wetland;
- (ii) A tidal flat;
- (iii) An intermittent watercourse; or
- (iv) A location where the areal extent of such groundwater plume occupies more than 0.5%, or other percentage approved in writing by the commissioner, of the upstream drainage basin of the surface water body to which such plume discharges. The percentage of the upstream drainage basin shall be measured from the intersection of the surface water body with such groundwater plume.

(B) Each substance in groundwater specified in subparagraph (A) of this subsection shall be remediated to a concentration that is either:

- (i) Equal to or less than the applicable water quality criteria or, if there are no such criteria, to criteria approved by the commissioner in accordance with section 22a-133k-3(i)(2) of the RSRs; or
- (ii) Equal to or less than the alternative surface water protection criteria calculated by an LEP in accordance with section 22a-133k-3(b)(2) of the RSRs or approved by the commissioner in accordance with section 22a-133k-3(b)(3) of the RSRs.

(b) [Surface-water protection criteria.] Alternative Surface Water Protection Criteria

With respect to substances in groundwater for which surface water protection criteria are specified in Appendix D of the RSRs or approved by the commissioner pursuant to section 22a-133k-3(i)(2) of the RSRs, alternative surface water protection criteria may be calculated by an LEP or approved in writing by the commissioner, pursuant to this subsection. For each substance, only one subdivision of this subsection may be used to calculate or to request commissioner approval of alternative surface water protection criteria. In addition, the commissioner may approve an alternative method of demonstrating compliance with surface water protection criteria under this subsection.

(1) [Except as provided in subdivision (2) of this subsection, remediation of a ground-water plume which discharges to a surface water body shall result in the reduction of each substance therein to a concentration which is consistent with subdivision (2)(C) of subsection (g) of this section and which is equal to or less than the surface-water protection criterion or an alternative surface-water protection criterion established in accordance with subdivision (3) of this subsection] Groundwater Plume Discharge to a Watercourse

(A) For a substance in a groundwater plume that discharges to an inland surface watercourse classified as AA, A, or B in the Water Quality Standards, alternative surface water protection criteria may be calculated. Any such calculation shall be performed by multiplying the applicable water quality criteria or, if there are no such water quality criteria, the criteria approved by the commissioner pursuant to section 22a-133k-3(i)(2) of the RSRs, by a dilution factor derived from the following equation:

$$DF = (0.25 \times Q_{99})/Q_{\text{plume}}$$

Terms	Description	Value	Units
DF	Release-specific dilution factor	substance-specific	unitless
Q99	Daily stream flow equal to or exceeded on 99 percent of days in a year	Waterbody-specific	ft ³ /sec
Q _{plume}	Average daily discharge of the subject groundwater plume: $Q_{plume} = KiA$	calculated	ft ³ /sec
K	Hydraulic conductivity	as measured	ft/sec
i	Hydraulic gradient	as measured	ft/ft
A	Area of discharge: $A = h * w$	as measured	ft ²
h	Thickness of groundwater plume at watercourse discharge area	as measured	ft
w	Width of groundwater plume at watercourse discharge area	as measured	ft

(B) For a substance in a groundwater plume that discharges to a coastal surface watercourse classified as SA or SB in the Water Quality Standards, alternative surface water protection criteria may be calculated. Any such calculation shall be performed by multiplying the applicable water quality criteria, or if there are no such water quality criteria, the criteria approved by the commissioner pursuant to section 22a-133k-3(i)(2) of the RSRs, by a dilution factor derived from the following equation:

$$DF = ((W \times 0.25) \times L \times D) / (T \times Q_{plume})$$

Terms	Description	Value	Units
D	Mean depth of the watercourse at mean low tide where the groundwater plume discharges	calculated	ft
DF	Release-specific dilution factor	substance-specific	unitless
L	Distance along which the groundwater plume intersects the watercourse discharge area	calculated	ft
W	Cross-sectional distance from one shoreline to the other for the tidally influenced watercourse under low tide conditions (0.25*watercourse width) where the maximum value for W is 100 feet	calculated	ft
T	Daily discharge duration	0.5	day
Q _{plume}	Average daily discharge of the subject groundwater plume: $Q_{plume} = KiA$	calculated	ft ³ /sec
K	Hydraulic conductivity	as measured	ft/day
i	Hydraulic gradient	as measured	ft/ft
A	Area of discharge: $A = h * w$	as measured	ft ²

<u>h</u>	<u>Thickness of groundwater plume at watercourse discharge area</u>	<u>as measured</u>	<u>ft</u>
<u>w</u>	<u>Width of groundwater plume at watercourse discharge area</u>	<u>as measured</u>	<u>ft</u>

(C) For purposes of this subdivision, no alternative surface water protection criteria shall exceed the maximum allowable alternative surface water protection criteria specified in the table below, which is the water quality criteria multiplied by a dilution factor calculated pursuant to subparagraph (A) or (B) of this subdivision.

Distance from compliance point to nearest downgradient surface water	Maximum Allowable Alternative SWPC
Less than or equal to 100 feet	100 times WQC
Greater than 100 feet to 200 feet	200 times WQC
Greater than 200 feet to 300 feet	300 times WQC
Greater than 300 feet to 400 feet	400 times WQC
Greater than 400 feet to 500 feet	500 times WQC
Greater than 500 feet to 600 feet	600 times WQC
Greater than 600 feet to 700 feet	700 times WQC
Greater than 700 feet to 800 feet	800 times WQC
Greater than 800 feet to 900 feet	900 times WQC
Greater than 900 feet	1,000 times WQC

(D) Written notice of the use of alternative surface water protection calculated by an LEP under this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs and shall also include the calculation, value and basis of terms, and dilution factor used.

(2) [If a ground-water plume (A) discharges to a wetland or an intermittent stream, or (B) the areal extent of such ground-water plume occupies more than 0.5%, or other percentage which is approved in writing by the Commissioner, of the upstream drainage basin of the stream to which such plume discharges measured from the intersection of stream and such ground-water plume, each substance therein shall be remediated to a concentration equal to or less than the applicable aquatic life criteria contained in Appendix D to the most recent Water Quality Standards, or equal to or less than an alternative water quality criterion adopted by the Commissioner in accordance with section 22a-426 of the General Statutes and paragraph 12b of the Water Quality Standards effective May 15, 1992.]
Aquifer Dilution

(A) Alternative surface water protection criteria may be calculated in accordance with subparagraph (B) of this subdivision, provided that:

(i) The portion of the groundwater plume for which such alternative criteria are calculated is at least five hundred feet from the nearest downgradient surface water; and

(ii) A dilution ratio for such groundwater plume is calculated pursuant to the following equation, and such ratio is equal to or greater than five:

$$DR = RC/DC$$

<u>Term</u>	<u>Description</u>	<u>Value</u>	<u>units</u>
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<u>DR</u>	<u>Release-specific dilution ratio</u>	<u>calculated</u>	<u>unitless</u>
<u>RC</u>	<u>Groundwater concentration of a substance within the release area</u>	<u>as measured</u>	<u>µg/L</u>
<u>DC</u>	<u>Groundwater concentration no more than fifty feet downgradient from the location where the RC was collected</u>	<u>as measured</u>	<u>µg/L</u>

(B) For substances in a groundwater plume that comply with subparagraph (A) of this subdivision, alternative surface water protection criteria shall be calculated by multiplying the surface water protection criteria, or if applicable the water quality criteria, by the dilution factor identified in the following table:

<u>Distance to nearest downgradient surface water</u>	<u>Dilution factor</u>
Greater than 500 feet to 600 feet	5
Greater than 600 feet to 700 feet	6
Greater than 700 feet to 800 feet	7
Greater than 800 feet to 900 feet	8
Greater than 900 feet to 1000 feet	9
Greater than 1000 feet	10

(C) Written notice of the use of alternative surface water protection criteria calculated by an LEP under this subparagraph shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs and shall also include the calculation, value and basis of terms, and dilution factor used.

(3) [Alternative surface-water protection criteria.] Commissioner Approval

[Alternative surface-water criteria may be calculated in accordance with subparagraph (A) of this subdivision or may be approved in writing by the Commissioner in accordance with subparagraph (B) of this subdivision.] The commissioner may approve or deny in writing a request for a release-specific alternative surface water protection criteria or an alternative method of demonstrating compliance with surface water protection criteria. No request under this subdivision shall be approved until it is demonstrated to the commissioner's satisfaction that such alternative criteria or alternative method for demonstrating compliance will protect all existing and proposed uses of surface water and is protective of human health and the environment. A request for such approval shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and may also include:

[(A) An alternative surface-water protection criterion may be calculated for a substance in Appendix D of the most recent Water Quality Standards by multiplying the lower of the human health or aquatic life criterion for such substance in said Appendix D by $[(0.25 \times 7Q_{10})/Q_{\text{plume}}]$ where Q_{plume} is equal to the average daily discharge of polluted ground water from the subject ground-water plume.]

[(B)](A) [The Commissioner may approve an alternative surface-water protection criterion to be applied to a particular substance at a particular release area. Any person requesting such approval shall submit to the Commissioner (i) a report on the] The Q99 stream flow rate[, under seven day ten year low flow conditions,] of the surface water body into which the subject ground[]water plume discharges;

(B) [(ii) a report on] The identification of other surface water or ground[]water discharges to the surface water body within one-half mile [upstream] of the areal extent of the subject ground[-]water plume[,];

(C) [(iii) a] A report on the instream water quality[, (iv) a report on the] into which the subject groundwater plume discharges, including assessment and use attainment information in the most current integrated water quality report and any applicable total maximum daily loads; and

(D) The flow rate of the subject ground[-]water [discharge from such source release area from such release area] plume that discharges to the surface water body and the extent and degree of mixing of such discharge in such surface water[, and (v) and any other information the Commissioner reasonably deems necessary to evaluate such request. The Commissioner shall not approve an alternative surface-water protection criterion under this subparagraph unless the requester demonstrates that such criterion will protect all existing and proposed uses of such surface water].

(c) **Volatilization [criteria] Criteria.**

(1) Volatilization Criteria for Groundwater

(A) [Except as specified in subdivisions (2), (3), (4) and (5) of] Unless other specified in this subsection, [all] each volatile organic substance in ground[]water [polluted with a volatile organic substance within 15 feet of the ground surface or a building,] shall be remediated [such that the concentration of each such substance] to a concentration that is equal to or less than [the applicable] either:

(i) The residential volatilization [criterion] criteria for ground[]water[.];or

(ii) [(2) If ground water polluted with a volatile organic substance is below a building used solely for industrial or commercial activity, such ground water shall be remediated such that the concentration of such substance is equal to or less than the applicable] The industrial/commercial volatilization [criterion] criteria for ground[]water, provided that the subject area above the groundwater polluted with volatile organic substances:

(I) Is not used for residential activity;

(II) Has limited access only to those individuals working at or temporarily visiting for industrial/commercial activity; and

(III) [an environmental land use restriction] An EUR is in effect [with respect to the parcel or portion thereof upon which such building is located] for the subject area or the entire parcel, which restriction [ensures that the parcel or portion thereof will not be used for any residential purpose in the future and that any future use of the parcel or portion thereof is limited to industrial or commercial activity] shall:

(a) Prohibit residential activity;

(b) Enumerate and require compliance with subclause (II) of this cause.

(B) This subdivision shall apply to:

(i) Volatile organic substances, other than volatile petroleum substances, within thirty (30) feet or less of the ground surface and the lowest portion of a building under which groundwater is polluted with such substances; and

(ii) Volatile petroleum substances, within ten (10) feet or less of the ground surface and the lowest portion of a building under which groundwater is polluted with such substances.

[(3)](2) Alternative Demonstration of Compliance with Volatilization Criteria for Groundwater

(A) [Remediation of a] For volatile organic [substance] substances in groundwater, remediation to the applicable volatilization [criterion for ground water shall] criteria specified in subdivision (1) of this subsection may not be required if the concentration of such [substance] substances in soil vapors below a building is equal to or less than:

(i) [the] The residential volatilization [criterion] criteria for soil vapor; or

(ii) [the] The industrial/commercial volatilization [criterion] criteria for soil vapor, [if] provided that the subject area above the groundwater polluted with volatile organic substances:

(I) [such building is solely used for industrial or commercial activity and,] Is not used for residential activity;

(II) Has limited access only to those individuals working at or temporarily visiting the building for industrial/commercial activity; and

(III) [an environmental land use restriction] An EUR is in effect [with respect to the parcel or portion thereof upon which such building is located] for the subject area or the entire parcel, which restriction [ensures that the parcel or portion thereof will not be used for any residential purpose in the future and that any future use of the parcel or portion thereof is limited to industrial or commercial activity] shall:

(a) Prohibit residential activity; and

(b) Enumerate and require compliance with subclause (II) of this clause.

(B) [The requirements of subdivision (1), (2), and (3) of this subsection do not apply if: (i) measures acceptable to the Commissioner have been taken to prevent the migration of such substance into any overlying building, (ii) a program is implemented to maintain and monitor all such measures, and (iii) notice of such measures has been submitted to the Commissioner on a form furnished by him which notice includes (aa) a brief description of the areal extent of the ground-water plume and of the area which exceeds any such volatilization or soil vapor criterion; (bb) a brief description of the method of controlling the migration of such substance into any overlying building; (cc) a plan for the monitoring and maintenance of such control method; and (dd) a map showing all existing buildings, the areal extent of the ground-water plume, and the location of such control method.] For volatile organic substances in groundwater, remediation to the volatilization criteria specified in subdivision (1) of this subsection may not be required if the substances in groundwater exceeding volatilization criteria are not at the water table and all of the analytical results from sampling the concentration of such substances at the water table, as seasonally demonstrated by groundwater monitoring representative of the uppermost portion of the water column are equal to or less than:

(i) The residential volatilization criteria for groundwater; or

(ii) The industrial/commercial volatilization criteria for groundwater, provided that the subject area above the groundwater polluted with volatile organic substances:

(I) Is not used for residential activity;

(II) Has limited access only to those individuals working at or temporarily visiting for industrial/commercial activity; and:

(III) An EUR is in effect for the subject area or the entire parcel, which restriction shall:

(a) Prohibit residential activity; and

(b) Enumerate and require compliance with subclause (II) of this clause.

(3) Exemption from Volatilization Criteria for Groundwater through Vapor Mitigation

For volatile organic substances in groundwater beneath an existing building, remediation to the volatilization criteria for groundwater specified in subdivision (1) of this subsection may not be required, provided that:

(A) Measures to prevent the migration of volatile organic substances into any overlying building have been implemented and submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs. The submittal shall also include:

(i) A brief description of the measures implemented to control the migration of such volatile organic substances into any overlying building;

(ii) A demonstration of the effectiveness of such control measures;

(iii) The plan for monitoring the effectiveness of such control measures over time and maintaining such control measures in good condition; and

(iv) A map showing all existing buildings, the areal extent of the groundwater plume, and the location of such control measures;

(B) The commissioner deems the measure proposed under subparagraph (A) acceptable and such measures have been and continue to be implemented and monitored; and

(C) An EUR, or other permanent control measures approved in writing by the commissioner, is or will be in effect for the subject area, which restriction or control measure shall:

- (i) Prohibit removal of any building above such volatile organic substances in groundwater; and
- (ii) Enumerate and require compliance with:

(I) Control measures deemed acceptable by the commissioner under subparagraphs (A) and (B) of this subdivision; and

(II) Any condition specified by the commissioner in the approval of such permanent control measures under this subparagraph.

(4) [Site-specific and alternative volatilization criteria.] Alternative Release-Specific Volatilization Criteria and Alternative Method of Demonstrating Compliance with Volatilization Criteria

With respect to volatile organic substances in groundwater or soil vapor for which volatilization criteria are specified in Appendix E or Appendix F of the RSRs or approved by the commissioner pursuant to section 22a-133k-3(i)(3) of the RSRs, the commissioner may approve or deny in writing a request for a release-specific alternative volatilization criteria. In addition, the commissioner may approve or deny in writing an alternative method of determining compliance with such criteria.

