

# The Remediation Standard Regulations

Connecticut Department of Energy  
and Environmental Protection  
and  
Environmental Professionals Organization  
of Connecticut, Inc.

## **DEEP Disclaimer**

The following presentation was performed by the Remediation Division of the Connecticut Department of Energy and Environmental Protection in April 2016 for the Environmental Professionals of Connecticut (EPOC). The presentation is intended to be an overview of the Remediation Standard Regulation (RSRs), section 22a-133k-1 through 22a-133k-3 of the Regulations of Connecticut State Agencies, which became effective on January 30, 1996 and revised in June 27, 2013. This overview is designed to answer general questions and provide basic information. You should refer to the appropriate statutes for the specific language. It is your responsibility to comply with all applicable laws. The information contained in this presentation is intended only to acquaint you with the Remediation Standard Regulations and does not constitute the Department's interpretation of the applicable laws.

# Remediation Standard Regulations - Introduction

# The Remediation Standard Regulations (“RSRs”)

- ◆ Sections 22a-133k-1 through -3 of the Regulations of Connecticut State Agencies (“RCSA”)
- ◆ Section 22a-133q-1 RCSA
- ◆ On DEEP website ([www.ct.gov/deep](http://www.ct.gov/deep))

**Update Effective June 27, 2013**

# The RSRs (link to regulations)

The screenshot shows a web browser window displaying the Connecticut Department of Energy & Environmental Protection website. The browser's address bar shows the URL: [http://www.ct.gov/deep/reg/htm.asp?fa=2715&qs=32912&deepNav\\_08D=1026](http://www.ct.gov/deep/reg/htm.asp?fa=2715&qs=32912&deepNav_08D=1026). The website header includes the state logo, the text "State of Connecticut", and "Department of ENERGY & ENVIRONMENTAL PROTECTION". A navigation menu contains links for Home, About Us, Programs & Services, Publications, Forms, and Contact Us. Below this, a secondary menu lists ENERGY, ENVIRONMENTAL QUALITY, NATURAL RESOURCES, OUTDOOR RECREATION, and PURA. The main content area is titled "Connecticut Remediation Standard Regulations" and contains the following text:

Connecticut's Remediation Standard Regulations (RSRs) provide detailed standards that may be used at any site to determine whether or not remediation of contamination is necessary to protect human health and the environment.

[Remediation Standard Regulations Fact Sheet](#)

**RSR "Wave 2" Concepts**

Beginning in August 2013, the Department has been releasing [Draft Discussion Documents](#) of concepts for potential future amendments to remediation regulations or new provisions for regulations ("Wave 2"), and is seeking public feedback.

**Risk-Based Decision-Making Evaluation**

[Documents related to the evaluation of risk-based decision-making](#)

**Amended RSRs (effective 6/27/13)**

The amendments to the Remediation Standard Regulations (RSRs) R.C.S.A. 22a-133k-1 through -3 became effective on June 27, 2013.

- [Remediation Standard Regulations \(PDF\)](#), as amended June 27, 2013 [This version contains the RSRs only. Please see the [Environmental Land Use Restrictions](#) webpage for the revised ELUR regulations.]
- A [redlined version, showing the changes from the original RSRs and ELURs](#) (PDF) is also available for the reader's convenience.
- [Hearing Officer's Report \(PDF\)](#) with Appendix IV, Final Text of Proposed Amendments to the Regulations

[Please note, these versions are unofficial and are made available for convenience of the reader, but are not official version of state law. The official version is available from the Secretary of State and published in the Connecticut Law Journal.]

Amendments include, but are not limited to:

The left sidebar contains a "Remediation / Sites Clean-Up" section with links for FAQs, Information for General Public/House Owners, Information for Business & Industry, Towns and Environmental Professionals, Guidance, Policies, Forms, Permits, Remediation / Sites Clean-Up Main Page, and Main Menu. Below this are four buttons: "Report an ENVIRONMENTAL Concern/Problem", "Calendar of Events", "Laws and Regulations", and "Maps and GIS Data".

# Structure

- ◆ Definitions
- ◆ Applicability
- ◆ Soil Remediation Standards
- ◆ Groundwater Remediation Standards
- ◆ Environmental Land Use Restrictions

# Structure

- ◆ Section 22a-133k-3
  - ◆ Subsection 22a-133k-3(a)
    - ◆ Subdivision 22a-133k-3(a)(1)
      - ◆ Subparagraph 22a-133k-3(a)(1)(A)
        - ◆ Clause 22a-133k-3(a)(1)(A)(i)
          - ◆ Subclause 22a-133k-3(a)(1)(A)(i)(aa)

# Definitions

Important terms such as:

- ◆ Analytical detection limit
- ◆ Upgradient/downgradient area
- ◆ Background concentration (different definitions for soil and groundwater)
- ◆ Polluted soil
- ◆ Polluted fill
- ◆ Release area

# Definitions

- ◆ Dilution Factor
- ◆ Dilution and Attenuation Factor /  
Dilution Attenuation Factor
- ◆ Engineered Control
- ◆ ETPH
- ◆ 95% Upper Confidence Level of the  
Arithmetic Mean

# Common Acronyms

- ◆ CSM – Conceptual Site Model
- ◆ AOC – Area of Concern
- ◆ COC – Contaminant /Chemical/Constituent of Concern
- ◆ APS – Additional Polluting Substance
- ◆ SCGD – Site Characterization Guidance Document
- ◆ NAPL – Non-Aqueous Phase Liquid
- ◆ DNAPL/LNAPL – Dense NAPL/Light NAPL
- ◆ UST/AST – Underground Storage Tank/  
Above ground Storage Tank
- ◆ PCB – Polychlorinated Biphenyls
- ◆ TPH – Total Petroleum Hydrocarbons
- ◆ ETPH – Extractable Total Petroleum Hydrocarbons

# Common Acronyms

- ◆ ND – Non-Detect
- ◆ BRL/BDL – Below Reporting Limit/Below Detection Limit
- ◆ SPLP/TCLP – Synthetic Precipitation Leaching Procedure/  
Toxicity Characteristic Leaching Procedure
- ◆ WQS – Water Quality Standards
- ◆ GWPC/SWPC – Groundwater Protection Criteria/  
Surface Water Protection Criteria
- ◆ VolC – Volatilization Criteria
- ◆ DPH – Department of Public Health
- ◆ CFR – Code of Federal Regulations
- ◆ CGS – Connecticut General Statutes
- ◆ RCSA - Regulations of Connecticut State Agencies

# Applicability

The RSRs apply to any action taken to remediate polluted soil, surface water, or a groundwater plume emanating from a release area, provided the action is either:

1. Required by a regulation, statute, or order of the Commissioner pursuant to Chapter 445, 446k, or Section 22a-208a(c)(2) of the Connecticut General Statutes (CGS), or
2. LEP actions required to be taken pursuant to the property transfer program and voluntary cleanup provisions of Sec's. 22a-134a, 22a-133x, or 22a-133y of the CGS.

22a-133k-1(b)

# Applicability

- ◆ Lots of remediation occurs outside established programs
- ◆ DEEP recommends use of RSRs in these situations
- ◆ Also consider public notice requirements of remediation programs (i.e., Property Transfer Program)
- ◆ This may avoid having to do work over in the future

# Purpose of RSRs

- ◆ Establish soil and water clean-up levels that protect human health
- ◆ Protect the environment in a manner consistent with the state's Water Quality Standards
- ◆ *RSRs define clean-up endpoints, not why, how, or when to reach the endpoints*

# Scope

**Do the RSRs require that further remedial actions be taken at sites for which remediation was previously completed and approved by the Commissioner?**

- ◆ No, if work completed and received written approval
- ◆ For work underway, must meet RSR criteria
- ◆ Subsequent actions (property transfer, enforcement, UST regulations) could require additional work

# Scope

## What timeframe is required?

- ◆ RSRs do not set a timeframe for achieving clean-up criteria
- ◆ Timeframes set by implementing mechanisms such as property transfer, enforcement action, RCRA corrective action, UST regulations, etc.
- ◆ Commissioner can expedite timeframe to be protective, if needed

# Scope

## What happens if the regulations change during remediation?

- ◆ Must achieve levels protective of human health and the environment to receive approval
- ◆ If cleanup not yet verified, the regulations in effect at the time of verification would apply

# Representativeness of Sampling Program

- ◆ Sampling program used in the decision making process must be representative of the conditions in the environment
- ◆ Therefore, it is expected that all COCs have been identified and their distribution and variability in the environment have been determined
- ◆ Conceptual Site Model (CSM) important

**Refer to Site Characterization Guidance (SCGD)**

# Guidance Documents

- ◆ Represent an approach DEEP finds acceptable and their use may expedite review and approval
- ◆ Developed by consensus of DEEP and stakeholders
- ◆ Other approaches may be acceptable
- ◆ DEEP recognizes that technology evolves

# Existing Guidance Documents

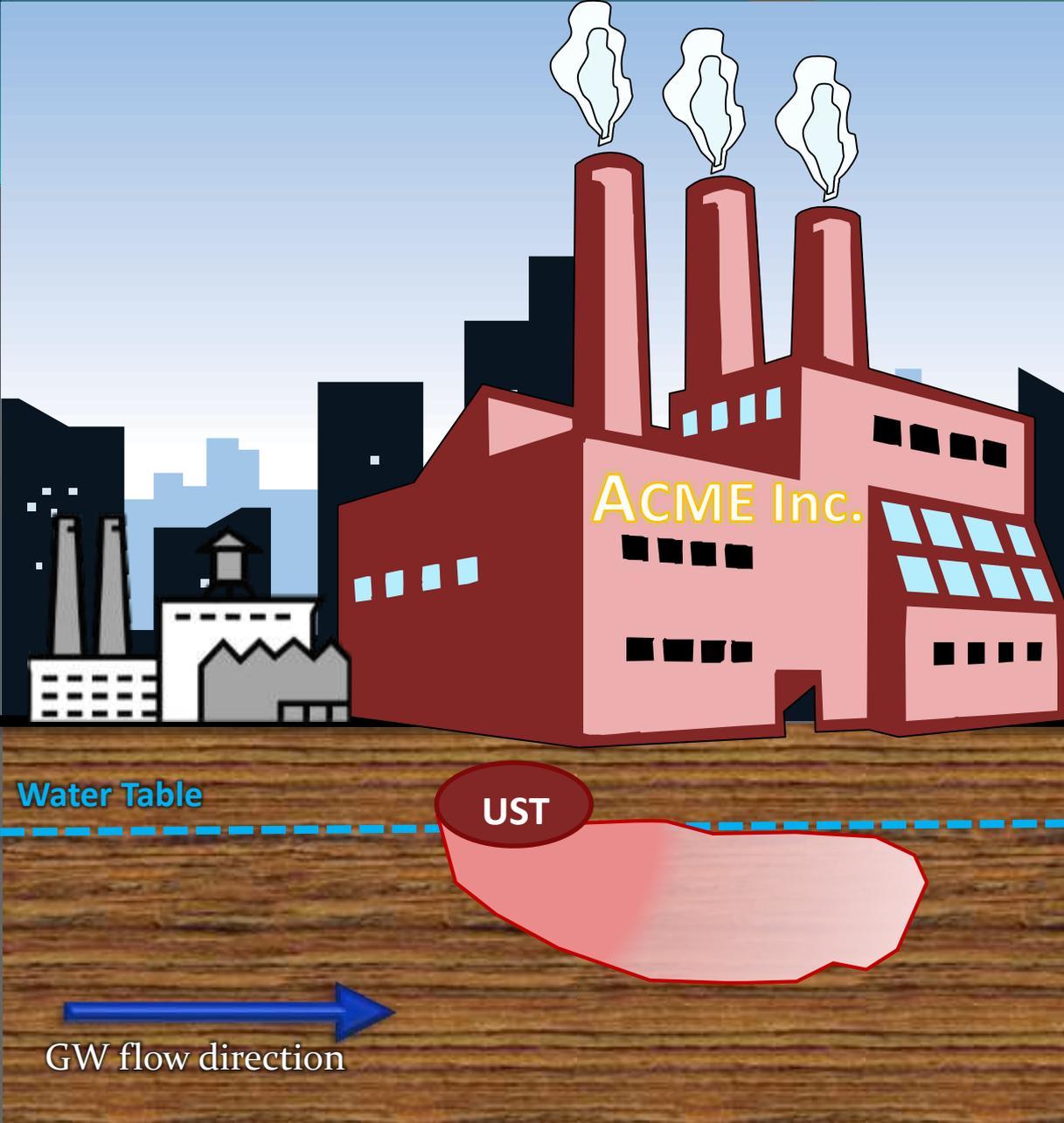
- ◆ Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory Determination of Volatile Organic Compounds
- ◆ Laboratory Quality Assurance Quality Control Reasonable Confidence Protocols
- ◆ Laboratory Quality Control Assurance and Quality Control, Data Quality Assessment and Data Usability Evaluation Guidance Document
- ◆ Environmental Land Use Restriction Guidance Document
- ◆ Site Characterization Guidance Document

# Existing Guidance Documents

- ◆ Guidance for Groundwater Monitoring for Demonstrating Compliance with the Connecticut Remediation Standard Regulations
- ◆ Engineered Control Guidance Document
- ◆ Verification Report Guidance Document (Updated Dec 1, 2013)
- ◆ Water Supply Well Receptor Guidance Document
- ◆ Use of Filters for Groundwater Sampling Technical Memorandum and Guidance
- ◆ Targeted Brownfield Remedy Guidance Document

# “New” Guidance Documents

- ◆ Guidance for Calculating the 95% Upper Confidence Level for Demonstrating Compliance with the Remediation Standard Regulations
- ◆ Guidance for Applying Technical Impracticability of Groundwater Remediation Variance Pursuant to the Remediation Standard Regulations
- ◆ RSR Wave 1 Update Guidance:
  - ◆ Rendering Soil Inaccessible Using Pavement
  - ◆ Pollutant Mobility Criteria Exception for Groundwater Infiltration
  - ◆ Exemptions for Incidental Sources
- ◆ Groundwater Compliance Monitoring Requirements -Fact Sheet dated November, 2014



## History of ACME Inc.

- Neighborhood utilized during Industrial Revolution to manufacture clocks
- Historically high metals concentration in soil
- Groundwater – GB
- Public water available in area
- GW flow to the Southeast
- Sensitive receptors – Little Brook
- Manufactured ACME Widgets since 1965
- Waste Oil UST release of TPH with mixture of VOCs

**Not to Scale**

# Land Use Type

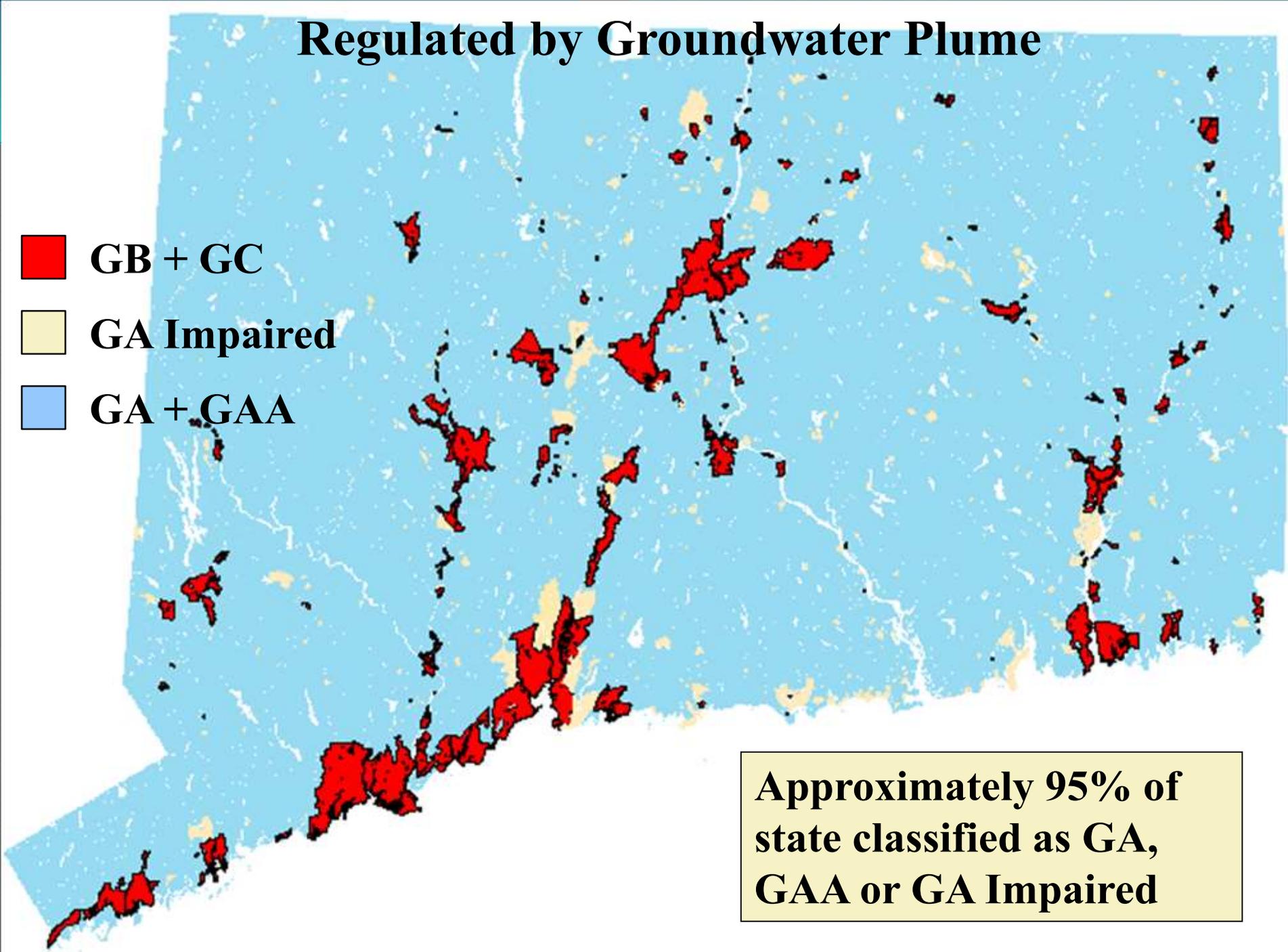
- ◆ 2 major land use types that dictate the appropriate remedial goal
  - ◆ Residential (22a-133k-(1)(58)
    - ◆ any activity related to a (A) residence or dwelling, including but not limited to a house, apartment, or condominium, or (B) school, hospital, day care center, playground, or outdoor recreational area
  - ◆ Industrial/Commercial (I/C) (22a-133k-(1)(33)
    - ◆ 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

# Groundwater Classification

- ◆ 2 major classification that dictate the appropriate remedial goal
  - ◆ GA (also includes GA-impaired and GAA)
    - ◆ Restore to natural quality
  - ◆ GB (also includes GC)
    - ◆ No risk to public health
    - ◆ Protect existing use
- ◆ Classifications based on the Connecticut Water Quality Standards
- ◆ “Classification” means the designation of the proposed uses of surface and ground waters with alphabetic characters which does not signify existing water quality.

# Regulated by Groundwater Plume

-  **GB + GC**
-  **GA Impaired**
-  **GA + GAA**



Approximately 95% of  
state classified as GA,  
GAA or GA Impaired

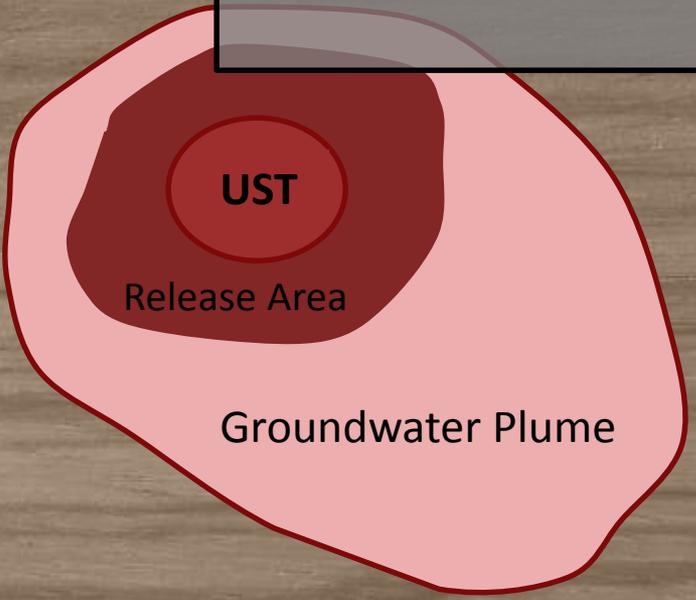
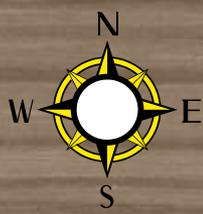
# Soil Standards - Direct Exposure Criteria

# Soil Remediation Standards

## *Important Concepts*

- ◆ Regulated by *release area*
- ◆ Regulated by *substance*
- ◆ “Release area” defined by extent of polluted soil (where detected **at all**, not just where > criteria)

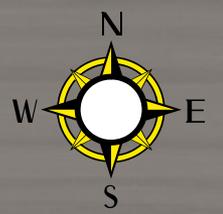
# Release Area



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Release Area

ACME Inc.



Source Area

Groundwater plume

⊗  
ND

⊗ GW Monitoring Well

⊗ Soil Boring

⊗  
ND

⊗  
10ppm

⊗  
100ppm

⊗  
10ppm

⊗

500 ppb

⊗  
ND

⊗  
25ppm

⊗  
5ppm

⊗  
30 ppb

⊗  
ND

⊗  
1ppm

⊗  
ND

⊗  
15 ppb

⊗  
5 ppb

⊗  
ND



Not to Scale

# Soil Remediation Standards

## *Important Concepts (cont'd)*

- ◆ Baseline criteria
- ◆ Additional Polluting Substances (APS)
- ◆ Options & Alternatives
  - ◆ Based on different human exposure assumptions or hydrologic conditions
- ◆ Environmental Land Use Restrictions

# Soil Remediation Standards

## *Important Concepts (cont'd)*

- ◆ Exceptions
  - ◆ Some require Commissioner's approval
- ◆ Variances
  - ◆ All require Commissioner's approval
- ◆ Exceptions and Variances are based on preventing or controlling exposures

# Soil Criteria

Polluted soil at a release area shall be remediated to a concentration that meets either:

- ◆ **Direct Exposure Criteria**

- ◆ dependent on land use

&

- ◆ **Pollutant Mobility Criteria**

- ◆ dependent on groundwater classification

OR

- ◆ **Background**

- ◆ concentration that naturally occurs in soil
- ◆ dependent on local (not regional) sampling data

# Cleanup to Background

- ◆ Requires notice to Commissioner –  
Which includes:
  - ◆ Description of subject area & soil characteristics
  - ◆ Map of subject release area, other release areas in the vicinity, and all soil samples collected for the purpose of determining background
  - ◆ Laboratory results of such samples

# Direct Exposure Criteria (DEC)

*Purpose* - minimize health risk from direct contact and ingestion of soil

*Apply* - to polluted soil within 15 feet of the surface (regardless of the location of the water table in relation to the ground surface)

# Direct Exposure Criteria

## ◆ *Residential*

- ◆ Applies to Residential *and* I/C property (if I/C - property can choose I/C option instead)

## ◆ *Industrial/Commercial (I/C)*

- ◆ Option (alternative to Residential criteria) if site will not be used for residential purposes *and ELUR recorded by owner*
- ◆ should consider zoning

Both Criteria listed in in Appendix A

# Direct Exposure Criteria Compliance

- ◆ Laboratory analyses of all samples from the release are below applicable criteria

**or**

- ◆ 95% Upper Confidence Level (95% UCL) of the arithmetic mean for each substance from the release area, which is a statistically derived value which equals or exceeds the true mean 95% of the time, is below applicable criteria

# Direct Exposure Criteria

## Exception – Incidental Sources

DEC does not apply to metals, petroleum hydrocarbons, and SVOCs in soil, if:

- ◆ Pollution is due to normal operation of motor vehicles (which cannot include refueling, repair, or maintenance of motor vehicles); or
- ◆ Normal paving and maintenance of asphalt, providing that such pavement has been maintained for its intended purpose

Guidance available on DEEP Website

# Direct Exposure Criteria

## Alternative Criteria and

## Alternative Method of Determining Compliance

- ◆ Submit risk assessment for Commissioner's approval (*use transmittal form*)
- ◆ Need to demonstrate that exposure pathways are substantially different than baseline assumptions
- ◆ For one substance
  - ◆ Risk of  $10^{-6}$  (for carcinogens)
  - ◆ Hazard Index of 1 (for non-carcinogens)
- ◆ For multiple substances
  - ◆ Cumulative risk of  $10^{-5}$
  - ◆ Cumulative Hazard Index of 1
- ◆ PCBs must be consistent with 40 CFR 761 and "Guidance on Remedial Actions at Superfund Sites with PCB Contamination" 22a-133k-2(d)(2)&(7)

# Direct Exposure Criteria

## Exception - **Inaccessible Soil**

- ◆ More than four feet below surface
- ◆ More than two feet below 3-inch paved surface pavement sub-base included
- ◆ Beneath an existing building
- ◆ Beneath other permanent structure with written notice provided to the Commissioner (*use transmittal form*)

# Direct Exposure Criteria

## Exception - Inaccessible Soil Cont'd

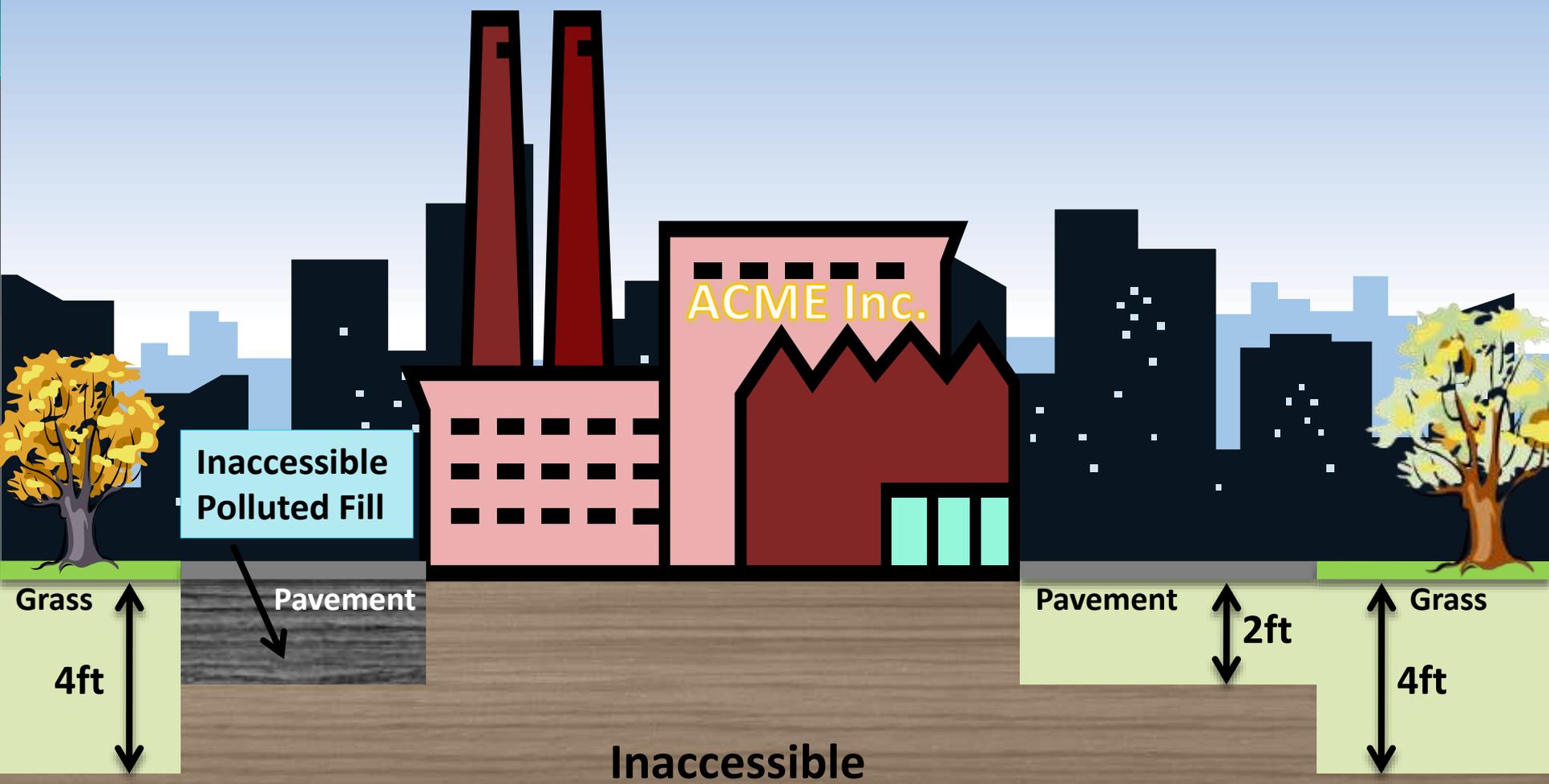
- ◆ Polluted fill beneath 3-inch paved surface is considered inaccessible, as long as such fill is:
  - ◆ Polluted only by SVOCs or Petroleum Hydrocarbons that are normal constituents of asphalt;
  - ◆ Polluted by metals in concentrations not in excess of 2x the applicable DEC; or
  - ◆ Any combination of the two conditions
- ◆ 2' of clean fill not needed when the above criteria are met – Guidance on DEEP Website

# Direct Exposure Criteria

## Inaccessible Soil - ELUR

- ◆ An Environmental Land Use Restriction (“ELUR”) must be recorded for Inaccessible Soil before remediation is considered complete - Only the landowner can record an ELUR
- ◆ ELUR must require that inaccessible soil will not be excavated or disturbed and any overlying building will not be demolished unless ELUR is released

# Direct Exposure Criteria



# Direct Exposure Criteria

## Variance – Engineered Control

- ◆ Concept of a “DEC only” Engineered Control formally added to the RSRs
- ◆ Engineered Control was formerly a PMC concept only (although it has always been acknowledged to control Direct Exposure, as well)
- ◆ Engineered Controls to be discussed further in next section (PMC)

# Direct Exposure Criteria PCBs

- ◆ Residential = 1 ppm
- ◆ Industrial for outdoor electrical substation or “restricted access” = 10 ppm
- ◆ Other restricted access location = as defined in 40 CFR 761.123
- ◆ ELUR required for “other restricted access location” area

# Direct Exposure Criteria PCBs

- ◆ Only substance with a criteria for inaccessible soil
  - ◆ Inaccessible criteria (w/ required ELUR) = 10 ppm
    - ◆ “Other restricted access location” = 25 ppm
    - ◆ “Outdoor electrical substation”, as defined in 40 CFR 761.123 = 25 ppm
      - ◆ Substation with label or notice, in accordance with 40 CFR 761 = 50 ppm

# Direct Exposure Recap

## ◆ Baseline

- ◆ Appendix A or Naturally Occurring Background (notice)
- ◆ Additional Polluting Substances (needs approval)

## ◆ Options

- ◆ Industrial Criteria (with ELUR – also in Appendix A)
- ◆ Alternative Criteria (needs approval)

## ◆ Exceptions

- ◆ Incidental Sources (self-implementing)
- ◆ Inaccessible Soil (with ELUR)

## ◆ Variance

- ◆ Engineered Control (with ELUR/Financial Assurance)

## Question 1

During an investigation at a site, it has been determined that there has been releases (non-PCB) to floor drains located inside of a building resulting in exceedances of the applicable residential DEC for several substances.

The property owner would like to convert the building to apartments but has funds to either remediate the releases or build the apartments, not both.

What options does the owner have?

## Question 1

During an investigation at a site, it has been determined that there has been releases (non-PCB) to floor drains located inside of a building resulting in exceedances of the applicable residential DEC for several substances. The property owner would like to convert the building to apartments but has funds to either remediate the releases or build the apartments, not both. What options does the owner have?