(A) [Site-specific residential volatilization criteria for ground water or soil vapor may be calculated using the equations in Appendix G to sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies.] A request for approval of alternative volatilization criteria or for an alternative method of demonstrating compliance with volatilization criteria shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

- (i) A description of the distribution and concentration of volatile organic substances in groundwater or soil vapor beneath any overlying building;
- (ii) A description of any site-specific conditions, including but not limited to, the value of all terms used and the source of any release-specific values.

(B) [The Commissioner may approve an alternative volatilization criterion for ground water or for soil vapor to be applied to a substance at a particular release area. The Commissioner shall not approve any alternative criterion under this subparagraph unless it has been demonstrated] No request under subparagraph (A) of this subdivision shall be approved unless such request demonstrates to the commissioner's satisfaction that such [criterion] criteria or alternative method of determining compliance is protective of human health and will ensure that volatile organic substances [from such] in ground[]water or soil vapor do not accumulate in the air of any [structure used for residential activities] building at a concentration which[,];

(i) [for] For any carcinogenic substance creates a risk to human health in excess of a 10^{-6} excess lifetime cancer risk level, and for any non-carcinogenic substance [does not exceed] is equal to or less than a hazard index of 1[, or]; and

(ii) [for] For a ground[-]water plume or soil vapor polluted with [multiple] ten or more volatile organic substances, does not exceed a cumulative excess cancer risk level of 10^{-5} for carcinogenic substances, and for non-carcinogenic substances with the same target organ, the cumulative hazard index does not exceed 1.

(C) Any approval of the commissioner under this subdivision, may require that an EUR is or will be in effect for the subject area, which restriction shall enumerate and require compliance with any conditions specified by the commissioner when issuing such approval.

(5) Exemption from [volatilization criteria.] Volatilization Criteria for Groundwater Through a No Build Restriction

For volatile organic substances in groundwater, remediation to the applicable volatilization criteria specified in subdivision (1) of this subsection may not be required if the water table is less than thirty (30) feet below the ground surface, no building exists over the groundwater polluted with such

substances at a concentration above applicable volatilization criteria, and the following conditions are satisfied:

(A) [The volatilization criteria do not apply to ground water polluted with volatile organic substances, where the water table is less than fifteen feet below the ground surface, if no building exists over the ground water polluted with volatile organic substances at a concentration above the applicable volatilization criteria, and (i) it has been documented that best efforts have been made to ensure that each owner of any parcel of land or portion thereof overlying such polluted ground water records an environmental land use restriction which ensures that no building is constructed over such polluted ground water; or (ii) the Commissioner has approved in writing a request demonstrating that no building can reasonably be expected to be constructed over the subject ground water or that natural attenuation or other methods of remediation will, within five years, reduce the concentration of volatile organic substances in such ground water to a concentration equal to or less than the applicable volatilization criteria.] The water table is less than thirty (30) feet below the ground surface:

(B) No building exists over the groundwater polluted with such substances at a concentration above applicable volatilization criteria;

[(B)](C) One of the following has been satisfied:

(i) An EUR is in effect for the subject area, which restriction shall;

(I) Prohibit construction of a building at the subject area; and

(II) Enumerate and require compliance with subparagraph (B) of this subdivision;

(ii) The commissioner has approved in writing a request demonstrating that no building can reasonably be expected to be constructed over the subject groundwater; or

(iii) The commissioner has approved in writing a request demonstrating that natural attenuation or other methods of remediation will, within five years, reduce the concentration of volatile organic substances in such groundwater to a concentration equal to or less than:

(I) Residential volatilization criteria; or

(II) The industrial/commercial volatilization criteria, in which case subdivision (1)(A)(ii) of this subsection shall apply; and

(D) For any volatile organic substances, other than volatile petroleum substances, that exceed the applicable volatilization criteria within thirty (30) feet of any part of a building, the potential for a vapor intrusion pathway into such building shall be thoroughly evaluated. If such evaluation identifies a vapor intrusion pathway into such building, compliance with subdivision (3) of this subsection shall be required.

(6) Exemption from Volatilization Criteria Through Indoor Air Monitoring

[(B) The] For volatile organic substances in groundwater, remediation to the applicable volatilization criteria specified in subdivision (1) of this subsection may not be required for ground[]water underlying an existing building. [do not apply to ground water polluted with volatile organic substances where the Commissioner has approved in writing and there have been implemented an indoor air monitoring program and measures to control the level of any such volatile organic substances in the air of the subject building] No request under subparagraph (A) of this subdivision shall be approved unless such request demonstrates to the commissioner's satisfaction that the conditions in the building overlying volatile organic substances in groundwater are protective of human health and the environment.

(A) [(i) Any person seeking the Commissioner's approval of an indoor air monitoring program] A request in accordance with this subdivision shall [submit] be submitted to [him: a detailed written plan describing the proposed] the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) The acknowledgement and consent of the owner of the building for which approval of the air

monitoring program is sought; and

(ii) An indoor air monitoring program and measures to control the level of any such volatile organic substances in the air of the subject building, including but not limited to:

(I) [a] A description of the distribution and concentration of volatile organic [compounds] substances beneath the building[,];

(II) Any measures to be taken;

(III) [the] The location of proposed monitoring points[,];

(IV) [the] The proposed frequency of monitoring[,];

(V) [the] The parameters to be monitored[, and a description of proposed];and

(VI) The actions to be taken in the event such monitoring indicates that [the monitored] selected parameters [exceed proposed specified concentrations and a proposed schedule for reporting to the Commissioner on the results of such monitoring for as long as monitoring is conducted at the site] are exceeded.

(B) [(ii) In approving] The commissioner may approve or deny in writing a request submitted under this subdivision. Approval of any indoor air monitoring program pursuant to this subdivision [the Commissioner may impose any additional conditions he deems necessary to ensure that the program adequately protects human health. In the event that the Commissioner approves an indoor air monitoring program pursuant to this subparagraph, any person implementing such program shall perform all actions specified in the approved plan, and any additional measures specified by the Commissioner in his approval of such plan] shall require that an ELUR is or will be in effect for the subject area, which restriction shall enumerate and require compliance with the indoor air monitoring program approved by the commissioner in writing, including any conditions imposed by the commissioner when approving such program.

(7) Building, for the purpose of this subsection, means any structure enclosed by a roof and walls that is capable of accumulating vapors from the subsurface.

(d) [Applicability of] Ground[-]water Protection Criteria[.]

(1) Exemption from Attaining Background Concentration in a GA Area

[Ground water in a GA area may be remediated to a concentration for] For substances in groundwater in a GA area, remediation to the background concentration may not be required if the concentration of each substance [therein] in a groundwater plume is equal to or less than the ground[-]water protection [criterion for each such substance if, with respect to the subject ground-water plume: (A) the background concentration for ground water is equal to or less than such ground-water protection criterion; (B) a public water supply distribution system is available within 200 feet of the subject parcel, parcels adjacent thereto, and any parcel within the areal extent of such plume; (C) such ground-water plume is not located in an aquifer protection area; and (D) such ground-water plume is not located within the area of influence of any public water supply well.] criteria and one of the following conditions exist:

(A) (i) A public water supply distribution system is available within two hundred feet of the parcel on which the release area is located, within two hundred feet of all adjacent parcels, and within two hundred feet of any parcel within the areal extent of the groundwater plume;

(ii) Such groundwater plume is not located in an aquifer protection area; and

(iii) Such groundwater plume is not located within the area of influence of any public water supply well;

(B) Prior to any soil or groundwater remediation, the groundwater plume is a diminishing state groundwater plume; or

(C) Each substance in groundwater is remediated to a concentration equal to or less than the groundwater protection criteria, and further reduction of the concentrations of such substances to the background concentration cannot be achieved using sound engineering and hydrogeologic

remediation practices.

(2) [If prior to any ground-water remediation the maximum concentration of a substance in a ground-water plume in a GA area is equal to or less than the ground-water protection criteria, remediation of ground water to achieve background ground-water concentration is not required, provided that the extent of the ground-water plume is not increasing over time and, except for seasonal variations, the concentration of the subject substance in such ground-water plume is not increasing at any point over time.] Alternative Groundwater Protection Criteria

With respect to substances in groundwater for which groundwater water protection criteria are specified in Appendix C of the RSRs, or approved by the commissioner pursuant to section 22a-133k-3(i)(1) of the RSRs, alternative groundwater protection criteria may be calculated by an LEP or approved in writing by the commissioner, pursuant to this subdivision.

(A) LEP Calculation of Alternative Groundwater Protection Criteria

(i) For a substance in groundwater located in an area designated on the Department’s “Potential Alternative Groundwater Protection Criteria Map” in Appendix I of the RSRs, alternative groundwater protection criteria may be calculated by an LEP, in accordance with clause (ii) or (iii) of this subparagraph, as applicable, provided that:

(I) Written notice of the use of alternative groundwater protection criteria shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(a) The alternative groundwater protection criteria calculation in accordance with clause (ii) or (iii) of this subparagraph; and

(b) Documentation demonstrating compliance with the requirements of this subparagraph, including but not limited to, a water supply well receptor survey;

(II) Any alternative groundwater protection criteria shall not exceed:

(a) One hundred times the groundwater protection criteria specified in Appendix C of the RSRs, or approved by the commissioner in accordance with section 22a-133k-3(i)(1) of the RSRs; and

(b) The residential volatilization criteria for groundwater specified in Appendix E of the RSRs, or approved by the commissioner in accordance with section 22a-133k-3(i)(3) of the RSRs;

(III) No public or private drinking water supply well is present on any subject parcel within or adjacent to the areal extent of the portion of the subject groundwater plume in which a substance exceeds the background concentration;

(IV) A public water supply distribution system is available within five hundred feet downgradient and two hundred feet in any direction of the subject groundwater plume;

(V) All releases to soil that constitute a source of pollution resulting in the subject groundwater plume have been remediated so there is no longer an on-going source in soil impacting groundwater;

(VI) Alternative pollutant mobility criteria is not used for the same substance for which alternative groundwater protection criteria is used;

(VII) The subject groundwater plume is a diminishing state groundwater plume; and

(VIII) The alternative groundwater protection criteria being calculated is not used for any portion of the subject groundwater plume located in bedrock unless approved by the commissioner in accordance with section 22a-133k-3(d)(2)(C) of the RSRs.

(ii) For volatile organic substances, the following equation shall be used to calculate alternative groundwater protection criteria in accordance with this subparagraph:

$$\text{Alternative GWPC} = \frac{\text{TAC} \times \text{HV} \times \text{ER} \times \text{MC}}{\text{f} \times \text{WFR}}$$

Terms	Description	Value	Units
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<u>Alternative GWPC</u>	<u>Criteria in groundwater as alternative to groundwater protection criteria</u>	<u>calculated</u>	<u>µg/L</u>
<u>TAC</u>	<u>Target Indoor Air Concentration as approved by the commissioner in accordance with Appendix G of the RSRs</u>	<u>substance-specific</u>	<u>µg/m³</u>
<u>f</u>	<u>Fraction of substance concentration volatilized</u>	<u>0.5</u>	<u>unitless</u>
<u>HV</u>	<u>House Volume</u>	<u>1,000</u>	<u>m³</u>
<u>ER</u>	<u>Air exchange rate per day, as a time weighted average</u>	<u>134</u>	<u>times per day</u>
<u>MC</u>	<u>Mixing coefficient</u>	<u>0.33</u>	<u>none</u>
<u>WFR</u>	<u>Water Flow Rate</u>	<u>3,183</u>	<u>L/day</u>

(iii) For semi-volatile organic substances, inorganic substances and pesticides, the following equation shall be used to calculate alternative groundwater protection criteria in accordance with this subparagraph:

$$\text{Alternative GWPC} = \text{WSF} \times \text{RSC} \times \text{DEC} \times \text{UCF}$$

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>Alternative GWPC</u>	<u>Criteria in groundwater as alternative to groundwater protection criteria</u>	<u>calculated</u>	<u>µg/L</u>
<u>WSF</u>	<u>Water to soil concentration factor, based upon accumulation of arsenic in soil</u>	<u>0.02</u>	<u>(mg/L)/ (mg/kg)</u>
<u>RSC</u>	<u>Relative source contribution to account for other background contributions to semi-volatile organic substances in soil</u>	<u>0.2</u>	<u>unitless</u>
<u>DEC</u>	<u>Residential direct exposure criteria in Appendix A of the RSRs or criteria approved by the commissioner pursuant to section 22a-133k-2(b)(7) of the RSRs</u>	<u>substance-specific</u>	<u>mg/kg</u>
<u>UCF</u>	<u>Unit Conversion Factor</u>	<u>1,000</u>	<u>µg/mg</u>

(B) Commissioner Approval of Alternative Groundwater Protection Criteria

For a substance in groundwater that is not located in an area designated on the Department's "Potential Alternative Groundwater Protection Criteria Map" in Appendix I of the RSRs, the commissioner may approve or deny in writing a request for an alternative groundwater protection criteria pursuant to this subparagraph. A request for such alternative groundwater protection criteria shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs. No request shall be approved unless such request demonstrates and demonstrate to the commissioner's satisfaction:

(i) Compliance with conditions of subclause (I) to (VII), inclusive, of subparagraph (A)(i) of this subdivision;

(ii) Calculation of proposed alternative groundwater protection criteria in accordance with clause (ii) and (iii) of subparagraph (A) of this subdivision, as applicable; and

(iii) Compliance with one of the following circumstances:

(I) Documentation shall be provided by a public or private water company subject to regulation by

the Department of Public Health demonstrates that public drinking water is available in the area where the subject groundwater plume is located, including an updated public water service area map on file with the Department of Public Health indicating that public water is now available;

(a) Where a public supply well distribution system has become available to any parcel within or adjacent to the areal extent of the portion of the groundwater plume not previously included on the Department’s “Potential Alternative Groundwater Protection Criteria Map” in Appendix I of the RSRs; and

(b) Where the subject groundwater plume is not located in an aquifer protection area or in an aquifer suitable for development of a public water supply, or

(II) As a result of stratified drift aquifer conditions where the subject groundwater plume is located, the aquifer is not suitable for development of a public water supply due to the hydrogeology, depth, and saturated thickness of the surficial materials or as otherwise determined by the commissioner:

(a) A demonstration that there is less than twenty feet of saturated sand or sand and gravel in such aquifer or pumping more than fifteen gallons per minute from such aquifer is not sustainable for public water use; and

(b) A cross-sectional map showing the nature and distribution of surficial materials in such aquifer.

(C) For a substance in groundwater that is located in an area designated on the Department’s “Potential Alternative Groundwater Protection Criteria Map” in Appendix I of the RSRs, and where the portion of the groundwater plume is located in bedrock. A request for such alternative groundwater protection criteria shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs. No request shall be approved unless such request demonstrates to the commissioner’s satisfaction the groundwater plume that exceeds the groundwater protection criteria will not pose a risk to human health and the environment and shall include a map showing the horizontal and vertical extent of the bedrock groundwater plume that exceeds or could be expected to exceed the groundwater protection criteria;

[(3)] [Any ground water in a GB area and which is used for drinking or other domestic purposes shall be remediated to reduce the concentration of each substance therein to a concentration equal to or less than the applicable ground-water protection criterion until such time as the use of such ground water for drinking or other domestic purposes is permanently discontinued.]

(e) Technical Impracticability [of Ground-water Remediation.] Variance

Groundwater may be eligible for a variance from compliance with the surface water protection criteria or the groundwater protection criteria if the commissioner determines that compliance with such criteria is technically impracticable. No request for a variance shall be approved unless such request demonstrates to the commissioner’s satisfaction the requirements of this subsection has been satisfied.