- a. Remediate the releases to comply with the residential DEC and build at a later time.
- b. Place an ELUR on the property restricting use to industrial/commercial and apply to DECD for funds under the BRRP Program.
- c. Render the contaminated soil under the floor inaccessible and place an ELUR on the property, thereby allowing for residential units.
- d. Either a. b. or c

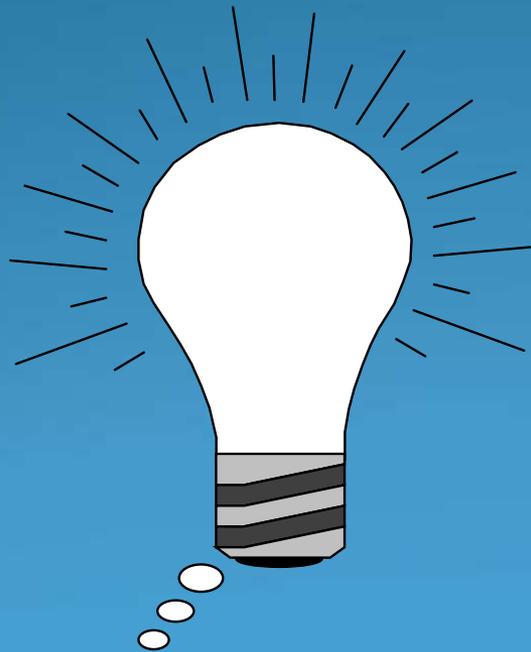
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- b. Place an ELUR on the property restricting use to industrial/commercial and apply to DECD for funds under the BRRP Program.
- c. Render the contaminated soil under the floor inaccessible and place an ELUR on the property, thereby allowing for residential units.
- d. **Either a. b. or c**

**All three options are available but for this scenario the owner preferred answer C. 22a-133k-2(b)(3) states that, “The direct exposure criteria for substances other than PCB do not apply to inaccessible soil...”**

# Direct Exposure Criteria



Q & A

# Soil Standards - Pollutant Mobility Criteria

# Pollutant Mobility Criteria

## Purpose

- ◆ GA - to prevent *any* pollution of the groundwater
- ◆ GB - to prevent unacceptable *further degradation* of the groundwater

# Pollutant Mobility Criteria

- ◆ Applies to polluted soil above the seasonal *low* water table
- ◆ EXCEPT it applies to polluted soil above the seasonal *high* water table if one or more of the following conditions are met:
  - ◆ Remediation is not technically practicable (burden of proof required at verification) *or*
  - ◆ Remediation would not result in permanent elimination of source (also requires burden of proof at verification) *or*
  - ◆ In GB area

# Pollutant Mobility Criteria

## **Baseline - VOCs, SVOCs, & TPH**

- ◆ Mass concentration compared to appropriate pollutant mobility criteria (mg/kg)
- ◆ Appendix B to RSRs
- ◆ See 2006 guidance on VOC sample collection (defines level of care expected during collection of samples for comparison with the RSRs)
- ◆ [http://www.ct.gov/deep/lib/deep/site\\_clean\\_up/guidance/soil\\_sampling\\_voc\\_final\\_wcomments.pdf](http://www.ct.gov/deep/lib/deep/site_clean_up/guidance/soil_sampling_voc_final_wcomments.pdf)

# Pollutant Mobility Criteria

## **Baseline** - Inorganics and PCBs

- ◆ TCLP/ SPLP result (mg/L) compared to appropriate pollutant mobility criteria
- ◆ Also in Appendix B to RSRs

NOTE: Mass result divided by 20 may be compared to the pollutant mobility criteria (mg/L) for site characterization – This “Rule of Thumb” is not valid for demonstration of compliance with the RSRs

# Pollutant Mobility Criteria

## Option for VOCs, SVOCs, & TPH (GA Area)

- ◆ May use TCLP/SPLP compared to groundwater protection criteria (GWPC) in Appendix C

# Pollutant Mobility Criteria Self-Implementing Options

In GA areas for VOCs:

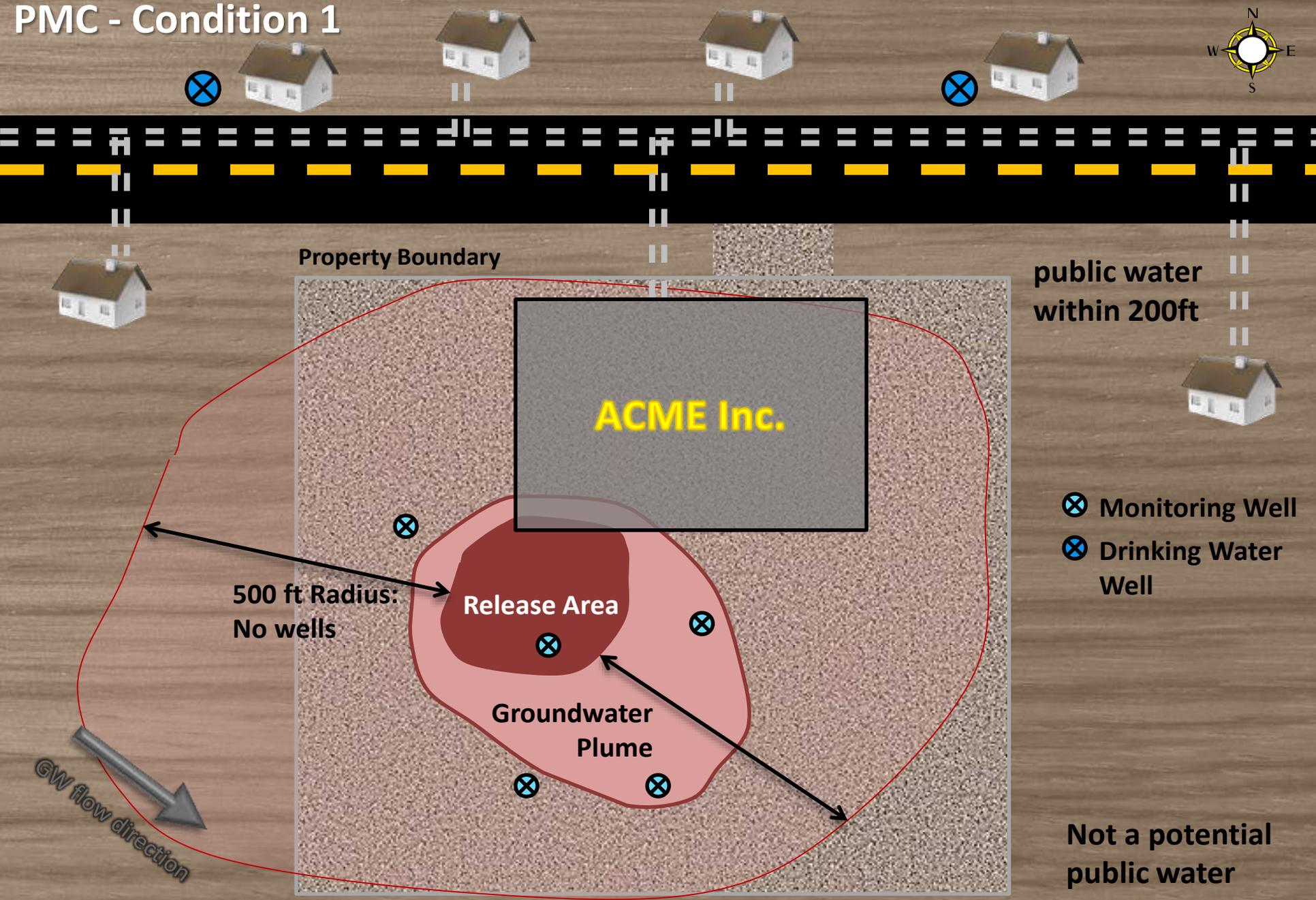
- ◆ TCLP/SPLP compared to 10x GWPC, or
- ◆ Mass compared to 10x PMC, or
- ◆ Mass compared to PMC x approved dilution or dilution/attenuation factor, **if**
  - ◆ No NAPL
  - ◆ Water table at least 15 feet above bedrock
  - ◆ Downward vertical flow less than horizontal flow **and**
  - ◆ 1 of 3 conditions are met

# Pollutant Mobility Criteria

## VOC GA 10x - *Condition 1*

- ◆ Public water supply available within 200 feet of the subject parcel, all adjacent parcels, and any parcels within the areal extent of the groundwater plume caused by the subject release area
- ◆ Groundwater within the plume not used for drinking
- ◆ No supply wells within 500 feet of release area
- ◆ Not a potential public water supply resource

# PMC - Condition 1



public water  
within 200ft

500 ft Radius:  
No wells

Release Area

Groundwater  
Plume

ACME Inc.

- ⊗ Monitoring Well
- ⊗ Drinking Water Well

Not a potential  
public water  
supply resource

Not to Scale

# Pollutant Mobility Criteria

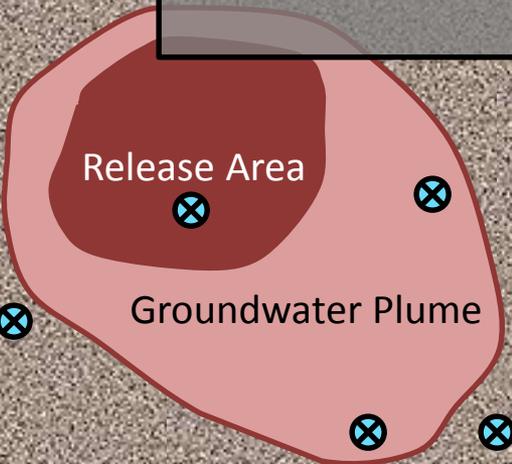
## VOC GA 10x - Condition 2

- ◆ Concentration of plume within 75 feet of the downgradient property line below GWPC
- ◆ Steady state plume
- ◆ Notice provided to Commissioner (*Form available on DEEP Website*)

# PMC - Condition 2



Property Boundary



- ⊗ Monitoring Well
- ⊗ Drinking Water Well



>75 ft

- GW Concentration <GWPC
- Plume Steady State
- Notice Provided

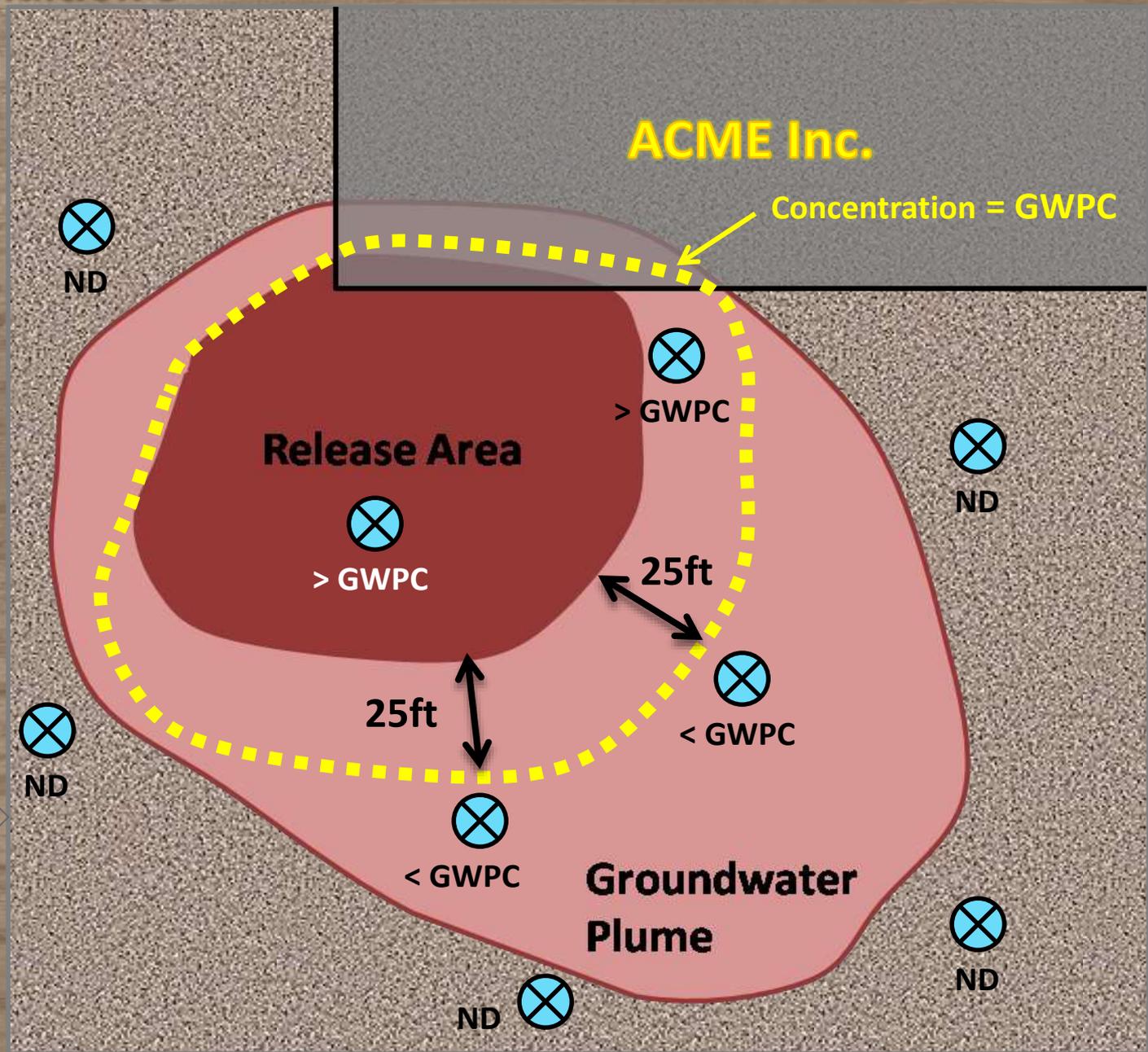
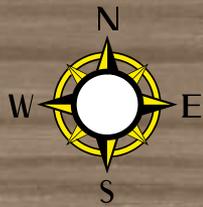
Not to Scale

# Pollutant Mobility Criteria

## VOC GA 10x - *Condition 3*

- ◆ Concentration of plume 25 feet downgradient of the release area is below GWPC
- ◆ Notice provided to Commissioner (*Form available on DEEP Website*)

# PMC - Condition 3



Not to Scale

Property Boundary

# Pollutant Mobility Criteria Self-Implementing Options

For Inorganics, SVOCs, PCBs, & Pesticides in a  
GA area:

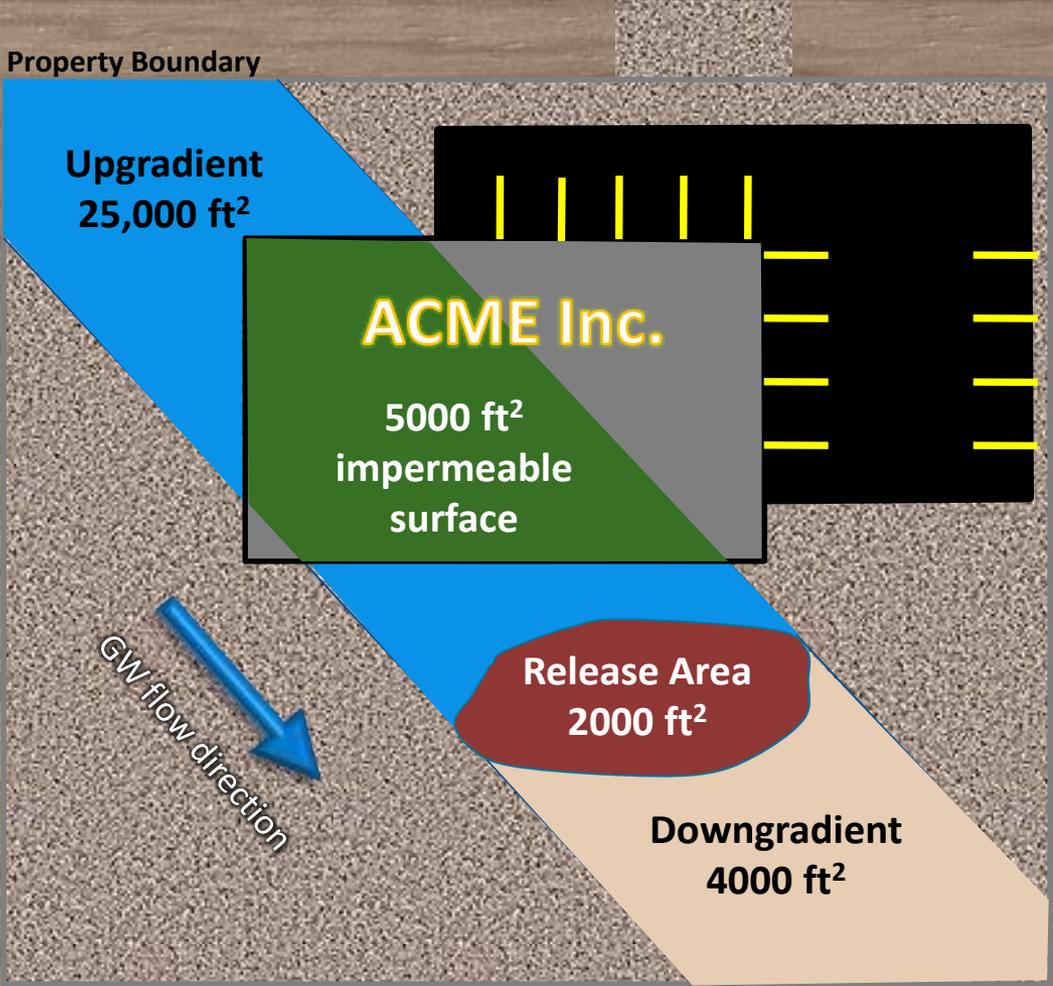
- ◆ TCLP/SPLP compared to 10x GWPC, or
- ◆ Mass compared to 10x PMC, **if**
  - ◆ Release area at least 25 feet from downgradient property line
  - ◆ No NAPL
  - ◆ Water table at least 15 feet above bedrock

# Pollutant Mobility Criteria Self-Implementing Options

In a GB area, provided that no NAPL is present -  
TCLP or SPLP compared to GWPC times:

- ◆ 10
- ◆ Ratio of the summation of the on-site areas up and downgradient of the release area to the release area ( $\leq 500$ ) “Ratio Method”
- ◆ Alternative Dilution or Dilution/Attenuation Factor

# GB ADF Based on Upgradient & Downgradient Areas



Since Building is impermeable the effective upgradient area is

$$25,000 \text{ ft}^2 - 5,000 \text{ ft}^2 = 20,000 \text{ ft}^2$$

$$(20,000 \text{ ft}^2 + 4000 \text{ ft}^2) / 2000 \text{ ft}^2 = 12$$

ADF = 12  
Acceptable <500

Not to Scale

# Pollutant Mobility Criteria Self-Implementing Options

In a GB area, TCLP or SPLP compared to GWPC times a DF or Mass compared to GA PMC times a DF:

- ◆  $DF = (1 + K_{id}/IL)(1 - F_{adj})$
- ◆ Provided that:
  - ◆ No NAPL
  - ◆ Notice to Commissioner (*Form on DEEP Website*)
  - ◆ Need at least 15 feet of unconsolidated aquifer above bedrock
  - ◆ Downward vertical flow less than horizontal

$$DF = (1 + K_{id}/IL)(1 - F_{adj})$$

DF = site specific dilution factor

K = hydraulic conductivity

i = horizontal gradient

d = 15' (depth) (specified)

I = infiltration rate (specified)

L = length of release area parallel to flow

$F_{adj}$  = background concentration for groundwater divided by the GWPC

# Determining the Presence of NAPL

Presence of NAPL in soil to be determined using the following formula:

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

where:

$C_{\text{NAP}}$  = concentration at or above which NAPL is present

$S$  = effective solubility

$\rho_b$  = dry soil bulk density

$K_d$  = soil-water partition coefficient (approximated by  $K_{\text{OC}} * f_{\text{OC}}$ )

$K_{\text{OC}}$  = soil organic carbon-water partition coefficient

$f_{\text{OC}}$  = fraction organic carbon of soil

$\theta_w$  = water-filled soil porosity ( $L_{\text{water}}/L_{\text{soil}}$ )

$\theta_a$  = air-filled soil porosity ( $L_{\text{air}}/L_{\text{soil}}$ )

$H'$  = Henry's law constant (dimensionless)

# Pollutant Mobility Criteria

## Exception for *Environmentally Isolated Soil*

- ◆ Beneath existing building or other structure approved by the Commissioner

Note - Building includes roof, walls, floor, etc.

Other structure examples - bridge abutment, large AST, clarifier, etc.

- ◆ Other conditions on next slide:

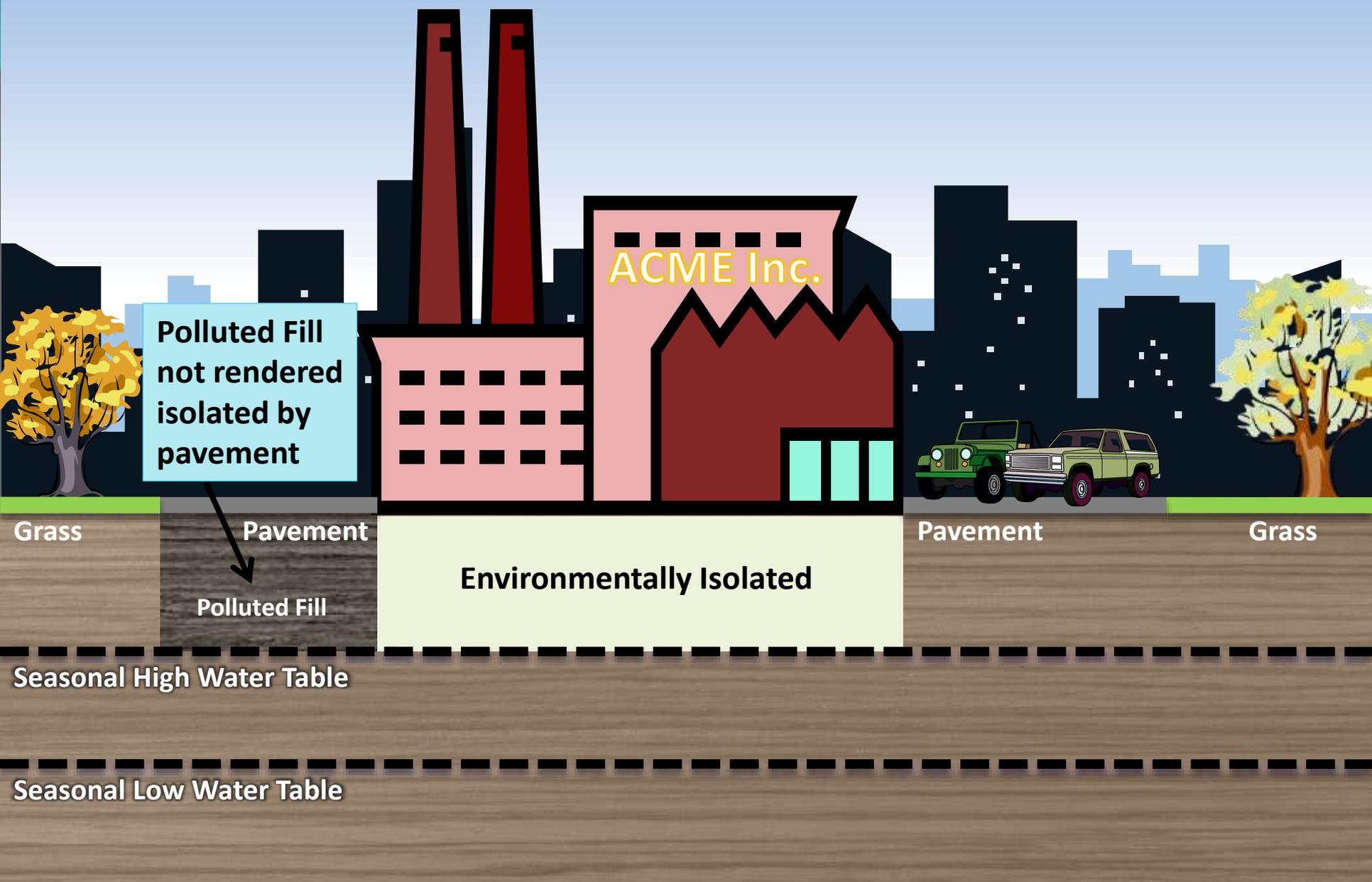
# Pollutant Mobility Criteria

## Exception for *Environmentally Isolated Soil*

Must meet the following conditions:

- ◆ Not a continuing source of pollution (i.e. no NAPL present)
- ◆ Not polluted with VOCs (or if polluted with VOCs, they have been remediated to the maximum extent prudent because VOCs can migrate to building interior or groundwater through the vapor phase)
- ◆ Above seasonal high water table (does not come in contact with the overburden aquifer)
- ◆ Requires the recordation of an ELUR

# Pollutant Mobility Criteria



Not to Scale

# Pollutant Mobility Criteria Exception for Polluted Fill

PMC does not apply to fill material solely polluted with coal ash, wood ash or asphalt fragments, provided:

- ◆ VOCs not present above applicable PMC;
- ◆ meets direct exposure criteria;
- ◆ the water supply is and will not be affected;
- ◆ public water available within 200 feet; and
- ◆ the fill was not placed illegally.

# Pollutant Mobility Criteria

## Exception for Groundwater Infiltration

PMC does not apply to substances, other than VOCs, in soil, if:

- ◆ (Self-Implementing) 80% of release area has been subject to infiltration (not obstructed by anthropogenic features) for five years, **or**
- ◆ (Commissioner's Approval) release area has been subject to sufficient infiltration, **and**

(NOTE: Further Guidance available on DEEP Website)

# Pollutant Mobility Criteria

## Exception for Groundwater Infiltration Cont'd (GA Areas)

Groundwater sampled for four consecutive quarters:

- ◆ Groundwater must meet GWPC and SWPC
- ◆ Groundwater samples must be collected in locations most likely to be contaminated
- ◆ Groundwater sample locations must be representative of the plume and the areal extent of plume must not be increasing over time, except for seasonal variations

# Pollutant Mobility Criteria

## Exception for Groundwater Infiltration Cont'd (GB Areas)

Groundwater sampled for four consecutive quarters:

- ◆ Groundwater must meet SWPC
- ◆ Groundwater must also meet GWPC in aquifer protection area or other area used as drinking water source
- ◆ Groundwater samples must be collected in locations most likely to be contaminated
- ◆ Sample locations must be representative of the plume and the areal extent of plume must not be increasing over time, except for seasonal variations

# Pollutant Mobility Criteria

## Exception for Incidental Sources

PMC does not apply (self-implementing) to metals, petroleum hydrocarbons, and SVOCs in soil, if:

- ◆ Pollution is due to normal operation of motor vehicles (which cannot include refueling, repair, or maintenance of motor vehicles); or
- ◆ Normal paving and maintenance of asphalt, providing that such pavement has been maintained for its intended purpose

Guidance available on DEEP Website

# Pollutant Mobility Criteria

## Additional Polluting Substances

- ◆ For substances for which a PMC does not exist, one must be developed
- ◆ Process will be discussed in later presentation

# Pollutant Mobility Criteria *Alternatives*

- ◆ Alternative Pollutant Mobility Criterion
- ◆ Alternative means of compliance
- ◆ Alternative Dilution Factor or Dilution Attenuation Factor
- ◆ Submit for Commissioner's approval  
*(Form on DEEP Website)*

# Alternative PMC for GA Areas

Request for approval of alternative PMC, alternative demonstration of compliance, or alternative dilution/dilution attenuation factor must demonstrate that release area will not degrade groundwater (exceed the GWPC) and/or prevent attainment of applicable groundwater remediation standards

# Alternative PMC for GB Areas

Request for approval of alternative PMC, alternative demonstration of compliance, or alternative dilution/dilution attenuation factor must demonstrate that groundwater at nearest downgradient property line will not exceed the GWPC

# Application of Pollutant Mobility Criteria

- ◆ Sampling needs to be representative of release area
- ◆ Two scenarios:
  - ◆ Less than 20 samples
  - ◆ More than 20 samples

# Applying the PMC - Less than 20 Samples

All samples must be below  
the applicable criteria

# Applying the PMC - More than 20 Samples

- ◆ All samples must meet applicable criteria

or

- ◆ The 95% UCL of the arithmetic mean of all samples is less than applicable criteria

# Variance from PMC

## **WIDESPREAD polluted fill**

PMC does not apply if:

- ◆ Geographically extensive (regional condition - not just site)
  - ◆ Example - fill areas near coastal harbors
- ◆ Meets Direct Exposure Criteria
- ◆ Will not affect drinking water supply
- ◆ Placement was not prohibited by law
- ◆ No VOCs

# Variations from PMC (and/or DEC) **Engineered Control of Polluted Soil**

Variance from PMC (and DEC) can be requested if:

- ◆ Commissioner authorized disposal
- ◆ Remediation of substance not technically practicable
- ◆ Commissioner determines that the removal creates unacceptable risk to human health
- ◆ Commissioner determines, after providing opportunity for public input, that control is acceptable because the cost of removal outweighs risk to human health and the environment if the engineered control fails

# Variances from PMC (and/or DEC) **Engineered Control of Polluted Soil**

## Definition:

"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 inspection, maintenance or monitoring.

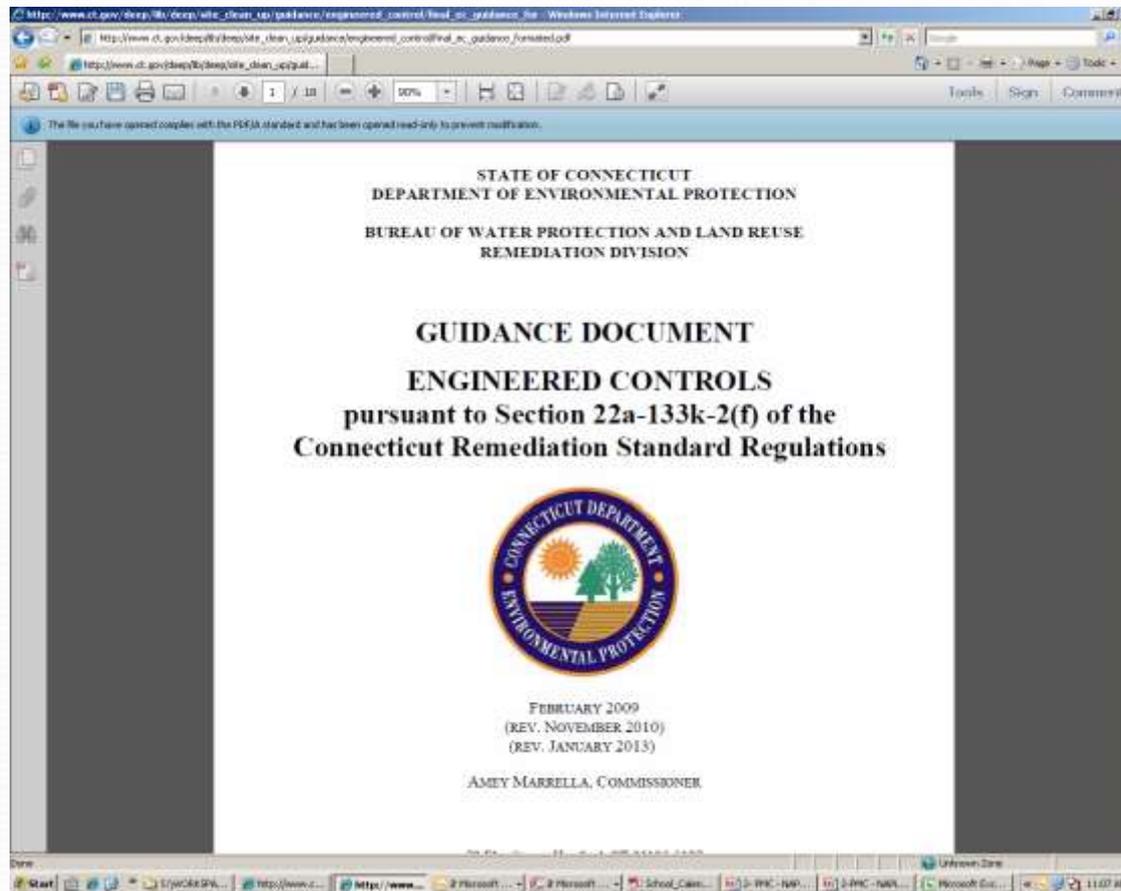
# Variations from PMC (and/or DEC) Engineered Control of Polluted Soil

An Engineered Control must accomplish the following performance standards:

- ◆ Physically isolate polluted soil
- ◆ Minimize migration of liquids – permeability  $< 10^{-6}$  (PMC only)
- ◆ Ensure that cap is and remains effective
- ◆ Plan for monitoring groundwater to ensure that any substances migrating will be detected (PMC only)
- ◆ Maintenance plan
- ◆ ELUR
- ◆ Financial Assurance

# Engineered Control Guidance available on DEEP Website

[http://www.ct.gov/deep/lib/deep/site\\_clean\\_up/guidance/engineered\\_control/final\\_ec\\_guidance\\_formated.pdf](http://www.ct.gov/deep/lib/deep/site_clean_up/guidance/engineered_control/final_ec_guidance_formated.pdf)



# PMC Recap

## ◆ **Baseline Criteria**

- ◆ Appendix B or Background
- ◆ Additional Polluting Substances

# PMC Recap cont'd

## ◆ Options

- ◆ (c)(2)(A) Comparison with GWPC (GA) (self implementing)
- ◆ (c)(2)(B),(C) Additional Dilution Factors (GA) (self implementing)
- ◆ (c)(2)(D),(E) Additional Dilution Factors (GB) (self implementing)

# PMC Recap cont'd

## ◆ Exceptions

- ◆ (c)(4)(A) Environmentally Isolated Soil (needs ELUR)
- ◆ (c)(4)(B) Polluted Fill (coal ash, wood ash, asphalt paving fragments) (self implementing)
- ◆ (c)(4)(C) Groundwater Infiltration (both self implementing and Commissioner approval options)
- ◆ (c)(5) Incidental Sources (vehicles/parking lot) (self implementing)

# PMC Recap cont'd

## ◆ Alternatives

- ◆ (d)(3),(5) Alternative Criteria and/or Alternative Demonstration of Compliance (GA and GB) (needs approval)
- ◆ (d)(4),(6) Alternative Dilution or Attenuation Factors (GA and GB) (needs approval)

# PMC Recap cont'd

## ◆ Variances

- ◆ (f)(1) Widespread Polluted Fill (PMC only) (needs Commissioner approval)
- ◆ (f)(2) Engineered Control (PMC and/or DEC) (needs Commissioner approval and ELUR/Financial Assurance)

## Question 1

During the investigation of a site, you discover a release area that has soil contaminated above the PMC. How should you deal with the contaminated soil?

## Question 1

During the investigation of a site, you discover a release area that has soil contaminated above the PMC. How should you deal with the contaminated soil?