(1) [Exemption from Background Due to Technical Impracticability] Request for Technical Impracticability Variance

[If remediation of a ground-water plume in a GA area to achieve compliance with subdivision (2) of subsection (a) of this section has reduced the concentration of a polluting substance to less than the ground-water protection criterion, and if further reduction of such concentration is technically impracticable, no further remediation of such ground-water plume for such substance shall be required.]

(A) A request for a technical impracticability variance shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

- (i) The substance and its concentration in the groundwater plume for which a variance is sought;
- (ii) A map showing the horizontal and vertical extent of the groundwater plume that exceeds or

could be expected to exceed surface water protection criteria or groundwater protection criteria;

(iii) A demonstration of compliance with the soil standards in section 22a-133k-2 of the RSRs, and unless it is demonstrated that remediation of soil is technically impracticable, that polluted soil is not contributing to the groundwater plume;

(iv) Laboratory analytical results of all representative sampling before, during, and after the implementation of such actions and a description of all actions to remediate the groundwater plume;

(v) A feasibility study for achieving compliance with the criteria for which a variance is sought that evaluates remediation methods and demonstrates that achieving compliance with such criteria in a reasonable timeframe is technically impracticable;

(vi) A demonstration that the subject groundwater plume is in a steady-state or is a diminishing state groundwater plume, or that the subject groundwater plume is hydraulically controlled;

(vii) A map and description of the proposed TI zone, including the identification of existing groundwater withdrawals and potential for future withdrawal of groundwater on parcels within and adjacent to the proposed TI zone, and a demonstration that such withdrawals will not induce movement of the subject groundwater plume into uncontaminated areas or adversely affect the protectiveness of the proposed variance;

(viii) A study to determine the risks posed by the polluted groundwater that would remain if a variance was granted. If such study shows a risk or a potential risk to human health or the environment, a contingency plan to eliminate or minimize such risk shall be included;

(ix) Measures for long-term monitoring, operation, maintenance, and reporting, to ensure that the selected remedy remains effective in its protectiveness. Such measures shall:

(I) Demonstrate through groundwater monitoring that the groundwater plume is not increasing in size or concentration, or otherwise migrating in a manner that would alter the risk assumptions of clause (viii) of this subparagraph;

(II) Confirm that unacceptable risks to human health and the environment do not occur and if such risk do occur, contingency actions will be taken to abate such risks, including but not limited to, changes in land use; and

(III) Demonstrate through monitoring that any proposed operation and maintenance controls are working properly and remain effective; and

(x) The type and estimated amount of financial assurance to be posted in accordance with the requirements of section 22a-133k-1(f) of the RSRs.

(B) Based upon the information submitted in accordance with subparagraph (A) of this subdivision, the commissioner will indicate, in writing, either that a groundwater plume does not qualify for a variance under this subsection, or alternatively, that the information specified in subdivision (2) of this subsection shall be submitted and may include conditions the commissioner deems appropriate to protect public health and the environment.

(2) [Variance Due to Technical Impracticability of Ground-water Remediation] Additional Information to be Submitted Upon Request

[The Commissioner may grant a variance from any of the requirements of this section if he finds that: non-aqueous phase liquids that cannot be contained or removed in accordance with R.C.S.A. section 22a-133k-2(g) are present; remediation to the extent technically practicable has reduced the concentration of pollutants in ground water to steady-state concentrations that exceed any applicable criteria; or achieving compliance with the applicable criteria is technically impracticable as determined using Directive No. 9234.2-25 issued September 1993 by the U.S. Environmental Protection Agency's Office of Solid Waste and Emergency Response.] After submission of the information required in this subdivision, the commissioner may approve or deny in writing a request for a technical impracticability variance. Unless otherwise specified by the commissioner, the following information shall be submitted within one hundred and twenty (120) days of a request for

such information by the commissioner. The information shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(A) [Any person requesting a variance pursuant to this subsection from any ground-water protection criterion shall submit: (i) information concerning the concentration of each substance in the ground-water plume with respect to which a variance is sought; (ii) information demonstrating that (aa) the extent of the ground-water plume which exceeds such ground-water protection criterion has been reduced to the extent technically practicable, or (bb) it is not technically practicable to reduce the extent of the ground-water plume; (iii) the results of a study conducted to determine the risks to human health posed by the polluted ground water remaining after such reduction; (iv) if such study shows a risk or a potential risk to human health, a plan to eliminate such risk or potential risk; (v) an application to change the ground-water classification of such polluted ground water to GB in accordance with section 22a-426 of the General Statutes; and (vi) any other information the Commissioner reasonably deems necessary to evaluate such request.] A demonstration that public notice has been provided in accordance with section 22a-133k-1(d) of the RSRs;

(B) [Any person requesting a variance pursuant to this subsection from the requirement to remediate ground water to a concentration which does not exceed the applicable surface-water protection criteria shall submit information concerning the concentration of each substance in the ground-water plume with respect to which a variance is sought. If such information demonstrates that any such concentration exceeds any applicable surface-water protection criterion, such person shall also submit: (i) a map showing the areal extent of the ground-water plume that exceeds such surface-water protection criterion, and (ii) a plan for controlling the migration of such substance to the receiving surface water body.] A certification that written notice of the extent and degree of such pollution allowed to remain in place has been provided to each owner of record of each parcel within the TI zone, at the address for such owner on the last-completed grand list of the municipality where the parcel is located, and to the Director of Health of the municipality or municipalities in which the TI zone is located;

(C) [If the Commissioner grants a variance pursuant to this subsection from any ground-water protection criterion, the person receiving the variance shall, no later than thirty days after the date of granting of such variance, submit to the Commissioner on a form prescribed and provided by him: (i) certification that written notice of the extent and degree of such pollution has been provided to each owner of property overlying the subject ground-water plume at which it is not technically practicable to remediate a substance to a concentration equal to or less than the ground-water protection criterion; (ii) certification that written notice of the presence of pollution on each such parcel and a description of the extent and degree of such pollution has been sent to the Director of Health of the municipality or municipalities in which the ground-water plume is located; and (iii) certification that best efforts have been made to ensure that each owner of property overlying the subject ground-water plume records an environmental land use restriction which ensures that the subject ground-water plume is not used for drinking or other domestic purposes;] If the commissioner has specified that an ELUR is required, the acknowledgement and consent from the owner of each parcel in the TI zone to such variance;

(D) [If the Commissioner grants a variance pursuant to this subsection from the requirement to remediate ground water to a concentration which does not exceed the applicable surface-water protection criteria, the person receiving the variance shall perform all actions specified in the plan submitted with the request for such variance, and any additional actions required by the Commissioner in his approval of such plan or granting of such variance.] A demonstration that financial assurance has been obtained in accordance with section 22a-133k-1(f) of the RSRs; and

(E) A demonstration, as specified by the commissioner in the written request for information under this subdivision, that either an ELUR is in effect on each parcel in the TI zone or other

permanent control measure is in place. Any ELUR or other permanent control measure shall:

(i) Enumerate and require compliance with the plan and measures specified in clause (viii) and (ix) of subdivision (1)(A) of this subsection;

(ii) Include conditions the commissioner deems appropriate to protect public health and the environment;

(iii) In addition to any requirement in the EUR Regulations, require the preparation of a report every five years, which reviews the implementation and effectiveness of the variance approved by the commissioner, including but not limited to, the impact of the use of groundwater on parcels adjacent to the TI zone. Such reports shall be maintained by the parcel owner who is requesting such variance and provided to the commissioner upon request; and

(iv) In addition, for a variance from compliance with the groundwater protection criteria:

(I) Prohibit the use of groundwater for drinking or other purposes; and

(II) Prohibit the withdrawal of groundwater, unless a withdrawal has been approved in writing by the commissioner.

(f) **Conditional Exemption for Incidental Sources[.]**

[Remediation criteria for ground water do not apply to] Compliance with the groundwater criteria specified in section 22a-133k-3(a) of the RSRs is not required for the following substances in groundwater under the circumstances described in this subsection:

(1) [Trihalomethanes] Substances resulting from releases of drinking water from a public water supply system; or

(2) Metals, petroleum hydrocarbons, or semi-volatile organic substances, provided such [pollution is] substances are the result of:

(A) An incidental release due to the normal operation of motor vehicles, not including refueling, repair or maintenance of a motor vehicle; or

(B) Normal paving and maintenance of a consolidated bituminous concrete surface provided such bituminous concrete surface has been maintained for its intended purpose.

(g) **Conditional Exemption for Groundwater Polluted with Pesticides**

Compliance with the groundwater criteria specified in section 22a-133k-3(a) of the RSRs is not required for pesticides in groundwater resulting from the application of pesticides at the release area, provided that:

(1) A determination has been made that such pesticides are present solely as a result of the application of pesticides;

(2) Compliance with the soil standards in section 22a-133k-2 of the RSRs has been achieved for any release of pesticides;

(3) The nature and approximate extent of pesticides in the groundwater has been evaluated;

(4) Potable water supply wells on the parcel where pesticides are in groundwater have been sampled and any exposure pathway to drinking water in such wells is eliminated or mitigated to the extent necessary to protect human health;

(5) A potable water supply well receptor survey identifying surrounding drinking water uses has been conducted;

(6) With respect to the parcel for which a demonstration of compliance with the RSRs is being made, if pesticides in the groundwater on such parcel exceed the groundwater criteria a notice is recorded on the municipal land records identifying such exceedance;

(7) If pesticides applied at a parcel, for which a demonstration of compliance with the RSRs is being made, are present in groundwater on other parcels at concentrations exceeding the groundwater criteria, best efforts have been made to ensure that an EUR has been placed providing notice that pesticides in groundwater on such affected parcels exceeds the groundwater criteria. A certification stating such best efforts have been made shall be submitted with the notice required under

subdivision (8) of this section; and

(8) Notice of compliance with the requirements of this subsection, including all documents demonstrating such compliance, is submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and is also submitted to the Director of Health of the municipality in which such pesticides in groundwater are located.

[(g)](h) Applying the [Criteria for Ground Water.] Groundwater Criteria

[Ground-water monitoring shall be conducted in accordance with this subsection for any ground-water plume and for any release area remediated in accordance with sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies, except for those release areas remediated solely to address exceedances of direct exposure criteria in accordance with section 22a-133k-2(b).] Compliance with the standards for groundwater in section 22a-133k-3 of the RSRs, or standards specified in section 22a-133k-2 of the RSRs that refer to or require groundwater monitoring, shall be based upon Groundwater monitoring conducted in compliance with this subsection.

(1) [Ground-water Monitoring.] Groundwater monitoring shall be capable of determining:

[Monitoring shall be designed to determine:]

(A) The conceptual site model for the release is valid;

(B) The background concentration at the nearest location upgradient of and unaffected by the release;

[(A)](C) The effectiveness of any soil remediation to prevent the pollution of ground[]water by substances from the release area;

[(B)](D) The effectiveness of any measures to render soil environmentally isolated;

[(C)](E) The effectiveness of any remediation [taken] to eliminate or minimize [health or safety risks] risks to human health and the environment associated with [such] each release being remediated, including but not limited to, any risks identified during remediation or identified in any risk assessment conducted in accordance with [subsection] section 22a-133k-3(e)[(2) of this section or otherwise identified] of the RSRs;

[(D)](F) Whether the concentration of a substance in ground[]water [in a GA area or an aquifer protection area meets the background concentration or ground-water protection criteria, as applicable, in accordance with the provisions of subdivision (2) of this subsection] is equal to or less than the applicable groundwater criteria for such substance;

[(E)] [Whether a substance in ground water meets the surface-water protection criteria and the applicable volatilization criteria in accordance with the provisions of subdivision (2) of this subsection; and]

(F) Whether a ground[-]water plume in a GB area interferes with any existing use of [the] ground[]water [for a drinking water supply or with any other existing use of the ground water], including but not limited to, a drinking water supply or an industrial, agricultural, or commercial [purposes.] use of groundwater; and

(G) The effectiveness of monitored natural attenuation to achieve compliance with groundwater criteria within a reasonable timeframe.

(2) [Compliance with Criteria for Ground Water.] Pre-requisites for Determining Compliance with Groundwater Criteria

The groundwater samples that will be used in determining compliance with an applicable criteria for a substance shall be collected after:

(A) [General.] All remedial actions conducted to achieve compliance with pollutant mobility criteria and the applicable groundwater criteria for such substance have been concluded, other than natural attenuation of a groundwater plume or the recording of an EUR;

[(i)] [Analytical results of samples used for determining compliance with an applicable remedial

criterion for a substance shall be collected after:]

[(I)] [All remedial actions conducted to achieve compliance with pollutant mobility and ground-water criteria for such substance have been concluded, other than natural attenuation of a ground-water plume or the recording of an environmental land use restriction;]

[(II)] [The aquifer is no longer subject to the transient effects on hydraulic head attributable to withdrawal from, or injection to, ground water for the purpose of remediation, or other effects due to site redevelopment or remediation;]

[(III)] [Any changes to the geochemistry, induced by remedial actions or monitoring well construction methods which might influence the concentration of such substance, have stabilized and equilibrium geochemical conditions are established; and]

[(IV)] [The concentration of such substance at each sampling location that represents the extent and degree of the ground-water plume is not increasing over time, except as a result of either natural attenuation or seasonal variations.]

[(ii)] [For determining compliance with an applicable remedial criterion for a substance, a minimum of four sampling events shall be performed which reflect seasonal variability on a quarterly basis, provided that all sampling events used to demonstrate compliance were performed within two years prior to the most current sampling event used to determine compliance, with the exception of monitoring conducted in accordance with subparagraph (D)(ii) of this subsection.]

[(iii)] [The Commissioner may approve in writing an alternative method of determining compliance with an applicable remedial criterion for a substance utilizing emerging technologies for which guidance, standard or industrial code has been published by a regulatory agency, governmental advisory group, or other recognized professional organization, at the time of the approval.]

(B) The aquifer is no longer subject to the transient effects on hydraulic head attributable to withdrawal from or injection to groundwater for the purpose of remediation, or other effects due to site redevelopment or remediation;

(C) Any changes to the geochemistry induced by remedial actions or monitoring well construction methods that might influence the concentration of such substance have stabilized and equilibrium geochemical conditions are established; and

(D) The groundwater plume is a diminishing state groundwater plume.

(3) Determining Compliance with Groundwater Criteria

With the exception of monitoring conducted in accordance with subparagraph (B)(ii) or (C)(ii) of this subdivision, when determining compliance with applicable groundwater criteria for substances, a minimum of four sampling events shall be performed which reflect seasonal variability on a quarterly basis, provided that all sampling events used to demonstrate compliance are performed within two years prior to the most current sampling event used to determine compliance, and shall comply with the subparagraphs of this subdivision.

(A) Determining Compliance with Ground[-]water Protection Criteria or the Background Concentration[.]

Compliance with the ground[-]water protection [criterion for a substance in ground water] criteria or the background concentration for each substance in ground[]water [for such substance] is achieved when [the] sampling locations used for compliance are representative of the subject ground[-]water plume, and either:

(i) [the] All laboratory analytical results for such substance at all [such] sampling locations are equal to or less than [either] the ground[-]water protection [criterion for such substance] criteria or the background concentration [for ground water], whichever is applicable[, as determined by subsection (d) of this section]; or

(ii) The ninety-five percent upper confidence level of the arithmetic mean of a statistically representative sampling [program] data set consisting [of not] of all laboratory analytical results for

such substance for no less than twelve consecutive monthly samples [from each such sampling location has been used to characterize the ground-water plume and the ninety-five percent upper confidence level of the arithmetic mean of all results of laboratory analyses of such samples for such substance are], calculated individually for each sampling location, is equal to or less than the [criterion for such substance] groundwater protection criteria or the background concentration, whichever is applicable.