- a. Collect enough samples (20) to be able to perform a 95% UCL calculation to demonstrate compliance
- b. Perform no remediation
- c. Cover with an Engineered Control (requiring Financial Assurance and ELUR)
- d. Excavate or Remediate Soil
- e. Potentially any of the above

## Question 1

An excavation has been used on a site to clean up a release area by the removal of the contamination. The confirmation samples include detections above the PMC criteria. How would you proceed to demonstrate compliance?

e. Potentially any of the above

Depending on the site conditions:

- a. Collect enough samples (20) to be able to perform a 95% UCL calculation to demonstrate compliance - appropriate if the data/calculation supports it
- b. Perform no remediation - possible if the release area is 80% uncovered and there is no groundwater contamination **or** if the contamination is due to an incidental source (automobile use/parking lot run-off)
- c. Cover with an Engineered Control (requiring Financial Assurance and ELUR) - possibly the best choice if DEC is also an issue

## Question 2

During the investigation of a site, you discover a release area that is half-covered by a parking lot and contains soil contaminated above the PMC. Can you use the lack of a plume resulting from the release area to demonstrate compliance with the PMC?

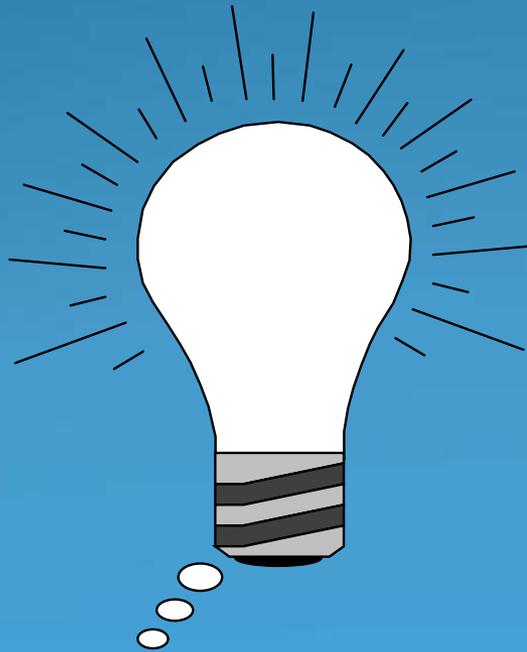
## Question 2

During the investigation of a site, you discover a release area that is half-covered by a parking lot and contains soil contaminated above the PMC. Can you use the lack of a plume resulting from the release area to demonstrate compliance with the PMC?

No. The self-implementing exception that allows PMC to not apply to a release area based on the lack of a resulting groundwater plume has a requirement that the release area be at least 80% uncovered by anthropogenic features, like the parking lot.

While the parking lot is not considered impermeable to render the soil environmentally isolated, it still affects the infiltration of water through the contaminated soil to the point that there is a concern that there may be a plume if the parking lot was to be removed (change in site conditions).

# Pollutant Mobility Criteria



Q & A

# Additional Polluting Substances

# Direct Exposure Criteria

## Additional Polluting Substances

- ◆ RSRs have cleanup criteria for 88 substances
- ◆ If a substance has been detected on site and is not one of the 88 substances, a numeric criterion must be requested and approved by the Commissioner (APS)
- ◆ This applies to DEC as well as PMC
- ◆ Surface Water Protection Criteria (SWPC) and Volatilization Criteria “APS” are an alternative to cleaning up to background

# Direct Exposure Criteria

## Additional Polluting Substances

- ◆ DEEP has two options for requesting criteria for APS
- ◆ Fast-Track option=Fast turnaround (approximately 1 week)
- ◆ Calculated option= Slower turnaround (more detailed review needed)
- ◆ Details and forms available on [APS Webpage](#)

# Additional Polluting Substances/Alternative Criteria **Fast-Track Option**

- ◆ DEEP has published numeric criteria that are available for expedited review and approval on a site-specific basis
- ◆ Form on DEEP website
- ◆ Approximately one week turnaround
- ◆ Transmittal Form not needed
- ◆ 2008 Draft RSRs not longer available as “readily-approvable” APS

# Fast-Track Form



Department of Energy & Environmental Protection  
 Bureau of Water Protection and Land Reuse  
 Remediation Division  
 79 Elm Street, Hartford, CT 06106-5127  
 (860) 424-3705 • [www.ct.gov/deep/remediation](http://www.ct.gov/deep/remediation)

.....DEEP USE ONLY (Date Stamp).....

## REQUEST FOR APPROVAL OF CRITERIA FOR ADDITIONAL POLLUTING SUBSTANCES AND CERTAIN ALTERNATIVE CRITERIA

In accordance with Sections 22a-133k-1 through k-3 of the Regulations of Connecticut State Agencies

This form is prescribed by the Commissioner and must be completed when requesting the Commissioner's approval to use site-specific cleanup criteria for Additional Polluting Substances and certain Alternative Criteria. For use of the criteria listed below for the site identified in this form, the Commissioner's approval is required pursuant to the Remediation Standard Regulations, Sections 22a-133k-1 through 22a-133k-3 (RSRs) of the Regulations of Connecticut State Agencies (RCSA).

If this request is for an anticipated Property Transfer Act Form I, II, or IV filing, the approval will be conditional on the submittal of such filing within one year of the date of this approval. After such time, if such filing was not submitted, this approval automatically expires.

In all other cases, the approval expires eight years from the date approved unless otherwise extended by the Commissioner in writing, or unless a Verification, Interim Verification, or Final Remedial Action Report (in the case of DEEP-lead or Voluntary Remediation under CGS Section 22a-133y only) is submitted within said timeframe.

All sections of this form must be completed, as applicable.

Check the box to indicate the program for which this form is being submitted:

Connecticut General Statutes (CGS) section 22a-134(a)-(e), Property Transfer Program

CGS section 22a-133x, Voluntary Remediation Program

CGS section 22a-133y, Voluntary Remediation Program

Other (specify) .....

**Site Identification** → RemID# .....

Name of Site: .....

Street Address: .....

City/Town: ..... State: .. Zip Code: .....

Groundwater Classification: .....

**Contact Information**

Certifying Party (if Property Transfer): ..... →  N/A

Person submitting Request: ..... Title: .....

Business Name: ..... E-mail Address: .....

Mailing Address: .....

City/Town: ..... State: .. Zip Code: .....

Business Phone: ..... Ext. .... Fax: .....

Request to use the 2003 Draft Volatilization and Soil Vapor Criteria Tables C2 and C3, as revised in 2015.

"I hereby request approval, in accordance with Sections 22a-133k-2(b)(5), 22a-133k-2(c)(6), 22a-133k-3(h), 22a-133k-3(b)(3)(B), and/or 22a-133k-3(c)(4)(B) of the RCSA, to use the criteria selected in the table below for Additional Polluting Substances at the site identified above."

Check the box indicating the criteria for which approval is requested. Selection of criteria must correspond to the groundwater classification of the site. The criteria below are not valid and effective for any release or property until and unless DEEP issues a written approval for use at a specific property. DEEP may update these criteria at any time, so no one should rely on them until receipt from DEEP of a property-specific approval. These criteria are provided and any person may elect to apply for a different criterion for any additional polluting substance provided that adequate documentation to support such request is submitted to DEEP.

Substance	Res. DEC (mg/kg)	IC. DEC (mg/kg)	CA. P1/C1 (mg/kg)	CE. P1/C1 (mg/kg)	RSV/CV (ppm)	ICSV/CV (ppm)	RSV/CV (mg/m <sup>3</sup> )	ICSV/CV (mg/m <sup>3</sup> )	SV/CV (µg/L)	ICSV/CV (µg/L)	RSV/CV (µg/L)	ICSV/CV (µg/L)
Acenaphthene	1,200	2,500	8.4	8.4	13	110	8	850	420	150	30,500	30,000
Acetone										10,000		
Acetonitrile	340	1,000	0.70	7.0	14	140	24	240	35	10,000	37,100	30,000
Acrolein	34	1,000	0.20	2.0	0.003	0.035	0.008	0.081	10	30	4.0	50
Alcohol										450		
Aldicarb										5.4		
Aldrin	0.04	0.04	0.002	0.01					0.05	0.05		
Aniline	110	1,000	0.20	1.2					8.1	41		
Atrazine										16		
Benzidine	0.20	0.20	0.20	1.0					5.0	5.0		
Benzo(a,h)perylene	8.4	78	1	1					0.48	150		
Benzoic acid	1,200	2,500	20	200					1,000	9,000		
Bis(2-chloroethoxy)methane	200	2,500	0.42	4.2					21	10,000		
Bromodichloromethane	18	170	0.02	0.21	0.002	0.048	0.012	0.31	1.0	510	1.1	35
Bromomethane	34	1,000	0.07	0.70	0.51	5.2	2	20	3.5	160	83	1,100
2-Butanone (MEK)										10,000		
Butylbenzene, n-	500	1,000	7.0	70	13	130	8	80	350	10,000	1,800	21,800
Butylbenzene, sec-	500	1,000	7.0	70	13	130	8	80	350	10,000	1,500	20,100
Butylbenzene, tert-	500	1,000	7.0	70	13	130	8	80	350	10,000	1,900	25,300

# Direct Exposure Criteria

## Calculated Criteria

- ◆ Criteria different than DEEP calculated criteria (Fast-Track) can be requested for different site-specific exposure assumptions
- ◆ These APS requests will require documentation of the calculations and rationale for the site-specific exposure assumptions. They also will require a more thorough review (for DEC, this includes consultation with DPH) and therefore will take more time to process

# Direct Exposure Criteria

## **APS Calculated Option**

- ◆ Proposed criteria can be calculated
- ◆ Risk of  $10^{-6}$  (for carcinogens)
- ◆ Hazard Index of 1 (for non-carcinogens)
- ◆ Commissioner will consider proposed criteria and any other relevant information

# Pollutant Mobility Criteria

## Additional Polluting Substances

- ◆ For substances for which a PMC does not exist, one must be developed
- ◆ As with DEC, two options are available: Fast-Track or calculated criteria

# Groundwater Protection Criteria Additional Polluting Substances

- ◆ Again, two options available: Fast-Track or calculated criteria
- ◆ Risk-based groundwater protection criteria using formula provided in the RSRs (different formulas for carcinogens and non-carcinogens)
- ◆ Requires Commissioner's approval after consultation with Department of Public Health

# Additional Polluting Substances SWPC and Volatilization Criteria

- ◆ Same two options: Fast-Track or calculated criteria
- ◆ For volatilization, the calculated criteria will include DPH as part of the review and will require the use of current toxicology information and exposure pathway assumptions.
- ◆ These options are an alternative to remediating the plume to background

# 2003 Volatilization Criteria

- ◆ Originally drafted to be more consistent with EPA's draft guidance issued in 2002
- ◆ Since DEEP has published Fast-Track criteria, the 2003 criteria will only be approved as *alternative* to promulgated RSR criteria
- ◆ The criteria contained in Appendix C, Tables C2 and C3, revised and published in December, 2015 must be used "in whole"

# 2003 Volatilization Criteria



• Department of Energy & Environmental Protection  
• Bureau of Water Protection and Land Reuse  
• Remediation Division  
79 Elm Street, Hartford, CT 06106-5127  
(860) 424-3705 • [www.ct.gov/deep/remediation](http://www.ct.gov/deep/remediation)

.....DEEP USE ONLY (Date Stamp)

## REQUEST FOR APPROVAL OF CRITERIA FOR ADDITIONAL POLLUTING SUBSTANCES AND CERTAIN ALTERNATIVE CRITERIA

In accordance with Sections 22a-133k-1 through k-3 of the Regulations of Connecticut State Agencies

This form is prescribed by the Commissioner and must be completed when requesting the Commissioner's approval to use site-specific cleanup criteria for Additional Polluting Substances and certain Alternative Criteria. For use of the criteria listed below for the site identified in this form, the Commissioner's approval is required pursuant to the Remediation Standard Regulations, Sections 22a-133k-1 through 22a-133k-3 (RSRs) of the Regulations of Connecticut State Agencies (RCSA).

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In all other cases, the approval expires eight years from the date approved unless otherwise extended by the Commissioner in writing, or unless a Verification, Interim Verification, or Final Remedial Action Report (in the case of DEEP lead or Voluntary Remediation under CGS Section 22a-133y only) is submitted within said timeframe.

All sections of this form must be completed, as applicable.

Check the box to indicate the program for which this form is being submitted:

- Connecticut General Statutes (CGS) section 22a-134a(e), Property Transfer Program
- CGS section 22a-133x, Voluntary Remediation Program
- CGS section 22a-133y, Voluntary Remediation Program
- Other (specify) \_\_\_\_\_

**Site Identification** → → RemID# \_\_\_\_\_

Name of Site: \_\_\_\_\_

Street Address: \_\_\_\_\_

City/Town: \_\_\_\_\_ → State: \_\_\_\_ → Zip Code: \_\_\_\_\_

Groundwater Classification: \_\_\_\_\_

**Contact Information**

Certifying Party (if Property Transfer): \_\_\_\_\_ →  N/A

Person submitting Request: \_\_\_\_\_ → Title: \_\_\_\_\_

Business Name: \_\_\_\_\_ → E-mail Address: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City/Town: \_\_\_\_\_ → State: \_\_\_\_ → Zip Code: \_\_\_\_\_

Business Phone: \_\_\_\_\_ → Ext. \_\_\_\_\_ → Fax: \_\_\_\_\_

Request to use the [2003 Draft Volatilization and Soil Vapor Criteria Tables C2 and C3](#), as revised in 2015.

# Additional Polluting Substances **EPH/VPH/APH**

- ◆ Form developed in 2012 to request approval of methodology and associated criteria
- ◆ Risk based criteria to evaluate petroleum releases
- ◆ Expedited review and approval process
- ◆ APS Form available on DEEP website

# Commissioner Prescribed Transmittal Form

Approval Request or Notice Transmittal Form available  
at DEEP web page

Transmittal Form shall be submitted along with:

- ◆ Any request for approval by Commissioner
- ◆ Any required notice to the Commissioner

Use of Transmittal Form helps DEEP be aware that the request/notice has been made and track the requests.

## Question 1

During a Phase I Investigation, it has been determined that PCE, TCE, and Tetrahydrofuran have historically been used as solvents at the site. Which chemicals need to be analyzed for during the subsequent investigations?

## Question 1

During a Phase I Investigation, it has been determined that PCE, TCE, and Tetrahydrofuran have historically been used as solvents at the site. Which chemicals need to be analyzed for during the subsequent investigations?

- a. Just PCE and TCE need to be analyzed for since there is no criterion established for Tetrahydrofuran.
- b. All three would need to be analyzed for but nothing would need to be done about any Tetrahydrofuran detections because there is no criterion established.
- c. All three would need to be analyzed for and an additional polluting substance criteria would need to be developed for Tetrahydrofuran if it is detected.

## Question 1

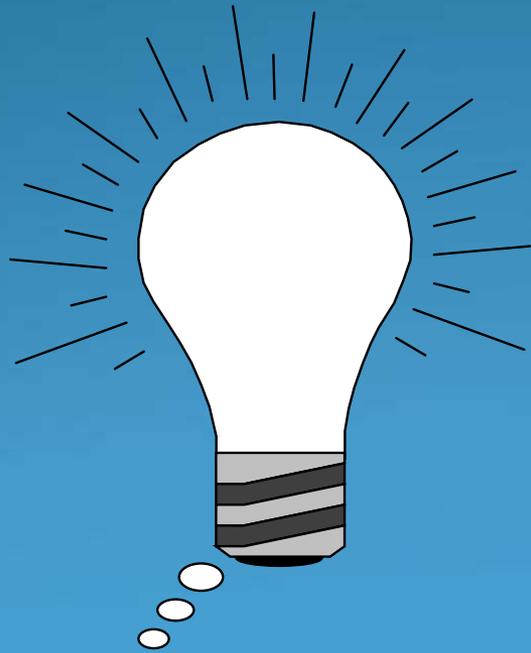
During a Phase I Investigation, it has been determined that PCE, TCE, and Tetrahydrofuran have historically been used as solvents at the site. Which chemicals need to be analyzed for during the subsequent investigations?

c. All three would need to be analyzed for and an additional polluting substance criteria would need to be developed for Tetrahydrofuran if it is detected.

**22a-133k-2(a)** – “polluted soil at a release area shall be remediated to a concentration which meets (1) (A) 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;”

**22a-133k-2(b)(4) Additional Pollution Substances** – Subdivision (4) of subsection (b) included in the subsection (b) reference in 22a-133k-2(a)

APS



Q & A

# 95% Upper Confidence Level

# Upper Confidence Level

- ◆ “Ninety-five percent upper confidence level of the arithmetic mean” is defined as 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.