(B) Determining Compliance with [Surface-water] Surface Water Protection Criteria[.] or Water Quality Criteria

Compliance with [a] the surface[-] water protection [criterion] criteria for [a] each substance in ground[]water is achieved when [the] sampling locations are representative of the subject ground[-]water plume, and either

(i) [the ninety-five percent upper confidence level of the arithmetic mean of all sample results representative of the subject ground water plume is equal to or less than such criterion; or (ii) the concentration of such substance] For sample locations in that portion of such groundwater plume which is [immediately] upgradient of the [point] area at which such ground[-]water discharges to the receiving surface[-] water body [is equal to or less than];

(I) [the applicable] All laboratory analytical results for such substance are less than or equal to the surface[-] water protection [criterion] criteria or, if applicable, the water quality criteria; or

(II) The ninety-five percent upper confidence level of the arithmetic mean of a statistically representative sampling data set consisting of all laboratory analytical results for such substance for no less than twelve consecutive monthly samples, calculated individually for each sampling location, is equal to or less than the surface water protection criteria or, if applicable, the water quality criteria; or

(ii) The ninety-five percent upper confidence level of the arithmetic mean of a statistically representative sampling data set consisting of all laboratory analytical results for such substance in the entire groundwater plume, collected to reflect seasonal variability on a quarterly basis, is equal to or less than the surface water protection criteria or, if applicable, the water quality criteria.

(C) Determining Compliance with Volatilization Criteria[.]

[A volatile substance may be remediated to a concentration as specified in either subdivision (2)(D)(i) or subdivision (2)(D)(ii) of this subsection.]

(i) [Compliance with volatilization criteria in ground water.] Compliance with [a] volatilization [criterion] criteria for [a] each substance in ground[]water is achieved when the sampling [locations are] is representative of the subject ground[-]water plume and [the results of] all laboratory [analyses of samples] analytical results for such substance are equal to or less than the applicable volatilization [criterion as determined by subsection (c) of this section] criteria for groundwater.

(ii) [Compliance with volatilization criteria in soil vapor.] Compliance with [a] volatilization [criterion] criteria for [a] each substance in soil vapor is achieved when the sampling [locations and frequency are] is representative of the subject soil vapor, including [seasonal variability] during the heating and cooling seasons, and the results of all laboratory [analyses of samples] analytical results for such substance are equal to or less than the applicable volatilization [criterion] criteria for soil vapor.

(D) Alternative Methods to Determine Compliance with the Groundwater Criteria

The commissioner may approve or deny in writing a request for an alternative to the methods prescribed in this subdivision to determine compliance with an applicable groundwater criteria. Such proposed alternative methods may be based upon emerging technologies and approaches for which guidance, a standard, or an industrial code has been published by a regulatory agency, governmental advisory group, or other recognized professional organization. A request under this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall

also include any other information that the commissioner deems necessary to evaluate such request. Any approval by the commissioner may specify conditions necessary to protect human health and the environment.

(4) Upgradient Groundwater Plume

(A) In the circumstance where it is demonstrated that substances in a groundwater plume from an upgradient parcel are migrating onto the subject downgradient parcel, the concentrations of such substances in the groundwater plume at the downgradient parcel may be equal to or less than the concentrations of such substances found in the groundwater plume at the boundary between such parcels, provided that:

(i) Soil on the downgradient parcel has been remediated and compliance with the standards for soil in section 22a-133k-2 of the RSRs have been achieved; and

(ii) At the downgradient parcel, all exposure pathways to drinking water supply wells and from volatilization of volatile organic substances into buildings have been eliminated or mitigated to the extent necessary to protect human health.

(iii) Such substances are not already present in a groundwater plume at the downgradient parcel.

(B) In the circumstance where it is demonstrated that substances in a groundwater plume from an upgradient parcel are migrating onto a downgradient parcel and such substances have co-mingled with the same substances found in a groundwater plume at the downgradient parcel, in addition to the requirements in subparagraph (A) of this subdivision:

(i) The co-mingled groundwater plume on the downgradient parcel may be equal to or less than the concentrations of such substances found in the groundwater plume at the boundary between such parcels; and

(ii) All exposure pathways to drinking water supply wells and from volatilization of volatile organic substances into buildings at all parcels impacted by the groundwater plume emanating from the downgradient parcel have been eliminated or mitigated to the extent necessary to protect human health.

(C) Notice of the use of this provision as part of remediation shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs and shall demonstrate compliance with this subdivision.

(D) This section does not apply to substances in a groundwater plume on a downgradient parcel where such substances are not migrating onto such parcel from an upgradient parcel or such substances are different than those migrating onto such parcel.

[(3)] [Matrix interference effects.]

[If any applicable criterion for a substance in ground water is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, the following action shall be taken:]

[(A)] [(i)] [“Test Methods for Evaluating Solid Waste: Physical/Chemical Methods,” SW-846, U.S. Environmental Protection Agency, Office of Solid Waste, Washington D.C. 20460 shall be consulted to determine if an analytical method sufficiently sensitive to achieve the applicable analytical detection limit was used to conduct the analysis of the subject substance. If there is available an alternative analytical method which is sufficient to achieve the required analytical detection limit, appropriate for the sample matrix, and has been approved by EPA or approved in writing by the Commissioner, the subject ground water shall be re-analyzed for the subject substance using such alternative method.]

[(ii)] [If a sample has been analyzed by one or more analytical methods in accordance with subparagraph (A)(i) of this subdivision and the applicable analytical detection limit has not been achieved due to matrix interference effects, such method(s) shall be modified in order to compensate for such interferences, in accordance with analytical procedures specified by EPA within the scope of

the analytical method.]

[(B)] [If, after re-analyzing the subject ground water and attempting to compensate for matrix interference effects in accordance with subparagraph (A) of this subdivision, any applicable criterion for a substance in ground water is less than the concentration for such substance that can be consistently and accurately quantified in a specific sample due to matrix interference effects, compliance with such criterion shall be achieved when such ground water has been remediated to the lowest concentration for such substance which can be consistently and accurately quantified without matrix interference effects.]

[(C)] [A detailed summary of all measures taken to overcome matrix interference effects and a determination of the lowest alternative quantification level applicable to the analysis of such substance shall be prepared and, if requested by the Commissioner in writing, shall be submitted to the Commissioner for his review and approval.]

[(h)](i) **Additional Polluting Substances**

(1) Groundwater Protection Criteria for Additional Polluting Substances

(A) [With respect to a substance] Any substance in ground[-]water for which a ground[-]water protection criterion is not specified [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies the Commissioner may approve in writing a ground-water protection criterion to apply to such substance. Any person requesting approval of a ground[-]water protection criterion such substance] in Appendix C of the RSRs, shall be remediated to the background concentration or to criteria obtained pursuant to this subdivision. A request under this subdivision shall [submit] be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) [(A) a risk-based] A proposed risk-based ground[-]water protection [criterion] criteria for [such] each substance calculated in accordance with [subdivision (2) of this subsection,] Appendix G of the RSRs;

(ii) [(B) the analytical detection] The laboratory reporting limit for [such] each substance[.];

(iii) [(C) a] A description of the organoleptic properties of [such] each substance [. Before approving a ground-water protection criterion the Commissioner shall consider the proposed risk-based ground-water protection criterion for such substance, the analytical detection limit for such substance, the organoleptic effects of such substance, any information about the health effects such substance may cause due to exposure pathways not accounted for in the proposed risk-based ground-water protection criterion, and any other information that the Commissioner reasonably deems necessary.]; and

(iv) Any information about the health effects such substance may cause due to exposure not accounted for in the proposed risk-based groundwater protection criteria.

(B) The commissioner may approve or deny in writing a request made under subparagraph (A) of this subdivision. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the requirements of this subdivision have been satisfied and that the proposed groundwater protection criteria will be protective of human health and the environment.

(C) Unless prohibited in writing by the commissioner, criteria approved by the commissioner pursuant to subparagraph (B) of this subdivision, may be the subject of a request for alternative criteria under section 22a-133k-3(d)(2) of the RSRs.

[(2)] [The risk-based ground-water protection criterion shall be calculated using the following equations:]

[(A)] [For carcinogenic substances;

$$GWPC = \left[\frac{Risk}{CSF} \right] \times \left[\frac{BW \times AT}{IR \times EF \times ED \times CF} \right]$$

[(B)] [For non-carcinogenic substances:

$$GWPC = [Rfd \times HI] \times \left[\frac{(BW \times AT \times SA)}{(IR \times EF \times ED \times CF)} \right]$$

[(C)] [The abbreviations used in subparagraphs (A) and (B) of this subdivision shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Term	Description	Units	Value
GWPC _{RB}	Risk-based Ground-water protection Criterion	ug/l	calculated
Risk	Target Cancer Risk Level	unitless	1.0E-06
HI	Hazard Index	unitless	1.0
CSF	Cancer slope Factor	(mg/kg-day) ⁻¹	substance-specific
RFD	Reference Dose	mg/kg-day	substance-specific
IR	Ingestion Rate	l/day	2
EF	Exposure Frequency	days/year	365
ED	Exposure Duration	years	70
CF	Conversion Factor	mg/ug	0.001
BW	Body Weight	kg	70
AT	Averaging Time,	days	25550
SA	Source Allocation	unitless	0.2

]

(2) Surface Water Protection Criteria for Additional Polluting Substances

(A) Any substance in groundwater for which a surface water protection criterion is not specified in Appendix D of the RSRs or for which there are no water quality criteria, shall be remediated to the background concentration or to criteria obtained pursuant to this subdivision. A request under this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

- (i) A proposed risk-based surface water protection criteria for each substance calculated in accordance with Appendix G of the RSRs;
- (ii) The laboratory reporting limit for each substance;
- (iii) A description of the bioaccumulative properties of each substance; and
- (iv) Any information about the ecological effects each substance may cause due to exposure not accounted for in the proposed risk-based surface water protection criteria.

(B) The commissioner may approve or deny in writing a request made under subparagraph (A) of this subdivision. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the requirements of this subdivision have been satisfied and that the proposed surface water protection criteria will be protective of human health and the environment.

(C) Unless prohibited in writing by the commissioner, criteria approved by the commissioner pursuant to subparagraph (B) of this subdivision, may be the subject of a request for alternative criteria under section 22a-133k-3(b) of the RSRs.

(3) Volatilization Criteria for Additional Polluting Substances

(A) Any substance in groundwater for which a volatilization criterion is not specified in Appendix E or Appendix F of the RSRs, shall be remediated to the background concentration or to criteria obtained pursuant to this subdivision. Such request may include target indoor air concentrations and volatilization criteria to apply to such substances in groundwater or soil vapor. A request under this subdivision shall be submitted to the commissioner in accordance with section 22a-133k-1(g) of the RSRs, and shall also include:

(i) A risk-based target indoor air concentration or volatilization criteria for each substance calculated in accordance with Appendix G of the RSRs;

(ii) The laboratory reporting limit for each substance;

(iii) A description of the odor threshold of each substance; and

(iv) Any information about the health effects each substance may cause due to exposure not accounted for in the proposed risk-based volatilization criteria.

(B) Such volatilization criteria shall ensure that such target indoor air concentrations will not be exceeded above the polluted groundwater.

(C) The commissioner may approve or deny in writing a request made under subparagraph (A) of this subdivision. No request shall be approved unless it is demonstrated to the commissioner's satisfaction that the requirements of this subdivision have been satisfied and that the proposed volatilization criteria will be protective of human health and the environment.

(D) Unless prohibited in writing by the commissioner, criteria approved by the commissioner pursuant to subparagraph (C) of this subdivision, may be the subject of a request for alternative criteria under section 22a-133k-3(c)(4) of the RSRs.

[(i)](j) **Additional Remediation of [Ground Water.] Groundwater**

Nothing in [sections 22a-133k-1 through 22a-133k-3, inclusive, of the Regulations of Connecticut State Agencies] the RSRs shall preclude the [Commissioner] commissioner from taking any action necessary to prevent or abate pollution, or to prevent or abate any threat to human health or the environment. If the presence of any substance impairs the aesthetic quality of any ground[]water which is or can reasonably be expected to be a source of water for drinking or other [domestic use] uses, additional remediation shall be conducted in order to reduce the concentration of such substance to a concentration appropriate for such use.

Appendix A to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs

Direct Exposure Criteria for Soil

Substance	Residential [Criteria] <u>DEC</u> in mg/kg(ppm)	Industrial/Commercial [Criteria] <u>DEC</u> in mg/kg(ppm)
Volatile Organic Substances		
Acetone	500	1,000
Acrylonitrile	1.1	11
Benzene	21	200
Bromoform	78	720
2-Butanone(MEK)	500	1,000

Carbon tetrachloride	4.7	44
Chlorobenzene	500	1,000
Chloroform	100	940
Dibromochloromethane	7.3	68
1,2-Dichlorobenzene	500	1,000
1,3-Dichlorobenzene	500	1,000
1,4-Dichlorobenzene	26	240
1,1-Dichloroethane	500	1,000
1,2-Dichloroethane	6.7	63
1,1-Dichloroethylene	1	9.5
cis-1,2-Dichloroethylene	500	1,000
trans-1,2-Dichloroethylene	500	1,000
1,2-Dichloropropane	9	84
1,3-Dichloropropene	3.4	32
Ethylbenzene	500	1,000
Ethylene dibromide (EDB)	0.007	0.067
Methyl-tert-butyl-ether	500	1,000
Methyl isobutyl ketone	500	1,000
Methylene chloride	82	760
Styrene	500	1,000
1,1,1,2-Tetrachloroethane	24	220
1,1,2,2-Tetrachloroethane	3.1	29
Tetrachloroethylene	12	110
Toluene	500	1,000
1,1,1-Trichloroethane	500	1,000
1,1,2-Trichloroethane	11	100
Trichloroethylene	56	520
Vinyl chloride	0.32	3
Xylenes	500	1,000
Semi-volatile Organic Substances		
Acenaphthylene	1,000	2,500
Anthracene	1,000	2,500
Benzo(a)anthracene	1	7.8
Benzo(b)fluoranthene	1	7.8
Benzo(k)fluoranthene	8.4	78
Benzo(a)pyrene	1	1
Bis(2-chloroethyl)ether	1	5.2
Bis(2-chloroisopropyl) ether	8.8	82

Bis(2-ethyl hexyl) phthalate	44	410
Butyl benzl phthalate	1,000	2,500
2-chlorophenol	340	2,500
Di-n-butyl phthalate	1,000	2,500
Di-n-octyl phthalate	1,000	2,500
2,4-Dichlorophenol	200	2,500
Fluoranthene	1,000	2,500
Fluorene	1,000	2,500
Hexachloroethane	44	410
Hexachlorobenzene	1	3.6
Naphthalene	1,000	2,500
Pentachlorophenol	5.1	48
Phenanthrene	1,000	2,500
Phenol	1,000	2,500
Pyrene	1,000	2,500
Inorganic Substances		
Antimony	27	8,200
Arsenic	10	10
Barium	4,700	140,000
Beryllium	2	2
Cadmium	34	1,000
Chromium, trivalent	3,900	51,000
Chromium, hexavalent	100	100
Copper	2,500	76,000
Cyanide	1,400	41,000
Lead	400	1,000
Mercury	20	610
Nickel	1,400	7,500
Selenium	340	10,000
Silver	340	10,000
Thallium	5.4	160
Vanadium	470	14,000
Zinc	20,000	610,000
Pesticides, PCBs and <u>Extractable</u> Total Petroleum Hydrocarbons		
Alachlor	7.7	72
Aldicarb	14	410
Atrazine	2.8	26
Chlordane	0.49	2.2

Dieldrin	0.038	0.36
Endrin	20	610
2-4 D	680	20,000
Heptachlor epoxide	0.067	0.63
Heptachlor	0.14	1.3
Lindane	20	610
Methoxychlor	340	10,000
Toxaphene	0.56	5.2
[PCB's]PCBs (The use of the Industrial/Commercial DEC requires the parcel to be used pursuant to section 22a-133k-2(b)(4),and in accordance with title 40 CFR Part 761)	<u>1</u>	<u>10</u>
Total Petroleum Hydrocarbons by EPA Method 418.1 (This method shall not be used for the analysis of samples collected after June 30, 2009)	500	2,500
Extractable Total Petroleum Hydrocarbons by CT ETPH Analysis (This method may be used for the analysis of samples collected on or after June 22, 1999)	500	2,500

Appendix B to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs

Pollutant Mobility Criteria for Soil

Substance	GA[, GAA Mobility Criteria] Area PMC in mg/kg (ppm)	GB [Mobility Criteria] Area PMC inmg/kg (ppm)
Volatile Organic Substances		
Acetone	14	140
Acrylonitrile	0.01	0.1
Benzene	0.02	0.2
Bromoform	0.08	0.8
2-Butanone(MEK)	8	80
Carbon tetrachloride	0.1	1
Chlorobenzene	2	20
Chloroform	0.12	1.2
Dibromochloromethane	0.01	0.1
1,2-Dichlorobenzene	3.1	3.1
1,3-Dichlorobenzene	12	120
1,4-Dichlorobenzene	1.5	15

Substance	GA], GAA Mobility Criteria] <u>Area PMC</u> in mg/kg (ppm)	GB [<u>Mobility Criteria] <u>Area</u> <u>PMC</u> inmg/kg (ppm)</u>
1,1-Dichloroethane	1.4	14
1,2-Dichloroethane	0.02	0.2
1,1-Dichloroethylene	0.14	1.4
cis-1,2-Dichloroethylene	1.4	14
trans-1,2-Dichloroethylene	2	20
1,2-Dichloropropane	0.1	1.0
1,3-Dichloropropene	0.01	0.1
Ethyl benzene	10.1	10.1
Ethylene dibromide (EDB)	0.01	0.1
Methyl-tert-butyl-ether	2	20
Methyl isobutyl ketone	7	14
Methylene chloride	0.1	1.0
Styrene	2	20
1,1,1,2-Tetrachloroethane	0.02	0.2
1,1,2,2-Tetrachloroethane	0.01	0.1
Tetrachloroethylene	0.1	1
Toluene	20	67
1,1,1-Trichloroethane	4	40
1,1,2-Trichloroethane	0.1	1
Trichloroethylene	0.1	1.0
Vinyl chloride	0.04	0.40
Xylenes	19.5	19.5
Semi-volatile <u>Organic</u> Substances		
Acenaphthylene	8.4	84
Anthracene	40	400
Benzo(a)anthracene	1	1
Benzo(b)fluoranthene	1	1
Benzo(k)fluoranthene	1	1
Benzo(a)pyrene	1	1
Bis(2-chloroethyl)ether	1	2.4
Bis(2-chloroisopropyl)ether	1	2.4
Bis(2-ethyl hexyl)phthalate	1	11
Butyl benzl phthalate	20	200
2-chlorophenol	1	7.2
Di-n-butyl phthalate	14	140
Di-n-octyl phthalate	2	20
2,4-Dichlorophenol	1	4

Substance	GA], GAA Mobility Criteria] <u>Area PMC</u> in mg/kg (ppm)	GB [Mobility Criteria] <u>Area PMC</u> in mg/kg (ppm)
Fluoranthene	5.6	56
Fluorene	5.6	56
Hexachloroethane	1	1
Hexachlorobenzene	1	1
Naphthalene	5.6	56
Pentachlorophenol	1	1
Phenanthrene	4	40
Phenol	80	800
Pyrene	4	40
Pesticides and [TPH] <u>Extractable Total Petroleum Hydrocarbons</u>		
Alachlor	0.230	0.4
Aldicarb	1	1
Atrazine	0.2	0.2
Chlordane	0.066	0.066
Dieldrin	0.007	0.007
2-4 D	1.4	14
Heptachlor epoxide	0.02	0.02
Heptachlor	0.013	0.013
Lindane	0.02	0.04
Methoxychlor	0.8	8
Simazine	0.8	8
Toxaphene	0.33	0.6
Total Petroleum Hydrocarbon by EPA Method 418.1 [or another EPA-approved method acceptable to the Commissioner] (This method shall not be used for the analysis of samples collected after June 30, 2009)	500	2,500
Extractable Total Petroleum Hydrocarbons by <u>CT</u> ETPH Analysis (This method may be used for the analysis of samples collected on or after June 22, 1999)	500	2,500

[Inorganic] Substances [and PCB]	GA], GAA Mobility Criteria] <u>Area PMC</u> by TCLP or by	GB [Mobility Criteria] <u>Area PMC</u> by TCLP or by SPLP in
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	SPLP in mg/[l]L (ppm)	mg/[l]L (ppm)
<u>Inorganic Substances and PCBs</u>		
Antimony	0.006	0.06
Arsenic	0.05	0.5
Barium	1	10.0
Beryllium	0.004	0.04
Cadmium	0.005	0.05
Chromium, total	0.05	0.5
Copper	1.3	13
Cyanide (by SPLP only)	0.2	2
Lead	0.015	0.15
Mercury	0.002	0.02
Nickel	0.1	1.0
Selenium	0.05	0.5
Silver	0.036	0.36
Thallium	0.005	0.05
Vanadium	0.05	0.50
Zinc	5	50
PCBs _g	0.0005	0.005

Appendix C to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs

[Ground-Water] Groundwater Protection Criteria [for GA and GAA Areas]

Substance	[Ground-water Protection Criteria] GWPC in [ug/l] <u>ug/L</u> (ppb)
Volatile Organic Substances	
Acetone	700
Acrylonitrile	0.5
Benzene	1
Bromoform	4
2-Butanone(MEK)	400
Carbon tetrachloride	5
Chlorobenzene	100
Chloroform	6
Dibromochloromethane	0.5
1,2-Dichlorobenzene	600
1,3-Dichlorobenzene	600
1,4-Dichlorobenzene	75

Substance	[Ground-water Protection Criteria] GWPC in [ug/l] <u>ug/L</u> (ppb)
1,1-Dichloroethane	70
1,2-Dichloroethane	1
1,1-Dichloroethylene	7
cis-1,2-Dichloroethylene	70
trans-1,2-Dichloroethylene	100
1,2-Dichloropropane	5
1,3-Dichloropropene	0.5
Ethyl benzene	700
Ethylene dibromide (EDB)	0.05
Methyl-tert-butyl-ether	100
Methyl isobutyl ketone	350
Methylene chloride	5
Styrene	100
1,1,1,2-Tetrachloroethane	1
1,1,2,2-Tetrachloroethane	0.5
Tetrachloroethylene	5
Toluene	1,000
1,1,1-Trichloroethane	200
1,1,2-Trichloroethane	5
Trichloroethylene	5
Vinyl chloride	2
Xylenes	530
Semi-volatile <u>Organic</u> Substances	
Acenaphthylene	420
Anthracene	2,000
Benzo(a)anthracene	0.06
Benzo(b)fluoranthene	0.08
Benzo(k)fluoranthene	0.5
Benzo(a)pyrene	0.2
Bis(2-chloroethyl)ether	12
Bis(2-chloroisopropyl)ether	12
Bis(2-ethyl hexyl)phthalate	2
Butyl benzl phthalate	1,000
2-chlorophenol	36
Di-n-butyl phthalate	700
Di-n-octyl phthalate	100

Substance	[Ground-water Protection Criteria] GWPC in [ug/l] <u>ug/L</u> (ppb)
2,4-Dichlorophenol	20
Fluoranthene	280
Fluorene	280
Hexachloroethane	3
Hexachlorobenzene	1
Naphthalene	280
Pentachlorophenol	1
Phenanthrene	200
Phenol	4,000
Pyrene	200
Inorganic Substances	
Antimony	6
Arsenic	50
Asbestos (in mfl)	7 [(mfl)]
Barium	1,000
Beryllium	4
Cadmium	5
Chromium (total)	50
Copper	1,300
Cyanide	200
Lead	15
Mercury	2
Nickel	100
Selenium	50
Silver	36
Thallium	5
Vanadium	50
Zinc	5,000
Pesticides, [PCB] <u>PCBs</u> and <u>Extractable</u> Total Petroleum Hydrocarbons	
Alachlor	2
Aldicarb	3
Atrazine	3
Chlordane	0.3
Dieldrin	0.002
2-4 D	70
Heptachlor epoxide	0.2

Substance	[Ground-water Protection Criteria] GWPC in [ug/l] <u>ug/L</u> (ppb)
Heptachlor	0.4
Lindane	0.2
Methoxychlor	40
Simazine	4
Toxaphene	3
PCB's	0.5
Total Petroleum Hydrocarbon by EPA Method 418.1 [or another EPA-approved method acceptable to the Commissioner] (This method shall not be used for the analysis of samples collected after June 30, 2009)	500
Extractable Total Petroleum Hydrocarbons by <u>CT</u> ETPH Analysis (This method may be used for the analysis of samples collected on or after June 22, 1999)	250

Appendix D to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs

Surface[-water] Water Protection Criteria for Substances in [Ground Water] Groundwater

Substance	[Surface-Water Protection Criteria] SWPC in [ug/L] <u>ug/L</u>(ppb)
Volatile Organic Substances	
Acrylonitrile	20
Benzene	710
Bromoform	10,800
Carbon tetrachloride	132
Chlorobenzene	420,000
Chloroform	14,100
Dibromochloromethane	1,020
1,2-Dichlorobenzene	170,000
1,3-Dichlorobenzene	26,000
1,4-Dichlorobenzene	26,000
1,2-Dichloroethane	2,970
1,1-Dichloroethylene	96
1,3-Dichloropropene	34,000
Ethylbenzene	580,000

Substance	[Surface-Water Protection Criteria] SWPC in [ug/L] <u>ug/L(ppb)</u>
Methylene chloride	48,000
1,1,2,2-Tetrachloroethane	110
Tetrachloroethylene	88
Toluene	4,000,000
1,1,1-Trichloroethane	62,000
1,1,2-Trichloroethane	1,260
Trichloroethylene	2,340
Vinyl chloride	15,750
Semi-volatile <u>Organic</u> Substances	
Acenaphthylene	0.3
Anthracene	1,100,000
Benzo(a)anthracene	0.3
Benzo(b)fluoranthene	0.3
Benzo(k)fluoranthene	0.3
Benzo(a)pyrene	0.3
Bis(2-chloroethyl) ether	42
Bis(2-chloroisopropyl) ether	3,400,000
Bis(2-ethyl hexyl)phthalate	59
Di-n-butyl phthalate	120,000
2,4-Dichlorophenol	15,800
Fluoranthene	3,700
Fluorene	140,000
Hexachloroethane	89
Hexachlorobenzene	0.077
Phenanthrene	[0.077] 14
Phenol	9,200,0000
Pyrene	110,000
Inorganic Substances	
Antimony	86,000
Arsenic	4
Asbestos (in mfl)	7 [mfl]
Beryllium	4
Cadmium	6
Chromium, trivalent	1,200

Substance	[Surface-Water Protection Criteria] SWPC in [ug/L] <u>ug/L(ppb)</u>
Chromium, hexavalent	110
Copper	48
Cyanide	52
Lead	13
Mercury	0.4
Nickel	880
Selenium	50
Silver	12
Thallium	63
Zinc	123
Pesticides and [PCB] <u>PCBs</u>	
Chlordane	0.3
Dieldrin	0.1
Endrin	0.1
Heptachlor epoxide	0.05
Heptachlor	0.05
Toxaphene	1
PCBs	0.5

Appendix E to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs

Volatilization Criteria for [Ground Water] Groundwater

Volatile Substance	Residential Volatilization Criteria for Ground[]water in [parts per billion] <u>ug/L (ppb)</u>	Industrial/Commercial Volatilization Criteria for Ground[]water in [parts per billion] <u>ug/L (ppb)</u>
Acetone	50,000	50,000
Benzene	215	530
Bromoform	[920] <u>75</u>	[3,800] <u>2,300</u>
2-Butanone (MEK)	50,000	50,000
Carbon Tetrachloride	[16] <u>5.3</u>	[40] <u>14</u>
Chlorobenzene	1,800	[6,150] <u>23,000</u>
Chloroform	[287] <u>26</u>	[710] <u>62</u>
1,2-Dichlorobenzene	[30,500] <u>5,100</u>	50,000
1,3-Dichlorobenzene	[24,200] <u>4,300</u>	50,000
1,4-Dichlorobenzene	[50,000] <u>1,400</u>	[50,000] <u>3,400</u>

Volatile Substance	Residential Volatilization Criteria for Ground[]water in [parts per billion] $\mu\text{g/L}$ (ppb)	Industrial/Commercial Volatilization Criteria for Ground[]water in [parts per billion] $\mu\text{g/L}$ (ppb)
1,1-Dichloroethane	[34,600] <u>3,000</u>	[50,000] <u>41,000</u>
1,2-Dichloroethane	[21] <u>6.5</u>	[90] <u>68</u>
1,1-Dichloroethylene	[1] <u>190</u>	[6] <u>920</u>
1,2-Dichloropropane	[14] <u>7.4</u>	[60] <u>58</u>
1,3-Dichloropropene	[6] <u>11</u>	[25] <u>360</u>
Ethyl benzene	50,000	50,000
Ethylene dibromide (EDB)	[4] <u>0.30</u>	[16] <u>11</u>
Methyl-tert-butyl-ether	50,000	50,000
Methyl isobutyl ketone	[50,000] <u>13,000</u>	50,000
Methylene chloride	[50,000] <u>160</u>	[50,000] <u>2,200</u>
Styrene	[580] <u>3,100</u>	[2,065] <u>42,000</u>
1,1,1,2-Tetrachloroethane	[12] <u>2</u>	[50] <u>64</u>
1,1,2,2-Tetrachloroethane	[23] <u>1.8</u>	[100] <u>54</u>
Tetrachloroethylene	[1,500] <u>340</u>	[3820] <u>810</u>
Toluene	23,500	50,000
1,1,1-Trichloroethane	[20,400] <u>650</u>	[50,000] <u>16,000</u>
1,1,2-Trichloroethane	[8,000] <u>220</u>	[19,600] <u>2,900</u>
Trichloroethylene	[219] <u>27</u>	[540] <u>67</u>
Vinyl chloride	[2] <u>1.6</u>	[2] <u>52</u>
Xylenes	21,300	50,000

Appendix F to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies] the RSRs

Volatilization Criteria for Soil Vapor

Volatile Substance	Residential Volatilization Criteria for Soil Vapor in parts per million by volume (ppmv)	Residential Volatilization Criteria for Soil Vapor in milligrams per cubic meter (mg/m^3)	Industrial/Commercial Volatilization Criteria for Soil Vapor in parts per million by volume (ppmv)	Industrial/Commercial Volatilization Criteria for Soil Vapor in milligrams per cubic meter (mg/m^3)
Acetone	[2400] <u>57</u>	[5701] <u>140</u>	[8250] <u>290</u>	[19597] <u>690</u>
Benzene	[1] <u>0.78</u>	[3] <u>2.5</u>	[113] <u>1.4</u>	[361] <u>4.6</u>
Bromoform	[1.5] <u>0.04</u>	[16] <u>0.42</u>	[6] <u>0.98</u>	[62] <u>10</u>
2-Butanone (MEK)	[2400] <u>130</u>	[7078] <u>376</u>	[8285] <u>230</u>	[24434] <u>690</u>