# Upper Confidence Level

- ◆ Provides a conservative estimate that is protective of potential receptors
- ◆ Accounts for uncertainties within data set
- ◆ The greater the number of samples collected, the more confidence that the 95% UCL will not underestimate the true mean of the data set (and the closer the 95% UCL will be to the true mean)

# Calculating the 95% UCL

- ◆ Guidance documents for calculating the UCL
  - ◆ Guidance for Calculating the 95% Upper Confidence Level for Demonstrating Compliance with the Remediation Standard Regulations
  - ◆ Supplemental Guidance to RAGS: Calculating the Concentration Term
- ◆ Use EPA or other software to calculate the UCL
  - ◆ ProUCL (current version 5.0)

# 95% UCL - Number of Samples

- ◆ *Collect sufficient number of discrete samples (not ND) to adequately characterize each release area*
- ◆ EPA Guidance (1992)
  - ◆ <10 samples per area of concern provide poor estimates of mean
  - ◆ 10-20 samples per area of concern provide somewhat better estimates of the mean
  - ◆ 20+ samples per area of concern provide fairly consistent estimates of mean

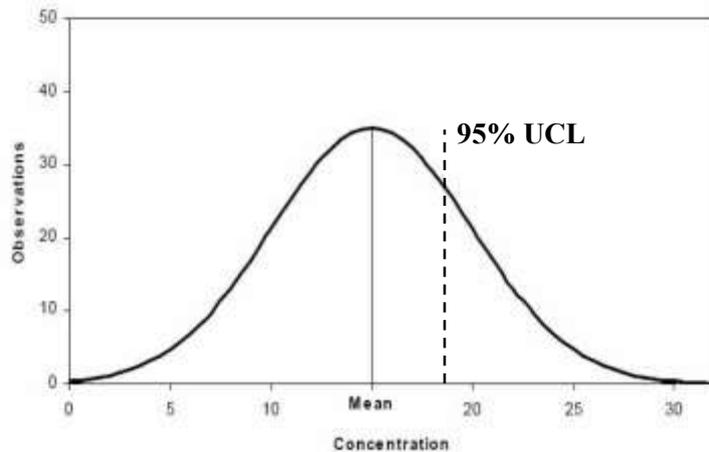
# Data Distributions

- ◆ Data distribution
  - ◆ Environmental data is commonly Lognormal
  - ◆ ProUCL tests for Normal, Lognormal, and Gamma Distributions
- ◆ Use different 95% UCL calculation methods for different distributions:
  - ◆ Normal, Lognormal, and Gamma distributions have different calculation methods
  - ◆ ProUCL also has Non-parametric (no known distribution) methods

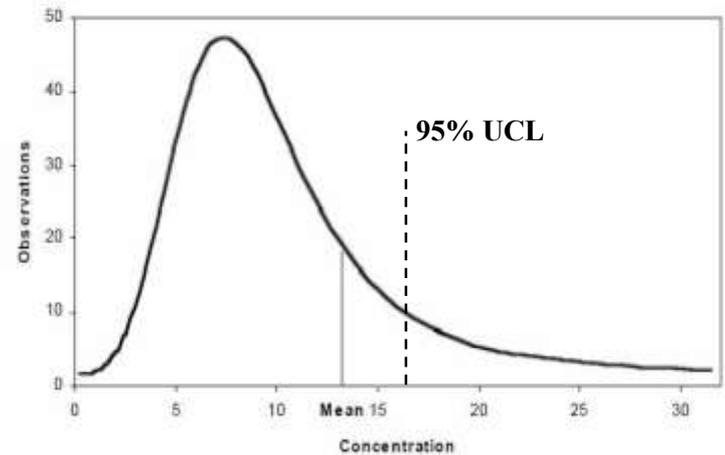
# Data Distributions cont'd

## ◆ Normal vs. Lognormal data distribution

EXAMPLE OF A NORMAL DISTRIBUTION



EXAMPLE OF A LOGNORMAL DISTRIBUTION

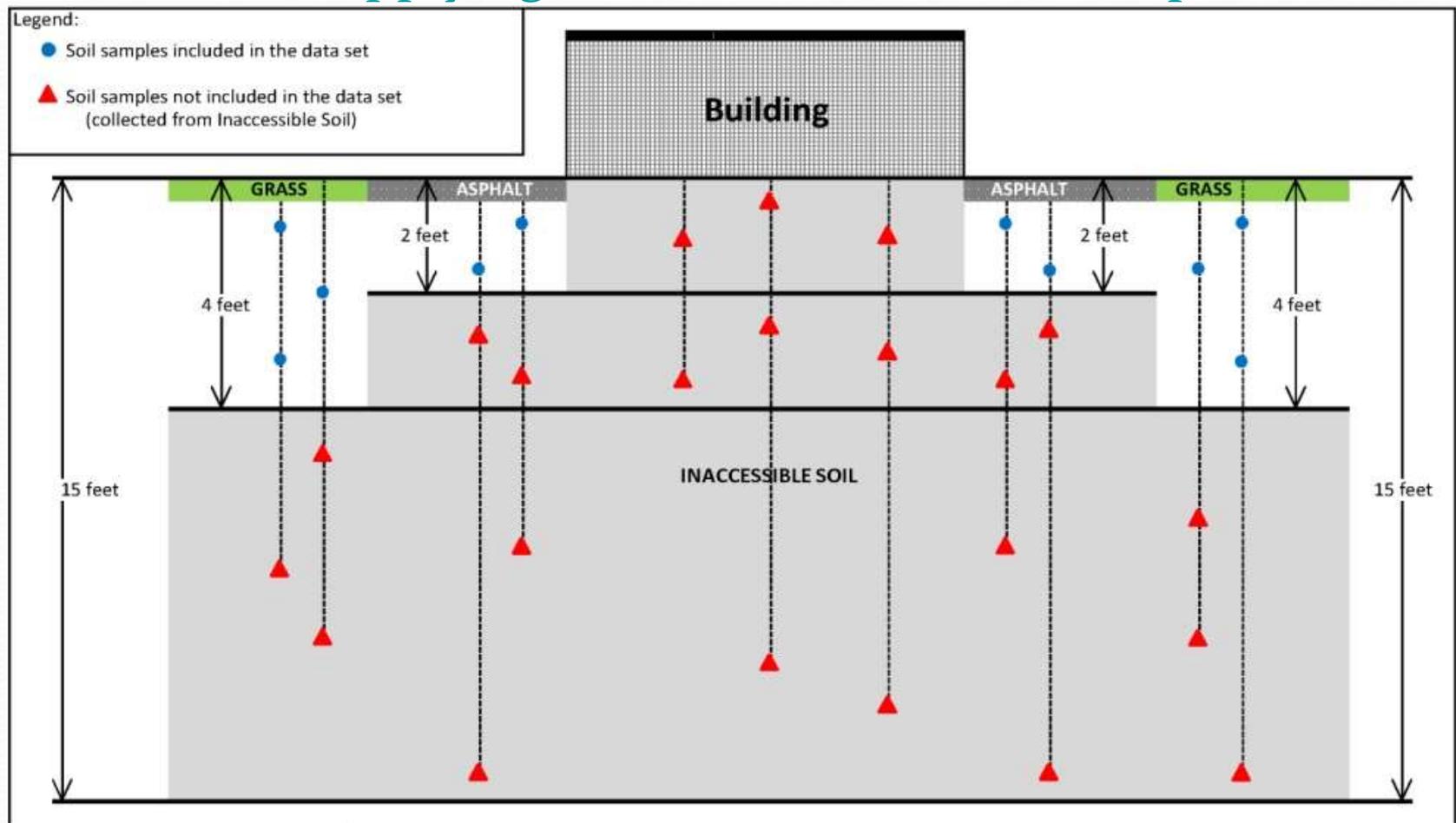


# 95% UCL – Handling NDs

- ◆ Appropriateness of the use of the NDs in the data set needs to be evaluated:
  - ◆ Delineate or Within Release Area?
  - ◆ Other lines of evidence?
- ◆ Proper estimation method needs to be used:
  - ◆ Normal, Lognormal, and Gamma Distributions - Regression on Order Statistics (ROS Method)
  - ◆ Non-parametric Distributions - Kaplan-Meier (KM Method)
  - ◆  $\frac{1}{2}$  Detection Limit no longer recommended

# 95% UCL Data Set Applicability

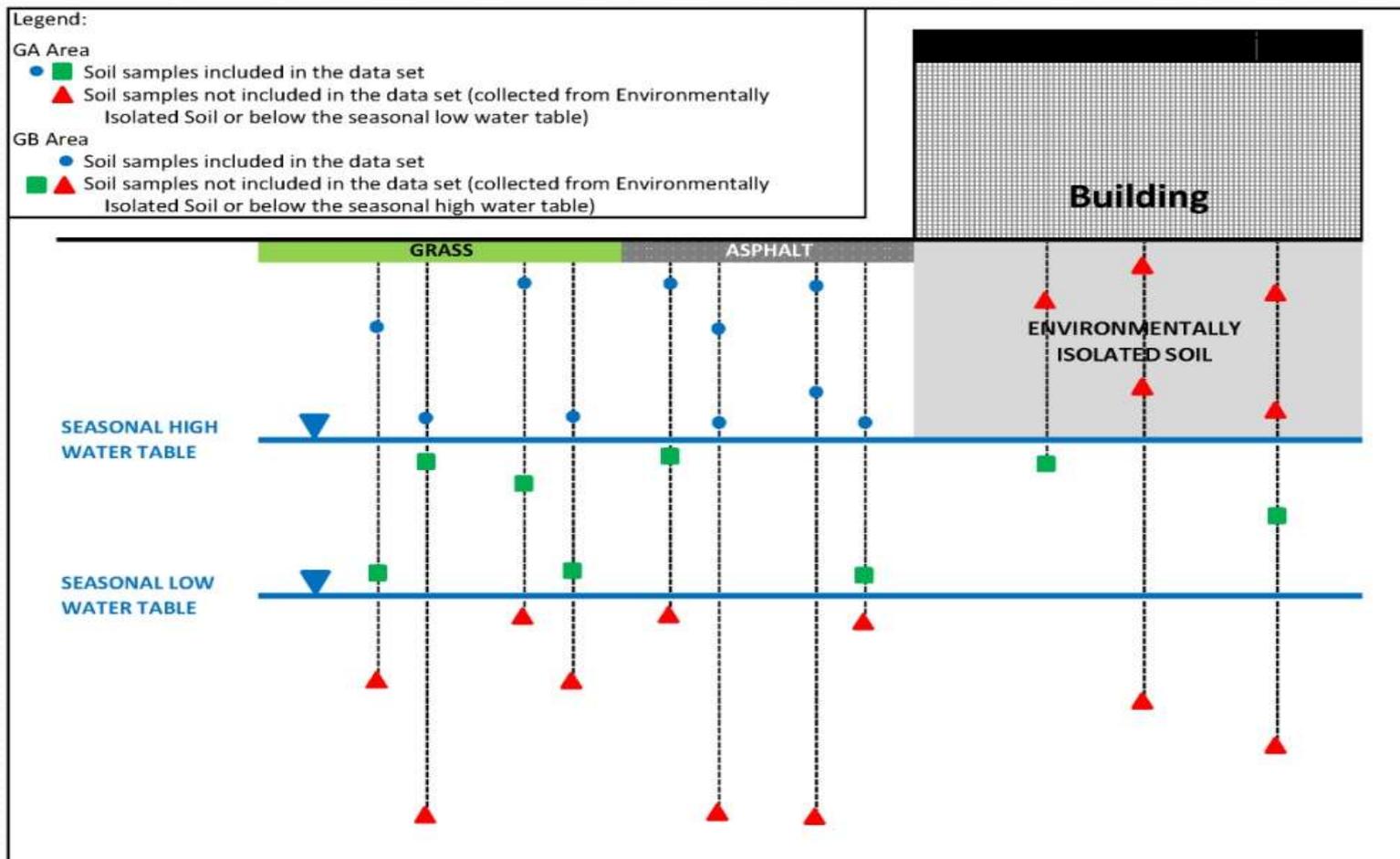
Release Area Sample Selection for DEC 95% UCL Calculation  
When Applying the Inaccessible Soil Exception



Note: All samples shown were collected from the Release Area

# 95% UCL Data Set Applicability

Release Area Sample Selection for PMC 95% UCL Calculation  
When Applying the Environmentally Isolated Soil Exception



Note: All samples shown were collected from the Release Area

# 95% UCL Application Example

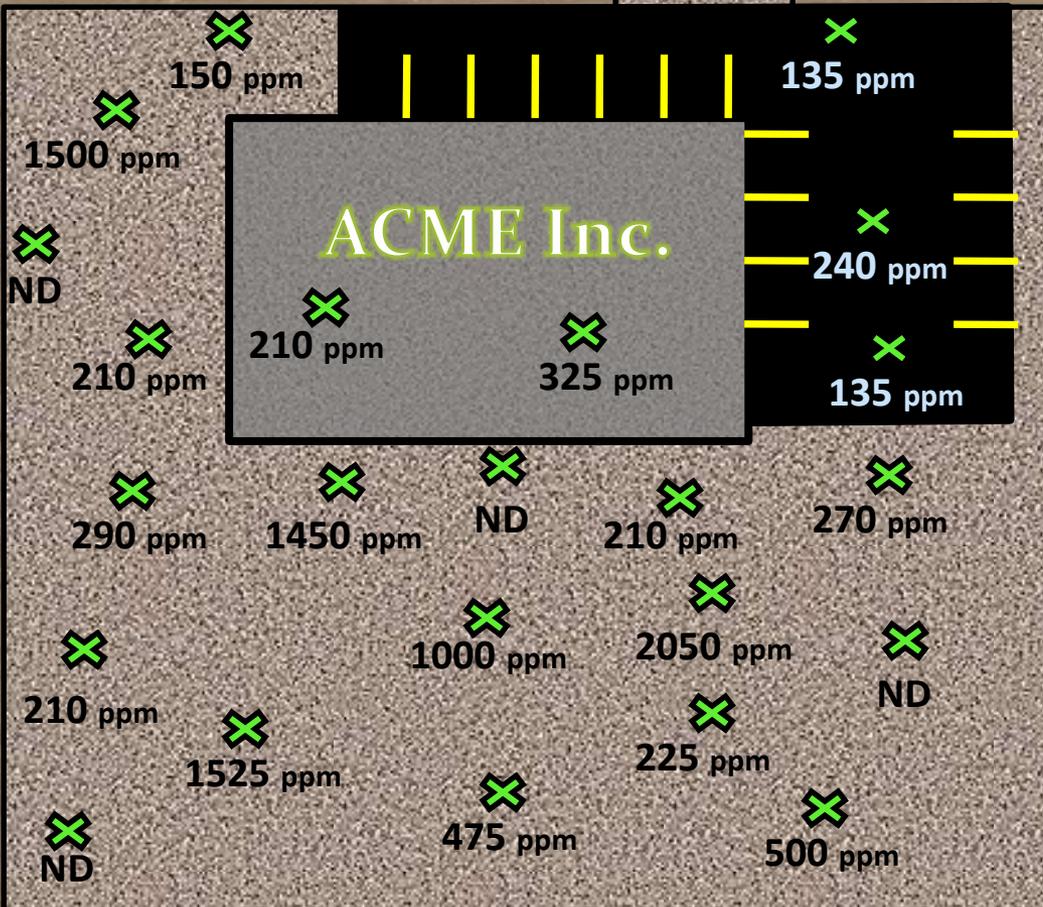


Property Boundary

ACME Inc.