Volatile Substance	Residential Volatilization Criteria for Soil Vapor in parts per million by volume (ppmv)	Residential Volatilization Criteria for Soil Vapor in milligrams per cubic meter (mg/m³)	Industrial/ Commercial Volatilization Criteria for Soil Vapor in parts per million by volume (ppmv)	Industrial/ Commercial Volatilization Criteria for Soil Vapor in milligrams per cubic meter (mg/m³)
Carbon Tetrachloride	[1] <u>0.06</u>	[6] <u>0.38</u>	[2.7] <u>0.12</u>	[17] <u>0.75</u>
Chlorobenzene	[31] <u>6.1</u>	[143] <u>28</u>	[106] <u>60</u>	[488] <u>280</u>
Chloroform	[4.5] <u>0.078</u>	[22] <u>0.38</u>	[10.4] <u>0.14</u>	[51] <u>0.69</u>
1,2-Dichlorobenzene	[240] <u>9.2</u>	[1443] <u>55</u>	[818] <u>95</u>	[4918] <u>570</u>
1,3-Dichlorobenzene	[240] <u>9.2</u>	[1443] <u>55</u>	[818] <u>95</u>	[4918] <u>570</u>
1,4-Dichlorobenzene	[950] <u>3</u>	[5712] <u>18</u>	[3270] <u>5.5</u>	[19661] <u>33</u>
1,1-Dichloroethane	[850] <u>14</u>	[3440] <u>58</u>	[3037] <u>150</u>	[12292] <u>600</u>
1,2-Dichloroethane	[1] <u>0.013</u>	[4] <u>0.053</u>	[1] <u>0.11</u>	[4] <u>0.43</u>
1,1-Dichloroethylene	[1] <u>1.9</u>	[4] <u>7.6</u>	[1] <u>7</u>	[4] <u>28</u>
1,2-Dichloropropane	[1] <u>0.021</u>	[5] <u>0.098</u>	[1] <u>0.13</u>	[5] <u>0.58</u>
1,3-Dichloropropene	[1] <u>0.035</u>	[5] <u>0.16</u>	[1] <u>0.89</u>	[5] <u>4.0</u>
Ethyl benzene	[1650] <u>9.3</u>	[7165] <u>40</u>	[5672] <u>93</u>	[24629] <u>400</u>
Ethylene dibromide (EDB)	[1] <u>0.0005</u>	[8] <u>0.0056</u>	[1] <u>0.007</u>	[8] <u>0.053</u>
Methyl-tert-butyl-ether	[1000] <u>34</u>	[3605] <u>120</u>	[3415] <u>73</u>	[12312] <u>260</u>
Methyl isobutyl ketone	[140] <u>6.8</u>	[574] <u>28</u>	[480] <u>68</u>	[1966] <u>280</u>
Methylene chloride	[1200] <u>0.65</u>	[4168] <u>2.3</u>	[2907] <u>6.8</u>	[10098] <u>24</u>
Styrene	[8] <u>9.3</u>	[34] <u>39</u>	[28] <u>95</u>	[119] <u>400</u>
1,1,1,2-Tetrachloroethane	[1] <u>0.009</u>	[7] <u>0.062</u>	[1.5] <u>0.22</u>	[10] <u>1.5</u>
1,1,2,2-Tetrachloroethane	[1] <u>0.0012</u>	[7] <u>0.0083</u>	[1] <u>0.028</u>	[7] <u>0.19</u>
Tetrachloroethylene	[11] <u>0.56</u>	[75] <u>3.8</u>	[27] <u>1</u>	[183] <u>6.9</u>
Toluene	[760] <u>42</u>	[2864] <u>160</u>	[2615] <u>180</u>	[9855] <u>690</u>
1,1,1-Trichloroethane	[1310] <u>70</u>	[7148] <u>380</u>	[4520] <u>130</u>	[24662] <u>690</u>
1,1,2-Trichloroethane	[40] <u>0.31</u>	[218] <u>1.7</u>	[93] <u>3.1</u>	[507] <u>17</u>
Trichloroethylene	[7] <u>0.14</u>	[38] <u>0.76</u>	[16] <u>0.26</u>	[86] <u>1.4</u>
Vinyl chloride	[1] <u>0.041</u>	[3] <u>0.11</u>	1	[3] <u>2.6</u>

Volatile Substance	Residential Volatilization Criteria for Soil Vapor in parts per million by volume (ppmv)	Residential Volatilization Criteria for Soil Vapor in milligrams per cubic meter (mg/m ³)	Industrial/ Commercial Volatilization Criteria for Soil Vapor in parts per million by volume (ppmv)	Industrial/ Commercial Volatilization Criteria for Soil Vapor in milligrams per cubic meter (mg/m ³)
Xylenes	[500] 38	[2192] 170	[1702] 160	[7461] 690

Appendix G to [Sections 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies Direct Exposure Criteria for Soil] the RSRs

[Volatilization Criteria for Ground Water]

Equations, Terms, and Values for Calculating Release-Specific Direct Exposure Criteria, Pollutant Mobility Criteria, Groundwater Protection Criteria, Surface Water Protection Criteria, and Volatilization Criteria, for Additional Polluting Substances and Alternative Volatilization Criteria.

[Site-Specific Volatilization Criteria for Ground Water may be calculated using the following equations:]

$$[GWC = TAC / (1000 \cdot VF_{GW})]$$

$$VF_{GW} = \left[\frac{H \cdot [(D_{EFFWS} / L_{GW}) / (ER \cdot L_B)] \cdot 1000}{1 + [(D_{EFF-WS} / L_{GW}) / (ER \cdot L_B)] + [(D_{EFF-WS} / L_{GW}) / ((D_{EFF-CRACK} / L_{CRACK}) \cdot \eta)]} \right]$$

$$[D_{EFF-WS} = (h_{CAP} + h_V) /]$$

$$[D_{EFF-CAP} = D_{AIR} \cdot (\theta_{ACAP}^{3.33} / \theta_T^2) + D_{WATER} / H \cdot (\theta_{WCAP}^{3.33} / \theta_T^2)]$$

$$[D_{EFF-S} = D_{AIR} \cdot (\theta_{AS}^{3.33} / \theta_T^2) + D_{WATER} / H \cdot (\theta_{WS}^{3.33} / \theta_T^2)]$$

$$[D_{EFF-CRACK} = D_{AIR} \cdot (\theta_{ACRACK}^{3.33} / \theta_T^2) + D_{WATER} / H \cdot (\theta_{WCRACK}^{3.33} / \theta_T^2)]$$

[Where:

Term	Description	Units	Value
GWC	Ground Water Volatilization Criteria	ug/kg	calculated
TAC	Target Indoor Air Concentration	ug/m ³	**
VF _{GW}	Ground Water Volatilization Factor	mg/m ³	calculated
H	Henry's Law Constant	unitless	substance-specific
D _{EFF-WS}	Effective Diffusion-Ground Water to Soil Surface	cm ² /s	calculated
L _{GW}	Depth to Ground Water (= h _{CAP} + h _V)	cm	site-specific
h _{CAP}	Thickness of Capillary Fringe	cm	site-specific
h _V	Thickness of Vadose Zone	cm	site-specific
ER _R	Residential Enclosed Space Air Exchange Rate	1/s	.00014
ER _I	Industrial Enclosed Space Air Exchange Rate	1/s	.00023

L_{BR}	Residential Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
L_{BI}	Industrial Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
$D_{EFF-CRACK}$	Effective Diffusion through Foundation Cracks	cm ² /s	calculated
L_{CRACK}	Enclosed Space Foundation or Wall Thickness	cm	site-specific
η	Areal Fraction of Cracks in Foundations / Walls	unitless	.01
$D_{EFF-CAP}$	Effective Diffusion through Capillary Fringe	cm ² /s	calculated
D_{EFF-S}	Effective Diffusion through Soil (In Vapor Phase)	cm ² /s	calculated
D_{AIR}	Diffusion Coefficient in Air	cm ² /s	8.40E-02 or chemical specific
D_{WATER}	Diffusion Coefficient in Water	cm ² /s	1.00E-05 or chemical specific
θ_{ACAP}	Volumetric Air Content in Capillary Fringe	unitless	site-specific
θ_{AS}	Volumetric Air Content in Vadose Zone	unitless	site-specific
θ_{ACRACK}	Volumetric Air Content in Foundation/Wall Cracks	unitless	site-specific
θ_{WCAP}	Volumetric Water Content in Capillary Fringe	unitless	site-specific
θ_{WS}	Volumetric Water Content in Vadose Zone	unitless	site-specific
θ_{WCRACK}	Volumetric Water Content in Foundation/Wall Cracks	unitless	site-specific
θ_T	Total Soil Porosity	unitless	site-specific

]

[**See attached “Table of Target Air Concentrations”]

[Volatilization Criteria for Soil Vapor]

[Site-Specific Volatilization Criteria for Soil Vapor may be calculated using the following equations:]

$$[SSVC = TAC / (1000 \cdot VF_{SSV})]$$

$$VF_{SSV} = \frac{[(D_{EFF-S} / L_S) / (ER \cdot L_B)]}{1 + [(D_{EFF-S} / L_S) / (ER \cdot L_B)] + [(D_{EFF-S} / L_S) / (D_{EFF-CRACK} / L_{CRACK}) \eta]}$$

]

$$[D_{EFF-S} = D_{AIR} \cdot (\theta_{AS}^{3.33} / \theta_T^2) + D_{WATER} / H \cdot (\theta_{WS}^{3.33} / \theta_T^2)]$$

$$[D_{EFF-CRACK} = D_{AIR} \cdot (\theta_{ACRACK}^{3.33} / \theta_T^2) + D_{WATER} / H \cdot (\theta_{WCRACK}^{3.33} / \theta_T^2)]$$

[Where:

Terms	Description	Units	Value
SSVC	Volatilization Criteria for Soil Vapor	mg/m ³ -air	calculated
TAC	Target Indoor Air Concentration	ug/m ³ -air	**

Terms	Description	Units	Value
VF_{SSV}	Volatilization Factor for Subsurface Vapors	unitless	calculated
H	Henry's Law Constant	unitless	substance-specific
$D_{EFF S}$	Effective Diffusion through Soil (in Vapor Phase)	cm^2/s	calculated
L_S	Depth to Soil Vapor Sample	cm	site-specific
ER_R	Residential Enclosed Space Air Exchange Rate	1/s	.00014
ER_I	Industrial Enclosed Space Air Exchange Rate	1/s	.00023
L_{BR}	Residential Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
L_{BI}	Industrial Enclosed Space Volume/Infiltration Area Ratio	cm	site-specific
$D_{EFF-CRACK}$	Effective Diffusion through Foundation Cracks	cm^2/s	calculated
L_{CRACK}	Enclosed Space Foundation or Wall Thickness	cm	site-specific
η	Areal Fraction of Cracks in Foundations / Walls	unitless	calculated
θ_{AS}	Volumetric Air Content in Vadose Zone	unitless	site-specific
θ_{ACRACK}	Volumetric Air Content in Foundation/Wall Cracks	unitless	site-specific
θ_{WS}	Volumetric Water Content in Vadose Zone	unitless	site-specific
θ_{WCRACK}	Volumetric Water Content in Foundation/Wall Cracks	unitless	site-specific
θ_T	Total Soil Porosity	unitless	site-specific

]

[** See attached "Table of Target Air Concentrations"]

[Table of Target Air Concentrations

Volatile Substance	Residential Target Indoor Air Concentration in micrograms per cubic meter	Industrial/Commercial Target Indoor Air Concentration in micrograms per cubic meter
Acetone	8.34 E02	1.17 E03
Benzene	3.25 E00	2.15 E01
Bromoform	2.21 E00	3.72 E00
2-Butanone (MEK)	1.04 E03	1.46 E03
Carbon Tetrachloride	1.00 E00	1.00 E00
Chlorobenzene	2.09 E01	2.92 E01
Chloroform	3.00 E00	3.00 E00
1,2-Dichlorobenzene	2.09 E02	2.92 E02
1,3-Dichlorobenzene	2.09 E02	2.92 E02

Volatile Substance	Residential Target Indoor Air Concentration in micrograms per cubic meter	Industrial/Commercial Target Indoor Air Concentration in micrograms per cubic meter
1,4-Dichlorobenzene	8.34 E02	1.17 E03
1,1-Dichloroethane	5.21 E02	7.30 E02
1,2-Dichloroethane	9.36 E-02	1.57 E-01
1,1-Dichloroethylene	4.87 E-02	8.18 E-02
1,2-Dichloropropane	1.28 E-01	2.15 E-01
1,3-Dichloropropene	6.58 E-02	1.10 E-01
Ethyl benzene	1.04 E03	1.46 E03
Ethylene dibromide (EDB)	1.11 E-02	1.86 E-02
Methyl-tert-butyl-ether	5.21 E02	7.30 E02
Methyl isobutyl ketone	8.34 E01	1.17 E02
Methylene chloride	6.00 E02	6.00 E02
Styrene	5.00 E00	7.17 E00
1,1,1,2-Tetrachloroethane	3.29 E-01	5.52 E-01
1,1,2,2-Tetrachloroethane	4.20 E-02	7.05 E-02
Tetrachloroethylene	1.10 E01	1.10 E01
Toluene	4.17 E02	5.84 E02
1,1,1-Trichloroethane	1.04 E03	1.46 E03
1,1,2-Trichloroethane	3.00 E01	3.00 E01
Trichloroethylene	5.00 E00	5.00 E00
Vinyl chloride	2.90 E-02	4.87 E-02
Xylenes	3.13 E02	4.38 E02

]

(1) Direct Exposure Criteria for Additional Polluting Substances(A) Residential Direct Exposure Criteria shall be calculated using the following equations:(i) For carcinogenic substances:

$$RDEC_{RB} = \left(\frac{RL}{CSF} \right) \div \left[\left(\frac{IR_{child} \times ED_{child} \times EF \times CF}{BW_{child} \times AT_c} \right) + \left(\frac{IR_{adult} \times ED_{adult} \times EF \times CF}{BW_{adult} \times AT_c} \right) \right]$$

(ii) For non-carcinogenic substances:

$$RDEC_{RB} = (RfD \times HI) \div \left[\left(\frac{IR_{child} \times ED_{child} \times EF \times CF}{BW_{child} \times AT_{child}} \right) + \left(\frac{IR_{adult} \times ED_{adult} \times EF \times CF}{BW_{adult} \times AT_{adult}} \right) \right]$$

(iii) The abbreviations in clauses (i) and (ii) of Appendix G(1)(A) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Term</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AT_c</u>	<u>Averaging Time – carcinogens</u>	<u>25,550</u>	<u>days</u>

<u>Term</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
AT_{adult}	<u>Averaging Time – adult non-carcinogen</u>	8,760	days
AT_{child}	<u>Averaging Time – child non-carcinogen</u>	2,190	days
BW_{adult}	<u>Body Weight – adult</u>	70	kg
BW_{child}	<u>Body Weight – child</u>	15	kg
CF	<u>Conversion Factor</u>	0.000001	kg/mg
CSF	<u>Cancer Slope Factor</u>	substance-specific	(mg/kg-day) ⁻¹
$RDEC_{RB}$	<u>Residential Risk-based Direct Exposure Criterion</u>	calculated	mg/kg
ED_{adult}	<u>Exposure Duration – adult non-carcinogen</u>	24	years
ED_{child}	<u>Exposure Duration – child non-carcinogen</u>	6	years
EF	<u>Exposure Frequency</u>	365	days/year
HI	<u>Hazard Index</u>	1.0	unitless
IR_{adult}	<u>Ingestion Rate – adult</u>	100	mg/day
IR_{child}	<u>Ingestion Rate – child</u>	200	mg/day
RfD	<u>Reference Dose</u>	substance-specific	mg/kg-day
RL	<u>Target Cancer Risk Level</u>	1.0E-06	unitless

(iv) If the residential Direct Exposure Criteria calculated pursuant to Appendix G(1)(A) of the RSRs exceeds the following ceiling values, the ceiling value shall be used in lieu of the calculated value:

<u>Volatile Organic Substances</u>	<u>Semi-volatile Organic Substances</u>	<u>Pesticides, PCBs and ETPH</u>	<u>Inorganic Substances</u>	<u>Units</u>
500	1,000	500	50,000	mg/kg

(v) The residential direct exposure criteria may be adjusted up to the laboratory reporting limit if the commissioner determines that the calculated residential risk-based direct exposure criteria is less than the laboratory reporting limit for such substance.