GW flow direction

- Contaminant – Nickel
- RDEC - 1400 ppm
- 23 samples collected
- 95% UCL calculation
- Detection Limit = 50 ppm

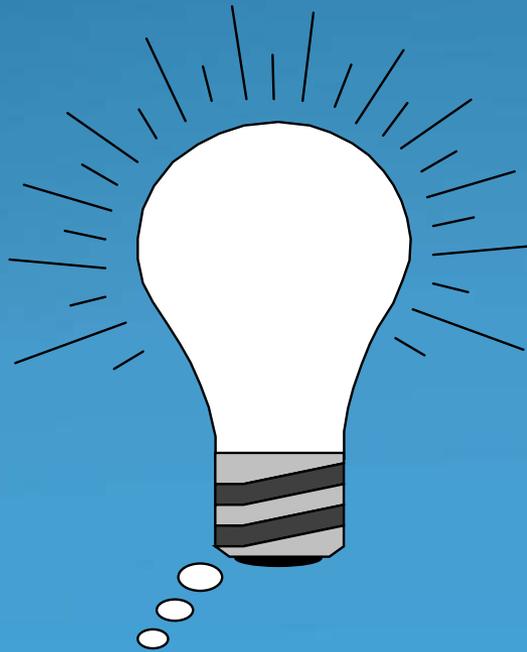


Not to Scale

# 95% UCL Data Sets

- ◆ Important to consider the representativeness of the data set – does the sampled distribution match the distribution in the ground?
- ◆ Assessment should be made to determine if the sampling program had the potential to bias and “skew” the sampled data set
- ◆ Just because you have enough samples to complete characterization does not mean that the data set is appropriate for use when estimating the 95% UCL – more samples may be needed

# 95% Upper Confidence Level



Q & A

# NAPL, Matrix Interference, Soil Reuse

# Light Non-Aqueous Phase Liquids (LNAPL)

- ◆ LNAPL must be removed in accordance with RCOSA 22a-449(d)-106(f) (UST regs)
- ◆ This means to the maximum extent practicable (e.g. cost not a consideration)

# Dense Non-Aqueous Phase Liquids (DNAPL)

- ◆ DNAPL must be contained or removed from soil and groundwater to the maximum extent prudent
- ◆ “Prudent” considers cost – see RSR definition @ 22a-133k-1(a)(54)

# Non-Aqueous Phase Liquids (NAPL)

- ◆ Non-recoverable NAPL can still pollute groundwater
- ◆ NAPL under buildings may not be easily recovered, but can still flow (potentially a continuing source of pollution)

# Matrix Interferences

- ◆ Requirements: After remediation is complete - must demonstrate compliance with applicable remediation criteria contained in RSRs
- ◆ Quantification at criteria levels is required
- ◆ Analytical methodology is specified in RSRs

# Overcoming Matrix Interference

- ◆ Evaluate analytical method
- ◆ Use more sensitive (approved) method
- ◆ Use flexibility within method
- ◆ Compliance is achieved at lowest concentration which can be consistently & accurately quantified
- ◆ Submit summary of measures taken for approval

# Commissioner May Require Additional Remediation of Soil

- ◆ To prevent or abate any threat to human health or the environment
- ◆ Multiple substances, especially carcinogens
- ◆ Unacceptable ecological risk
- ◆ Soil eroding into surface water body



# Reuse of excavated soil depends on category

# Hazardous Waste

Treatment, storage, disposal, and transportation of hazardous waste must be done in accordance with Hazardous Waste Management Regulations and RCRA

# Special Waste

- ◆ Commissioner may authorize polluted soil which is not a hazardous waste to be disposed of as a special waste under the Solid Waste Regulations
- ◆ Obtain Special Waste Disposal Authorization

# Reuse Rules for Polluted Soil

Polluted soil which meets applicable DEC and PMC may be re-used on-site (notice required) or on another parcel approved by the Commissioner (approval required), **if:**

# Reuse Rules for Polluted Soil Cont'd

- ◆ Location of re-use is documented with map(s) submitted to Commissioner
- ◆ Soil not placed below water table
- ◆ Soil not placed in an area subject to erosion
- ◆ If the soil exceeds GA PMC, such soil may not be placed over soil and groundwater which is unaffected by a release, regardless of groundwater class
- ◆ For PCBs, Commissioner must issue written approval (even if reused on-site)

# Re-Use Rules for Polluted Soil

Soil handling also subject to:

- ◆ General Permit for Contaminated Soil and/or Sediment Management (Solid Waste Permit)

*Soil/sediment is contaminated if affected by known or suspected release & determined or reasonably suspected to be > RDEC or > GA PMC*

# Re-Use Rules for Polluted Soil

General Permit for Contaminated Soil and/or  
Sediment Management available on DEEP  
website

# Natural Soil

May be used at any parcel if:

- ◆ no naturally-occurring substance exceeds background
- ◆ no man-made compounds are detectable above analytical detection limit



# Clean Fill

Definition of clean fill in solid waste regulations includes natural soil and polluted soil treated to meet DEC and PMC *reused in accordance with the RSR re-use rules.*

## Question 1

There is a site that is currently undeveloped. Investigations have determined that there have been surface releases at several locations around the site. These releases have resulted in several areas that have soils that contain contaminants at concentrations greater than the Residential DEC and GA PMC. Under the soil re-use rules, can these areas be consolidated into a single location and then be rendered inaccessible and environmentally isolated by the construction of a building?

## Question 1

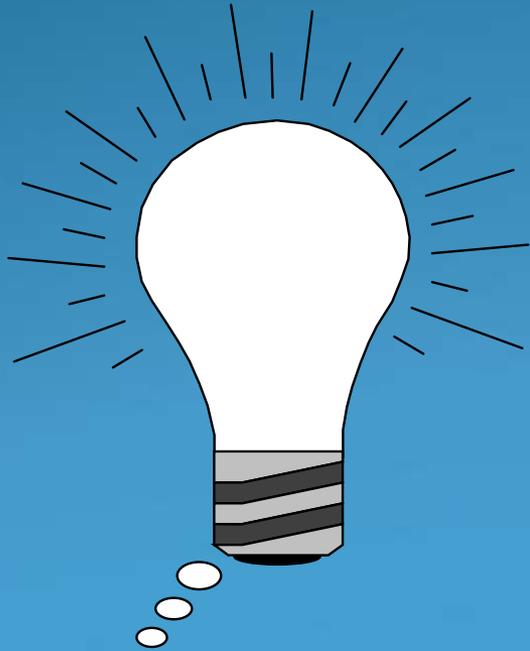
There is a site that is currently undeveloped. Investigations have determined that there have been surface releases at several locations around the site. These releases have resulted in several areas that have soils that contain contaminants at concentrations greater than the Residential DEC and GA PMC. Under the soil re-use rules, can these areas be consolidated into a single location and then be rendered inaccessible and environmentally isolated by the construction of a building?

Yes, as long as the following regulations are followed:

- 22a-133k-2(h)(3): Re-use of polluted soil requires that notice (including a map showing location and depth) are provided to the Commissioner. The soil cannot be placed below the water table and cannot be placed above soil and groundwater which have not been affected by a release at the parcel (means that the consolidation would need to be at one of the release areas).
- 22a-133k-2(b)(3) & (c)(4)(A): Soil must comply with the definitions of inaccessible and environmentally isolated and ELUR must be in place to ensure that the conditions will not change for the soil to be excepted from the DEC and PMC.
- 22a-133k-1(a)(18) & (32): Definitions of inaccessible and environmentally isolated require that the soil be beneath existing building, not be a continuing source of pollution, not be polluted with VOCs (or if so, remediated to the maximum extent prudent), and be above the seasonal high water table.

NOTE: “Existing building” means existing at the time of ELUR recordation and site verification, not necessarily existing at the time of investigation/remediation.

# NAPL, Matrix Interference, & Soil Reuse

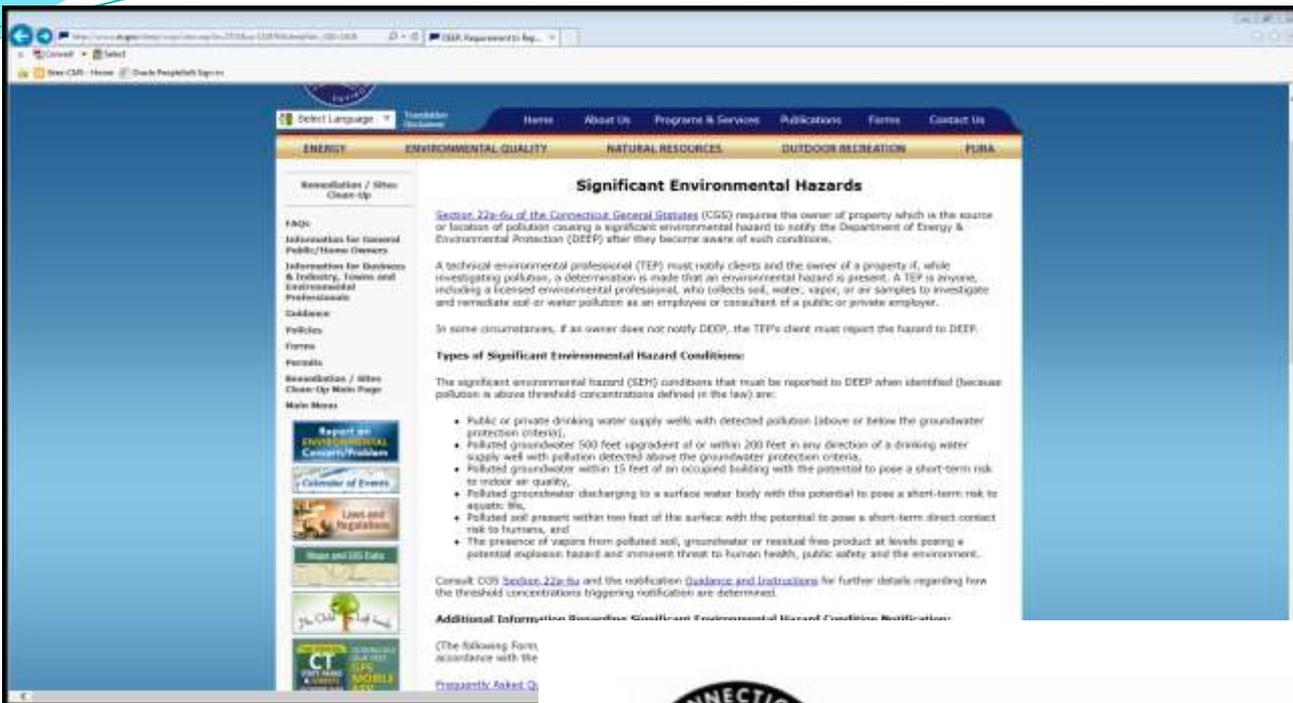


Q & A

# Significant Environmental Hazards

# Online Resource

## Significant Environmental Hazard Webpage



## Significant Environmental Hazard Fact Sheet



Connecticut Department of  
Energy & Environmental Protection  
Bureau of Water Protection & Land Reuse  
Remediation Division

### *An Environmental Program Fact Sheet*

## Reporting of Significant Environmental Hazards

*This fact sheet contains information about the requirement to report significant environmental hazards pursuant to Section 22a-6a of the Connecticut General Statutes, effective October 1, 1998 & amended July 1, 2015.*

### Overview

Significant environmental hazards are defined by the presence of pollution that may affect:

- a public or private drinking water well's water quality;

# Online Resource

DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION  
ENVIRONMENTAL PROTECTION

STATE OF CONNECTICUT

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## List of Significant Environmental Hazards Reported to DEEP

(pursuant to Section 22a-6(u) of the Connecticut General Statutes)

The Connecticut Department of Energy & Environmental Protection (DEEP) is required to provide a list of Significant Environmental Hazards reported to DEEP on the DEEP website. The list is updated periodically as additional hazard notices are received, and it contains information on hazard notices reported to DEEP for the period shown in the upper right corner of each page. The published list contains information on hazard notifications submitted to DEEP after August 1, 2002. Historic hazard reports dating back to October 1, 1998 will be added to the list as time permits.

Property owners are required to submit information on certain types of environmental conditions to DEEP when such conditions are encountered during an environmental site investigation or remediation of a parcel. DEEP refers to the reporting of these conditions as "reporting of significant environmental hazards" or "hazard notifications".

The [List](#) linked below contains the following information for each entry:

- REMEDIATION/ SITES CLEAN-UP
- FAQS
- INFORMATION FOR GENERAL PUBLIC/HOME OWNERS
- INFO FOR BUSINESS & INDUSTRY, TOWNS AND ENVIRONMENTAL PROFESSIONALS
- GUIDANCE
- POLICIES
- FORMS
- PERMITS
- REMEDIATION / SITE CLEAN-UP MAIN PAGE
- DEP MAIN MENU

## List of Significant Environmental Hazards Reported to DEEP

- ◆ SEH Report includes:
  - ◆ Type of hazard
  - ◆ DEEP Response
  - ◆ Action taken

List of Significant Environmental Hazards Reported to the DEEP					Period covering 8/01/2002 through 1/31/2012
<b>Ashford</b>					
Site Location	Date Notified	Type of Hazard	Response	Action	
Residential Property 70 Perry Hill Road	8/21/2002	Pollution detected in groundwater above standards may threaten a drinking water well.	DEP discussed with the environmental consultant additional sampling data obtained for nearby threatened wells that shows there was no pollution in the wells. DEP requested that the data be submitted for detailed review.	Action pending	
<b>Avon</b>					
Site Location	Date Notified	Type of Hazard	Response	Action	
Avon Municipal Landfill 281 Huckleberry Hill Road	7/5/2007	Pollution was detected in a supply well but is below standards.	DEP directed the town to identify wells within 500 feet and continue to conduct an already approved landfill monitoring program.	Sampled residential wells and installed new monitoring well for landfill. Monitoring program continuing.	
Mold Service Station No. 01-363 411 West Main Street	6/9/2010	Pollution detected in groundwater above standards may threaten a drinking water well.	The DEP directed the property owner to confirm if a neighboring supply well exists and, if so, sample the well for constituents of concern.	Action pending	
Village Cleaners & Tailors 102 West Main Street	11/22/2006	Pollution detected in groundwater above standards may threaten a drinking water well.	DEP directed the property owner to sample the onsite supply well, identify supply wells within 500 feet, and sample any identified wells for pollutants detected at the site.	Five wells identified within 500 feet but they are upgradient and not at risk. Volatile organic compounds not detected in on-site drinking water supply well. Site is undergoing investigation and remediation under Property Transfer Program.	

# Reporting of certain Significant Environmental Hazard

- ◆ Section 22a-6u of the Connecticut General Statutes
- ◆ Established - October 1, 1998

# Background

- ◆ Triggered by particular release or site condition
- ◆ Notification statute assumes that short-term risk is discovered during site investigation
- ◆ Short-term risk is determined through reference to the RSRs
- ◆ DEEP can require actions to mitigate short-term risk – may or may not be to RSRs

# Background

- ◆ Sites under Order/Consent Order to investigate pollution are not subject to Hazard Notifications
- ◆ Both a TEP or LEP must notify their client and the owner of the parcel
- ◆ Does not address the LEP's obligation to hold human health and the environment paramount under CGS 22a-133v
- ◆ Now self-implementing requirements prior to notifying

# Requirements

- ◆ DEEP is required to acknowledge Hazard within 10 days of receiving notice
- ◆ Within Acknowledgement letter, DEEP may direct owner to conduct initial action
- ◆ SEH and Acknowledgment Letter submitted to:
  - Town Elected Official
  - Town Manager
  - Local Health Official





## 2. Drinking Water Well below standard

- ◆ Drinking water supply well is polluted below GWPC
  - ◆ TEP                      Notify owner & client – 7 days
  - ◆ Owner                    Notify DEEP                      – 7 days

### 3. Groundwater above standards threatens wells

- ◆ Groundwater contamination in a monitoring well exceeds the GWPC
- ◆ Drinking water well is within 500 ft downgradient or 200 ft in any direction
  - ◆ TEP                      Notify owner & client        – 7 days
  - ◆ Owner                    Notify DEEP                                – 7 days
- ◆ Receptor Survey needed - CSM

## 4. Direct Exposure threat from surface soil

- ◆ Soil within 2ft of the surface exceeds DEC (except petroleum)
  - ◆ 15 times DEC for Residential
  - ◆ 30 times the DEC for I/C or 15 times if contaminated with Metals or PCBs with residential activity within 300 ft
  - ◆ TEP Notify client – 7 days
  - ◆ Owner Notify DEEP – 90 days
- ◆ Do not need to notify if soil inaccessible or remediated, treated and disposed within 90 days

# 5. Volatilization Threat To A Building

- ◆ Groundwater within 15 feet beneath a building is contaminated with VOCs above 10 times Residential or I/C volatilization criteria depending on land use
- ◆ TEP                      Notify owner & client – 7 days
- ◆ Owner                    Notify DEEP                                      – 30 days

## 6. Surface Water Threat

- ◆ Groundwater is contaminated and discharges to a surface water body
- ◆ Discharging groundwater is above 10 times the acute toxicity levels or the presence of NAPL
  - ◆ TEP                      Notify owner & client – 7 days
  - ◆ Owner                    Notify DEEP                      – 7 days

# 7. Explosion Risk

- ◆ Groundwater plume with vapors that pose an explosion hazard is migrating under a building or utility line
  - ◆ TEP Notify owner & client – 24 hrs
  - ◆ Owner Notify DEEP and Fire Marshal
    - 2 hrs verbally
    - 5 days written
  - ◆ Client Notify DEEP if Owner doesn't

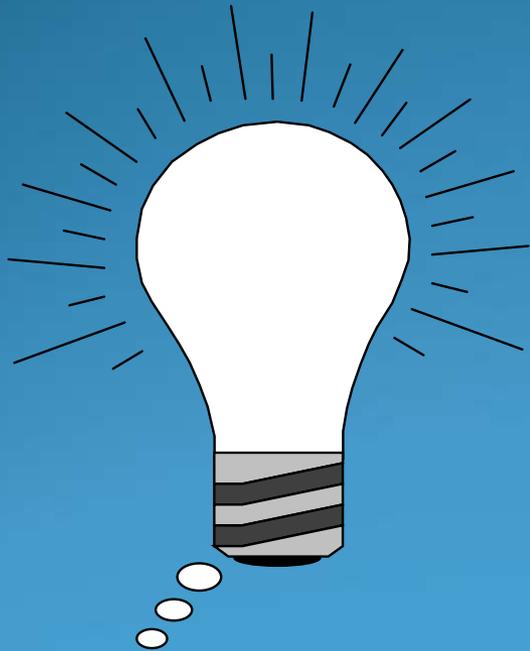
# Common Confusion

- ◆ If SEH is identified, the TEP must notify their client
- ◆ TEP must notify property owner of the parcel where the pollution is originating
- ◆ Owner where pollution originates not always the same as client