(B) Industrial/commercial Direct Exposure Criteria shall be calculated using the following equations:

(i) For carcinogenic substances:

$$I/C DEC_{RB} = \left(\frac{RL}{CSF} \right) \times \left(\frac{BW \times AT_c}{IR \times ED \times EF \times CF} \right)$$

(ii) For non-carcinogenic substances:

$$I/C DEC_{RB} = \left(\frac{RfD \times HI \times BW \times AT}{IR \times ED \times EF \times CF} \right)$$

(iii) The abbreviations in clauses (i) and (ii) of Appendix G(1)(B) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AT_c</u>	<u>Averaging Time – carcinogens</u>	<u>25,550</u>	<u>days</u>
<u>AT</u>	<u>Averaging Time – non-carcinogen</u>	<u>9,125</u>	<u>days</u>
<u>BW</u>	<u>Body Weight – adult</u>	<u>70</u>	<u>kg</u>
<u>CF</u>	<u>Conversion Factor</u>	<u>0.000001</u>	<u>kg/mg</u>
<u>CSF</u>	<u>Cancer Slope Factor</u>	<u>substance-specific</u>	<u>(mg/kg-day)⁻¹</u>
<u>I/CDEC_R_B</u>	<u>Industrial/Commercial Risk-based Direct Exposure Criterion</u>	<u>calculated</u>	<u>mg/kg</u>
<u>ED</u>	<u>Exposure Duration</u>	<u>25</u>	<u>years</u>
<u>EF</u>	<u>Exposure Frequency</u>	<u>250</u>	<u>days/year</u>
<u>HI</u>	<u>Hazard Index</u>	<u>1.0</u>	<u>unitless</u>
<u>IR</u>	<u>Ingestion Rate</u>	<u>50</u>	<u>mg/day</u>
<u>RfD</u>	<u>Reference Dose</u>	<u>substance-specific</u>	<u>mg/kg-day</u>
<u>RL</u>	<u>Target Cancer Risk Level</u>	<u>1.0E-06</u>	<u>unitless</u>

(iv) If the industrial/commercial direct exposure criteria calculated pursuant to Appendix G(1)(B) of the RSRs exceeds the following ceiling values, the ceiling value shall be used in lieu of the calculated value:

<u>Volatile Organic Substances</u>	<u>Semi-volatile Organic Substances</u>	<u>Pesticides, PCBs and ETPH</u>	<u>Inorganic Substances</u>	<u>Units</u>
<u>1,000</u>	<u>2,500</u>	<u>1,000</u>	<u>50,000</u>	<u>mg/kg</u>

(v) The industrial/commercial direct exposure criteria may be adjusted up to the laboratory reporting limit if the commissioner determines that the calculated industrial/commercial risk-based direct exposure criteria is less than the laboratory reporting limit for such substance.

(2) Pollutant Mobility Criteria for Additional Polluting Substances

(A) Pollutant Mobility Criteria for inorganic substances shall be calculated using the following equations:

(i) For GA area groundwater classification:

$$PMC_{mg/L} = GWPC \times CF$$

(ii) For GB area groundwater classification:

$$PMC_{mg/L} = GWPC \times CF \times DF$$

(B) Pollutant Mobility Criteria for organic substances shall be calculated using the following equations:

(i) For GA area groundwater classification:

$$PMC_{mg/kg} = GWPC \times CF \times AAF$$

(ii) For GB area groundwater classification:

$$PMC_{\text{mg/kg}} = GWPC \times CF \times AAF \times DF$$

(C) The abbreviations in subparagraphs (A) and (B) of Appendix G(2) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AAF</u>	<u>Analytical Adjustment Factors</u>	<u>20</u>	<u>unitless</u>
<u>CF</u>	<u>Conversion Factor</u>	<u>0.001</u>	<u>mg/μg</u>
<u>DF</u>	<u>Dilution Factor</u>	<u>10</u>	<u>unitless</u>
<u>GWPC</u>	<u>Groundwater Protection Criteria</u>	<u>substance-specific</u>	<u>μg/L</u>
<u>PMC</u>	<u>Pollutant Mobility Criteria</u>	<u>calculated</u>	<u>mg/kg or mg/L</u>

(3) Groundwater Protection Criteria for Additional Polluting Substances

(A) Groundwater Protection Criteria shall be calculated for carcinogenic substances using the following equation:

$$GWPC = \left(\frac{RL}{CSF} \right) \times \left(\frac{BW \times AT}{IR \times EF \times ED \times CF} \right)$$

(B) Groundwater Protection Criteria shall be calculated for non-carcinogenic substances using the following equation:

$$GWPC = \frac{RfD \times HI \times BW \times AT \times SA}{IR \times EF \times ED \times CF}$$

(C) The abbreviations in subparagraphs (A) and (B) of Appendix G(3) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AT</u>	<u>Averaging Time</u>	<u>25,550</u>	<u>days</u>
<u>BW</u>	<u>Body Weight</u>	<u>70</u>	<u>kg</u>
<u>CSF</u>	<u>Cancer Slope Factor</u>	<u>substance-specific</u>	<u>(mg/kg-day)⁻¹</u>
<u>CF</u>	<u>Conversion Factor</u>	<u>0.001</u>	<u>mg/μg</u>
<u>ED</u>	<u>Exposure Duration</u>	<u>70</u>	<u>years</u>
<u>EF</u>	<u>Exposure Frequency</u>	<u>365</u>	<u>days/year</u>
<u>GWPC</u>	<u>Risk-based Groundwater Protection Criterion</u>	<u>calculated</u>	<u>μg/L</u>
<u>HI</u>	<u>Hazard Index</u>	<u>1.0</u>	<u>unitless</u>
<u>IR</u>	<u>Ingestion Rate</u>	<u>2</u>	<u>L/day</u>
<u>RfD</u>	<u>Reference Dose</u>	<u>substance-specific</u>	<u>mg/kg-day</u>
<u>RL</u>	<u>Target Cancer Risk Level</u>	<u>1.0E-06</u>	<u>unitless</u>

SA	Source Allocation	0.2	unitless
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(D)If the Groundwater Protection Criteria calculated pursuant to Appendix G(3)(A) or (B) of the RSRs exceeds the following ceiling values, the ceiling value shall be used in lieu of the calculated value:

Volatile Organic Substances	Semi-volatile Organic Substances	Pesticides, PCBs, and ETPH	Inorganic Substances	Units
1,000	1,000	1,000	1,000	µg/L

(E)The groundwater protection criteria may be adjusted up to the laboratory reporting limit if the commissioner determines that the calculated risk-based groundwater protection criteria is less than the laboratory reporting limit for such substance.

(F)The groundwater protection criteria may be adjusted down to the organoleptic threshold if the commissioner determines that the calculated risk-based groundwater protection criteria is higher than the organoleptic threshold for such substance.

(4)Surface Water Protection Criteria for Additional Polluting Substances

(A)Determining Water Quality Criteria

For substances that have no water quality criteria in the water quality standards, such criteria shall be determined using EPA's national recommended water quality criteria and, if no such criteria are available, then by using the following:

(i)Determining the Water Quality Criteria for Chronic Aquatic Life

(I)In accordance with title 40 CFR 132 Appendix A (Great Lakes Water Quality Initiative Methodologies for Development of Aquatic Life Criteria and Values);

(II)Using the Tier 1 protocols for calculating a Criterion Continuous Concentration; or

(III)If insufficient information is available to use the Tier 1 Criterion Continuous Concentration procedure, using the Tier 2 protocols for calculating a Secondary Continuous Concentration.

(ii)Calculating the Water Quality Criteria for Human Health for Fish Consumption:

(I)For carcinogenic substances:

$$WQC = \frac{RL \times BW \times CF}{CSF \times FC \times BAF}$$

(II)For non-carcinogenic substances:

$$WQC = \frac{RfD \times BW \times CF \times RSC}{FC \times BAF}$$

(III)The abbreviations in subclauses (I) and (II) of Appendix G(4) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

Terms	Description	Value	Units
BAF	Bioaccumulation Factor	substance-specific	unitless
BW	Body Weight	70	kg
CF	Conversion Factor	1,000	µg/mg
CSF	Cancer Slope Factor	substance-specific	(mg/kg-day) ⁻¹
FC	Fish Consumption Rate	0.0175	kg/d

<u>RfD</u>	<u>Reference Dose</u>	<u>substance-specific</u>	<u>mg/kg-day</u>
<u>RL</u>	<u>Risk Level</u>	<u>1.00E-06</u>	<u>unitless</u>
<u>WQC</u>	<u>Water Quality Criteria</u>	<u>substance-specific</u>	<u>µg/L</u>
<u>RSC</u>	<u>Relative Source Contribution</u>	<u>0.2</u>	<u>unitless</u>

(B) Calculating the Surface Water Protection Criteria

The risk-based surface water protection criteria shall be calculated, for the lower of aquatic life or human health water quality criteria:

(i) Water quality criteria for freshwater chronic aquatic life protection as determined using subparagraph (A) of this subdivision, multiplied by ten; or

(ii) Water quality criteria for human health for fish consumption calculated using subparagraph (A) of this subdivision, multiplied by the applicable flow factor multiplied by ten, using the following values:

<u>Flow Factor</u>	<u>Substance Risk Level</u>
<u>1</u>	<u>For known human carcinogens or substances which may bioaccumulate BCF > 100</u>
<u>2</u>	<u>For non-carcinogenic substances</u>
<u>3</u>	<u>For carcinogenic substances</u>

(C) If the Surface Water Protection Criteria calculated pursuant to Appendix G(4)(B) of the RSRs exceeds the following ceiling values, the ceiling value shall be used in lieu of the calculated value:

<u>Volatile Substances</u>	<u>Semi-volatile Organic Substances</u>	<u>Pesticides, PCBs and ETPH</u>	<u>Inorganic Substances</u>	<u>Units</u>
<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>10,000</u>	<u>µg/L</u>

(D) The surface water protection criteria may be adjusted up to the laboratory reporting limit if the commissioner determines that the calculated risk-based surface water protection criteria is less than the laboratory reporting limit for such substance.

(5) Volatilization Criteria for Additional Polluting Substances

(A) Residential Target Indoor Air Concentrations shall be calculated using the following equations:

(i) For carcinogenic substances:

$$TAC = \frac{RL \times BW \times AT_c \times CF}{CSF_i \times C_{expF} \times C_{sensF} \times IR_{air} \times EF \times ED}$$

(ii) For non-carcinogenic substances:

$$TAC = \frac{HQ \times BW \times RfD_i \times AT \times CF}{C_{expF} \times IR_{air} \times EF \times ED}$$

(iii) The abbreviations in subparagraph (A) of Appendix G(5) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AT</u>	<u>Averaging Time – non-carcinogen</u>	<u>10,950</u>	<u>days</u>

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AT_c</u>	<u>Averaging Time – carcinogen</u>	<u>25,550</u>	<u>days</u>
<u>BW</u>	<u>Body Weight</u>	<u>70</u>	<u>kg</u>
<u>CexpF</u>	<u>Children’s Exposure Factor</u>	<u>2</u>	<u>unitless</u>
<u>CF</u>	<u>Conversion Factor</u>	<u>1,000</u>	<u>µg/mg</u>
<u>CsensF</u>	<u>Children’s Sensitivity Factor</u> <u>CsensF = 1 for non-carcinogens and non-mutagenic carcinogens. CsensF = 2 for mutagenic carcinogens</u>	<u>substance-specific</u>	<u>unitless</u>
<u>CSF_i</u>	<u>Cancer Slope Factor – Inhalation</u>	<u>substance-specific</u>	<u>(mg/kg-day)⁻¹</u>
<u>ED</u>	<u>Exposure Duration</u>	<u>30</u>	<u>years</u>
<u>EF</u>	<u>Exposure Frequency</u>	<u>350</u>	<u>days/year</u>
<u>HQ</u>	<u>Hazard Quotient</u>	<u>1</u>	<u>unitless</u>
<u>IR_{air}</u>	<u>Inhalation Rate – air</u>	<u>20</u>	<u>m³/day</u>
<u>RfD_i</u>	<u>Reference Dose – inhalation</u>	<u>substance-specific</u>	<u>mg/m³</u>
<u>RL</u>	<u>Risk Level</u>	<u>1.00E-06</u>	<u>unitless</u>
<u>TAC</u>	<u>Target Indoor Air Concentration</u>	<u>substance-specific</u>	<u>µg/m³</u>

(iv) If the residential Target Indoor Air Concentration calculated pursuant to Appendix G(5)(A)(i) or (A)(ii) of the RSRs exceeds a ceiling value of 500 µg/m³, the ceiling value shall be used in lieu of the calculated value.

(B) Industrial/Commercial Target Indoor Air Concentrations shall be calculated using the following equations:

(i) For carcinogenic substances:

$$TAC = \frac{RL \times BW \times AT_c \times CF}{CSF_i \times IR_{air} \times EF \times ED}$$

(ii) For non-carcinogenic substances:

$$TAC = \frac{HQ \times BW \times RfD_i \times AT \times CF}{IR_{air} \times EF \times ED}$$

(iii) The abbreviations used in subparagraph (B) of Appendix G(5) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
<u>AT</u>	<u>Averaging Time – non-carcinogen</u>	<u>9,125</u>	<u>days</u>
<u>AT_c</u>	<u>Averaging Time – carcinogen</u>	<u>25,550</u>	<u>days</u>
<u>BW</u>	<u>Body Weight</u>	<u>70</u>	<u>kg</u>
<u>CF</u>	<u>Conversion Factor</u>	<u>1,000</u>	<u>µg/mg</u>
<u>CSF_i</u>	<u>Cancer Slope Factor – inhalation</u>	<u>substance-</u>	<u>(mg/kg-day)⁻¹</u>

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
		specific	
<u>ED</u>	<u>Exposure Duration</u>	25	years
<u>EF</u>	<u>Exposure Frequency</u>	250	days/year
<u>HQ</u>	<u>Hazard Quotient</u>	1	unitless
<u>IR_{air}</u>	<u>Inhalation Rate – air</u>	10	m ³ /day
<u>RfD_i</u>	<u>Reference Dose – inhalation</u>	substance-specific	mg/m ³
<u>RL</u>	<u>Risk Level</u>	1.00E-06	unitless
<u>TAC</u>	<u>Target Indoor Air Concentration</u>	substance-specific	μg/m ³

(iv) If the industrial/commercial Target Indoor Air Concentration calculated pursuant to Appendix G(5)(B)(i) or (B)(ii) of the RSRs exceeds a ceiling value of 500 μg/m³, the ceiling value shall be used in lieu of the calculated value.

(C) Volatilization Protection Criterion shall be calculated using the following equations:

(i) For Volatilization Criteria for Groundwater:

$$GWVC_{\mu\text{g/L}} = \frac{TAC}{CF \times \alpha \times H}$$

(ii) If the groundwater volatilization criteria calculated pursuant to Appendix G(5)(C)(i) of the RSRs exceeds a ceiling value of 50,000 μg/L, the ceiling value shall be used in lieu of the calculated value.

(iii) For Volatilization Criteria for Soil Vapor:

$$SVVC_{\text{mg/m}^3} = \frac{TAC}{CF \times \alpha}$$

$$SVVC_{\text{ppmv}} = SVVC_{\text{mg/m}^3} \times \left(\frac{MV}{MW} \right)$$

(iv) The attenuation factor for diffusion and advection (α) shall be calculated using the following equations:

$$\alpha = \frac{A \times e^B}{e^B + A + (A/C) \times (e^B - 1)}$$

$$A = \frac{D_T^{\text{eff}} \times A_B}{Q_R \times L_T} \quad \text{or} \quad A = \frac{D_T^{\text{eff}}}{E_R \times (V_R/A_R) \times L_T}$$

$$B = \frac{Q_{\text{soil}} \times L_{\text{crack}}}{D_{\text{crack}}^{\text{eff}} \times \eta \times A_B} \quad \text{or} \quad B = \left(\left(\frac{Q_{\text{soil}}}{Q_B} \right) \times E_B \times \left(\frac{V_B}{A_B} \right) \times L_{\text{crack}} \right) / (D_{\text{crack}}^{\text{eff}} \times \eta)$$

$$C = \frac{Q_{\text{soil}}}{Q_R}$$

$$D_{T}^{eff} = \frac{L_T}{(L_{vadose}/D_{vadose}^{eff}) + (L_{cap}/D_{cap}^{eff})}$$

$$D_{crack}^{eff} = D^{air} \times \left(\frac{\theta_{v-crack}^{3.33}}{\theta_{T-crack}^2} \right) + \left(\frac{D^{water}}{H} \right) \times \left(\frac{\theta_{m-crack}^{3.33}}{\theta_{T-crack}^2} \right)$$

$$D_{vadose}^{eff} = D^{air} \times \left(\frac{\theta_{v-vadose}^{3.33}}{\theta_{T-vadose}^2} \right) + \left(\frac{D^{water}}{H} \right) \times \left(\frac{\theta_{m-vadose}^{3.33}}{\theta_{T-vadose}^2} \right)$$

$$D_{cap}^{eff} = D^{air} \times \left(\frac{\theta_{v-cap}^{3.33}}{\theta_{T-cap}^2} \right) + \left(\frac{D^{water}}{H} \right) \times \left(\frac{\theta_{m-cap}^{3.33}}{\theta_{T-cap}^2} \right)$$

(v) The abbreviations used in subparagraph (C) of Appendix G(5) of the RSRs shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
α	<u>Attenuation Factor for Diffusion and Advection</u>	<u>calculated</u>	<u>unitless</u>
A_B	<u>Surface Area of the Enclosed Space in Contact with Soil</u>	<u>site-specific</u>	<u>m²</u>
<u>CF</u>	<u>Conversion Factor</u>	<u>1,000</u>	<u>L/m³ or µg/mg</u>
D_{air}	<u>Molecular Diffusion Coefficient in Air</u>	<u>substance-specific</u>	<u>m²/d</u>
D_T^{eff}	<u>Total Effective Diffusion</u>	<u>calculated</u>	<u>cm²/s</u>
D_{crack}^{eff}	<u>Effective Diffusion Through Foundation Cracks</u>	<u>calculated</u>	<u>cm²/s</u>
D_{cap}^{eff}	<u>Effective Diffusion Through Capillary Fringe</u>	<u>calculated</u>	<u>cm²/s</u>
D_{vadose}^{eff}	<u>Effective Diffusion Through Vadose Zone</u>	<u>calculated</u>	<u>cm²/s</u>
D_{water}	<u>Molecular Diffusion Coefficient in Water</u>	<u>substance-specific</u>	<u>m²/d</u>
D_{water}/D_{air}	<u>Ratio of Molecular Diffusion in Water to Air = $\frac{D_{water}}{D_{air}}$</u>	<u>calculated</u>	<u>unitless</u>
E_B	<u>Enclosed Space Air Exchange Rate</u>	<u>site-specific</u>	<u>1/day</u>
<u>GWVC</u>	<u>Groundwater Volatilization Criteria</u>	<u>calculated</u>	<u>µg/L</u>
<u>H</u>	<u>Henry's Law Constant</u>	<u>substance-specific</u>	<u>unitless</u>
<u>k</u>	<u>Soil Vapor Permeability</u>	<u>site-specific</u>	<u>cm²</u>
L_T	<u>Depth from foundation to source</u>	<u>site-specific</u>	<u>m</u>
L_{cap}	<u>Thickness of Capillary Fringe</u>	<u>site-specific</u>	<u>m</u>
L_{crack}	<u>Foundation Thickness</u>	<u>site-specific</u>	<u>m</u>

L_{vadose}	Thickness of Vadose Zone = $L_T - L_{\text{cap}}$	calculated	m
MV	Molar Volume (at standard conditions)	24.45	L
MW	Molecular Weight	substance-specific	g/mol
η	Fraction of Enclosed Space Area Open for Vapor Intrusion	site-specific	m ² /d
$\theta_{\text{m-cap}}$	Volumetric Moisture Content in Cracks in Capillary Fringe	site-specific	unitless
$\theta_{\text{T-cap}}$	Total Porosity in Capillary Fringe	site-specific	unitless
$\theta_{\text{V-cap}}$	Volumetric Vapor Constant in Capillary Fringe = $\theta_{\text{T-cap}} - \theta_{\text{m-cap}}$	calculated	unitless
$\theta_{\text{m-crack}}$	Volumetric Moisture Content in Cracks	site-specific	unitless
$\theta_{\text{T-crack}}$	Total Porosity in Crack	site-specific	unitless
$\theta_{\text{V-crack}}$	Volumetric Vapor Content in Cracks = $\theta_{\text{T-crack}} - \theta_{\text{m-crack}}$	calculated	unitless
$\theta_{\text{m-vadose}}$	Volumetric Moisture Content in Vadose Zone	site-specific	unitless
$\theta_{\text{T-vadose}}$	Total Porosity in Vadose Zone	site-specific	unitless
$\theta_{\text{V-vadose}}$	Volumetric Vapor Content in Vadose Zone = $\theta_{\text{T-vadose}} - \theta_{\text{m-vadose}}$	calculated	unitless
ΔP	Indoor-Outdoor Air Pressure Difference	site-specific	g/ms ²
Q_B	Enclosed Space Volumetric Air Flow Rate = $V_B E_B$	calculated	m ³ /d
Q_{soil}	Pressure Driven Soil Gas Flow Rate from the subsurface into the enclosed space = $(2\pi k \Delta P X_{\text{crack}}) / [\mu \ln(2Z_{\text{crack}}/R_{\text{crack}})]$	calculated	m ³ /d
Q_{soil}/Q_B	Ratio of Soil Gas Intrusion Rate to Building Ventilation Rate = Q_{soil}/Q_B	calculated	unitless
R_{crack}	Effective Crack Radius or Width = $\eta A_B / X_{\text{crack}}$	calculated	m
SVVC	Soil Vapor Volatilization Criteria	calculated	mg/m ³
TAC	Target Indoor Air Concentration calculated using subparagraph (A) or (B), as applicable	substance-specific	μg/m ³
μ	Viscosity of Air	substance-specific	g/ms
VB	Enclosed Space Volume	site-specific	m ³
V_B/V_A	Ratio of Enclosed Space Volume to Exposed Surface Area = V_B/V_A	calculated	m
X_{crack}	Total Length of Cracks through which Soil Gas	site-specific	m

	Vapors are Flowing		
Z_{crack}	Crack Opening Depth Below Grade	site-specific	m

Appendix H to the RSRs

Equations, Terms, and Values for Calculating Release-Specific Alternative Pollutant Mobility Criteria

(1) Release-Specific Pollutant Mobility Criteria shall be calculated using the following equation:

$$\text{Alt PMC} = \text{GWC} \times \text{DF} \left(K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right)$$

(2) The abbreviations in subdivision (1) of Appendix H of the RSRs, shall be interpreted in accordance with the following table and shall be assigned the values specified therein:

<u>Terms</u>	<u>Description</u>	<u>Value</u>	<u>Units</u>
Alt PMC	<u>Alternative Pollutant Mobility Criteria</u>	calculated	mg/kg
GWC	<u>Groundwater Criteria Goal</u>	substance-specific (lowest of groundwater criteria applicable to release area)	mg/L
DF	<u>Dilution Factor</u>	20 or calculated in accordance with section 22a-133k-2(c)(2)(E)(ii) of the RSRs with $F_{\text{adj}} = 0$	unitless
K_d	<u>Distribution Coefficient for Organic Contaminants may be approximated by: $K_{\text{oc}} * f_{\text{oc}}$</u>	substance-specific (see table below for inorganic substances)	L/kg
K_{oc}	<u>Soil Organic Carbon-water Partition Coefficient</u>	substance-specific (see table below for organic substances)	L/kg
f_{oc}	<u>Soil Fraction of Organic Carbon</u>	0.001 or tested for site-specific value (max value = 0.006)	kg/kg
θ_w	<u>Water-filled Soil Porosity</u>	0.28	$L_{\text{water}}/L_{\text{soil}}$
θ_a	<u>Air-filled Soil Porosity</u>	0.15	$L_{\text{air}}/L_{\text{soil}}$
H'	<u>Henry's Law Constant</u>	substance-specific (see tables below)	unitless
ρ_b	<u>Dry Soil Bulk Density</u>	1.5	kg/L

Soil Organic Carbon-Water Partition Coefficient (K_{oc}) and Henry's Law Constant (H') Values for Organic Substances

<u>Substance</u>	<u>K_{oc} (L/kg)</u>	<u>H' (Dimensionless)</u>
<u>Acenaphthylene</u>	6,800	4.51E-03

Substance	K_{oc} (L/kg)	H' (Dimensionless)
Acetone	0.575	1.75E-03
Acrylonitrile	2	4.10E-03
Alachlor	310	4.30E-07
Aldicarb	24.6	5.89E-08
Anthracene	23,500	2.67E-03
Atrazine	360	1.21E-07
Benzene	62	2.26E-01
Benzo(a)anthracene	358,000	1.37E-04
Benzo(a)pyrene	969,000	4.63E-05
Benzo(b)fluoranthene	1,230,000	4.55E-03
Benzo(k)fluoranthene	1,230,000	3.40E-05
Bis(2-chloroethyl)ether	76	7.38E-04
Bis(2-chloroisopropyl)ether	360	3.03E-03
Bis(2-ethylhexyl)phthalate	111,000	4.18E-06
Bromoform	126	2.18E-02
2-Butanone (MEK)	10	1.12E-03
Butyl benzyl phthalate	13,700	5.17E-05
Carbon tetrachloride	152	1.20E+00
Chlordane	51,300	1.99E-03
Chlorobenzene	224	1.61E-01
Chloroform	53	1.39E-01
2-Chlorophenol	398	1.60E-02
Dibromochloromethane (Chlorodibromomethane)	63.1	3.21E-02
1,2-Dichlorobenzene (<i>o</i>)	379	7.95E-02
1,3-Dichlorobenzene (<i>m</i>)	700	1.08E-01
1,4-Dichlorobenzene (<i>p</i>)	616	1.12E-01
1,1-Dichloroethane	53	2.23E-01
1,2-Dichloroethane	38	4.51E-02
1,1-Dichloroethylene	65	6.11E-01
<i>cis</i> -1,2-Dichloroethylene	35.5	1.70E-01
<i>trans</i> -1,2-Dichloroethylene	38	3.80E-01
2,4-Dichlorophenol	159	1.30E-04
2,4-Dichlorophenoxyacetic acid (2,4-D)	29.6	1.45E-06
1,2-Dichloropropane	47	1.16E-01
1,3-Dichloropropene	27	1.44E-01
Dieldrin	25,500	6.19E-04
Di- <i>n</i> -butyl phthalate	1,570	3.85E-08

Substance	K_{oc} (L/kg)	H' (Dimensionless)
<u>Di-<i>n</i>-octyl phthalate</u>	<u>140,000</u>	<u>2.74E-03</u>
<u>Ethylbenzene</u>	<u>204</u>	<u>1.41E-01</u>
<u>Ethylene dibromide (EDB)</u>	<u>66</u>	<u>2.76E-02</u>
<u>Fluoranthene</u>	<u>49,100</u>	<u>6.60E-04</u>
<u>Fluorene</u>	<u>7,710</u>	<u>2.61E-03</u>
<u>Heptachlor</u>	<u>9,530</u>	<u>4.47E-02</u>
<u>Heptachlor epoxide</u>	<u>83,200</u>	<u>3.90E-04</u>
<u>Hexachlorobenzene</u>	<u>80,000</u>	<u>5.41E-02</u>
<u>γ-HCH (Lindane)</u>	<u>1,350</u>	<u>5.74E-04</u>
<u>Hexachloroethane</u>	<u>1,780</u>	<u>1.59E-01</u>
<u>Methoxychlor</u>	<u>80,000</u>	<u>6.48E-04</u>
<u>Methyl isobutyl ketone</u>	<u>65</u>	<u>5.33E-03</u>
<u>Methyl-tert-butyl-ether (MTBE)</u>	<u>34</u>	<u>2.42E-02</u>
<u>Methylene chloride</u>	<u>10</u>	<u>1.31E-01</u>
<u>Naphthalene</u>	<u>1,190</u>	<u>1.98E-02</u>
<u>Pentachlorobenzene</u>	<u>32,100</u>	<u>2.87E-02</u>
<u>Pentachlorophenol</u>	<u>7,960</u>	<u>1.00E-06</u>
<u>Phenanthrene</u>	<u>21,200</u>	<u>9.43E-04</u>
<u>Phenol</u>	<u>28.8</u>	<u>1.63E-05</u>
<u>Pyrene</u>	<u>68,000</u>	<u>4.51E-04</u>
<u>Simazine</u>	<u>147</u>	<u>3.85E-08</u>
<u>Styrene</u>	<u>912</u>	<u>1.07E-01</u>
<u>1,1,1,2-Tetrachloroethane</u>	<u>86</u>	<u>4.51E-01</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>79</u>	<u>1.56E-02</u>
<u>Tetrachloroethylene</u>	<u>265</u>	<u>8.36E-02</u>
<u>Toluene</u>	<u>140</u>	<u>2.74E-01</u>
<u>Toxaphene</u>	<u>95,800</u>	<u>2.46E-04</u>
<u>1,1,1-Trichloroethane</u>	<u>135</u>	<u>9.47E-01</u>
<u>1,1,2-Trichloroethane</u>	<u>75</u>	<u>3.73E-02</u>
<u>Trichloroethylene</u>	<u>94</u>	<u>3.74E-01</u>
<u>Vinyl chloride</u>	<u>18.6</u>	<u>1.14E+00</u>
<u>Xylenes</u>	<u>1,700</u>	<u>2.16E-01</u>

Distribution Coefficient (K_d) and Henry's Law Constant (H') Values for Inorganic Substances

Substance	K_d (L/kg)	H' (Dimensionless)
<u>Antimony</u>	<u>45</u>	=

<u>Arsenic</u>	<u>25</u>	=
<u>Barium</u>	<u>12</u>	=
<u>Beryllium</u>	<u>26</u>	=
<u>Cadmium</u>	<u>17</u>	=
<u>Chromium (hexavalent or total)</u>	<u>31</u>	=
<u>Chromium (trivalent only)</u>	<u>1900</u>	=
<u>Copper</u>	<u>35</u>	=
<u>Cyanide</u>	<u>9.9</u>	=
<u>Lead</u>	<u>900</u>	=
<u>Mercury</u>	<u>0.06</u>	<u>4.67E-01</u>
<u>Nickel</u>	<u>18</u>	=
<u>Silver</u>	<u>0.13</u>	=
<u>Selenium</u>	<u>17</u>	=
<u>Thallium</u>	<u>45</u>	=
<u>Vanadium</u>	<u>1,000</u>	=
<u>Zinc</u>	<u>18</u>	=

Appendix I of the RSRs

Potential Alternative Groundwater Protection Criteria Map

The Department of Energy and Environmental Protection shall make Appendix I available on the Department's Internet website and which shall also be made available at the Department of Energy and Environmental Protection, Division of Water Protection and Land Reuse, 79 Elm Street, 2nd floor, Hartford, Connecticut during regular business hours.