# Common Confusion

- ◆ For groundwater SEH, triggering criteria is GWPC not DWAL
- ◆ If source of pollution is unknown notification by the property owner of the investigated parcel is still necessary for some SEH
- ◆ Receptor Survey and topography not acceptable to conclude there are no downgradient wells to justify no SEH condition

# Significant Environmental Hazards



Q & A

# Groundwater Criteria Background, GWPC, & SWPC

# Groundwater Remediation Standards

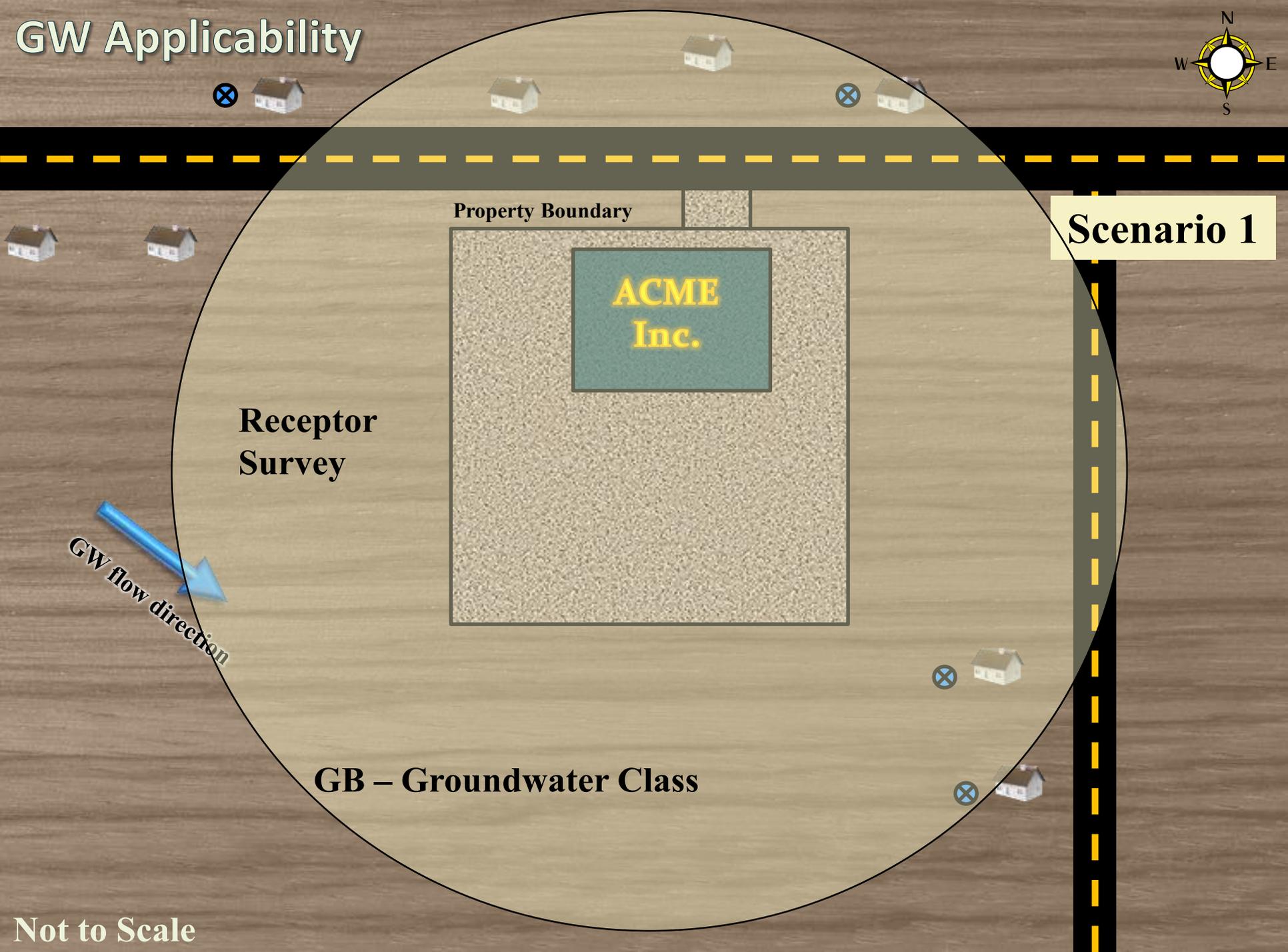
- ◆ Section 22a-133k-3 of the Regulations of Connecticut State Agencies

# Groundwater Remediation Standards

## *Important Concepts*

- ◆ Regulated by groundwater plume
  - ◆ Location of plume
    - ◆ GA
    - ◆ GB
  - ◆ Migration of plume

# GW Applicability



Receptor Survey

GW flow direction

Property Boundary

ACME Inc.

Scenario 1

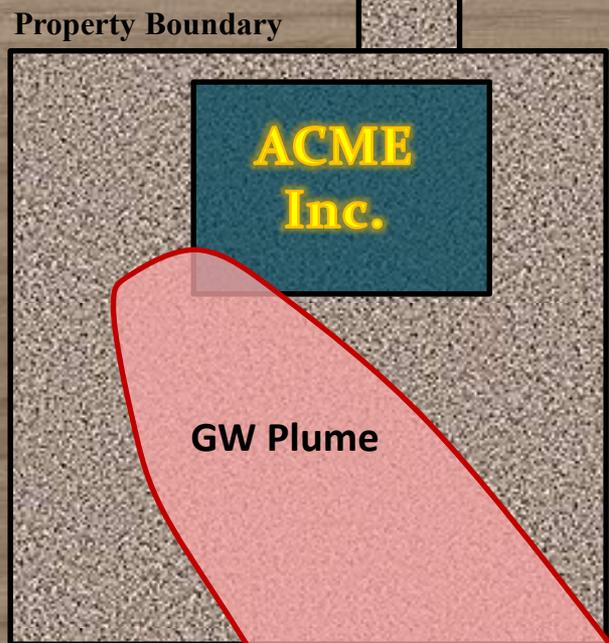
GB - Groundwater Class

Not to Scale

# GW Applicability



**Scenario 2**



**Receptor Survey**



**GB – Groundwater Class**

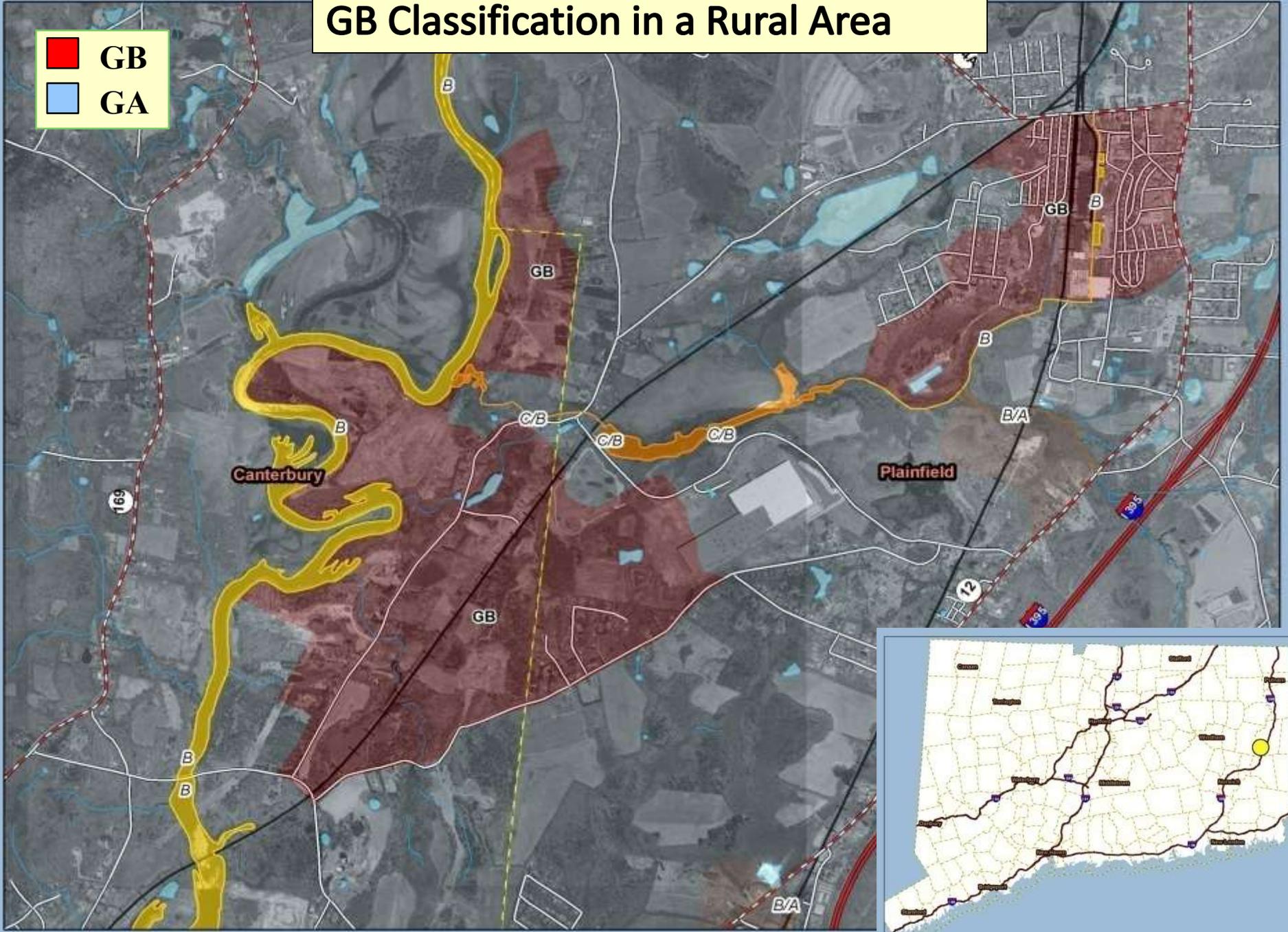
**GA – Groundwater Class**

**Not to Scale**



# GB Classification in a Rural Area

- GB
- GA



# Groundwater Remediation Standards

## *Important Concepts*

- ◆ Regulated by substance
  - ◆ Numerical criteria
    - ◆ GWPC
    - ◆ SWPC
    - ◆ Res VolC
    - ◆ I/C VolC

# Development of GWPC

- ◆ Risk based number protects people drinking groundwater ( $10^{-6}$  carcinogens; HI = 1)
- ◆ Basis – Federal MCL, State Action Level or risk-based calculated using RSR formula
- ◆ Adjusted upward based on detection limit
- ◆ Adjusted downward based on ceiling level

# Groundwater Exception – Incidental Sources

Groundwater criteria do not apply to groundwater impacted with

- Trihalomethanes from public water system
- Metals, petroleum hydrocarbons, and SVOCs, if:
  - ◆ Groundwater Pollution is due to normal operation of motor vehicles (which cannot include refueling, repair, or maintenance of motor vehicles); or
  - ◆ Normal paving and maintenance of asphalt, providing that such pavement has been maintained for its intended purpose

Guidance available on DEEP Website

# Overall Goals of Groundwater Remediation

- ◆ Protect and preserve groundwater in GA areas as a natural resource
- ◆ Protect existing use of groundwater regardless of groundwater classification
- ◆ Prevent further degradation of groundwater quality
- ◆ Prevent degradation of surface-water from discharges of contaminated groundwater
- ◆ Protect human health

# Representativeness of Sampling Program

- ◆ Key to correct application of RSRs
- ◆ Used in the decision making process to represent the conditions in the environment
- ◆ Expected that all substances of concern
  - have been identified
  - distribution in the environment determined
- ◆ Refer to Site Characterization Guidance

# Representativeness of Sampling Program

- ◆ Elements that go into gathering representative samples
  - Utilizing all knowledge of the release
    - Size of release area
    - Size of the plume (3D)
    - Type of contaminant
  - Flow direction
  - Multiple rounds
    - Capture variability in water table
    - Steady state

# Major Components

- ◆ Criteria (GWPC, SWPC and VolC)
- ◆ Background
- ◆ Applying the appropriate criteria
- ◆ Groundwater monitoring
- ◆ Technical Impracticability (TI)

# Key Definitions

- ◆ **Background** concentration of ground water
- ◆ Groundwater **plume** [3-D]
- ◆ Areal extent of groundwater plume [2-D]
- ◆ Groundwater **Flow Direction**

# Groundwater Remediation Requirements

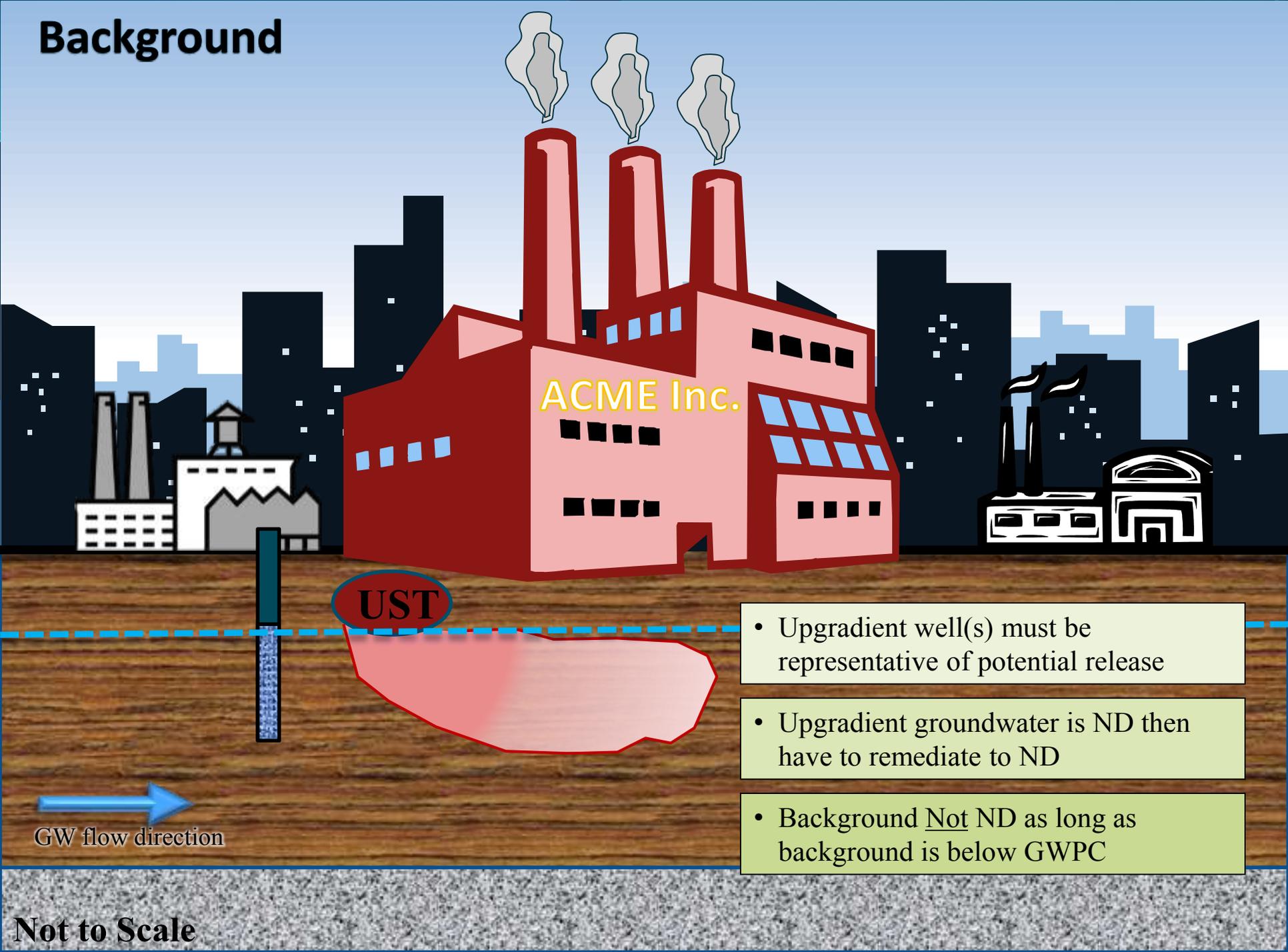
- ◆ Meet surface water protection criteria (SWPC) or alternative
- ◆ Meet volatilization criteria (VolC) or alternative
- ◆ Attain goal for groundwater classification area

**Only after soil and groundwater is characterized can you apply appropriate criteria**

# Groundwater Remediation Goal in GA Area / GAA Area

- ◆ Remediation to BACKGROUND
- ◆ Two exceptions

# Background



ACME Inc.

UST

GW flow direction

- Upgradient well(s) must be representative of potential release

- Upgradient groundwater is ND then have to remediate to ND

- Background Not ND as long as background is below GWPC

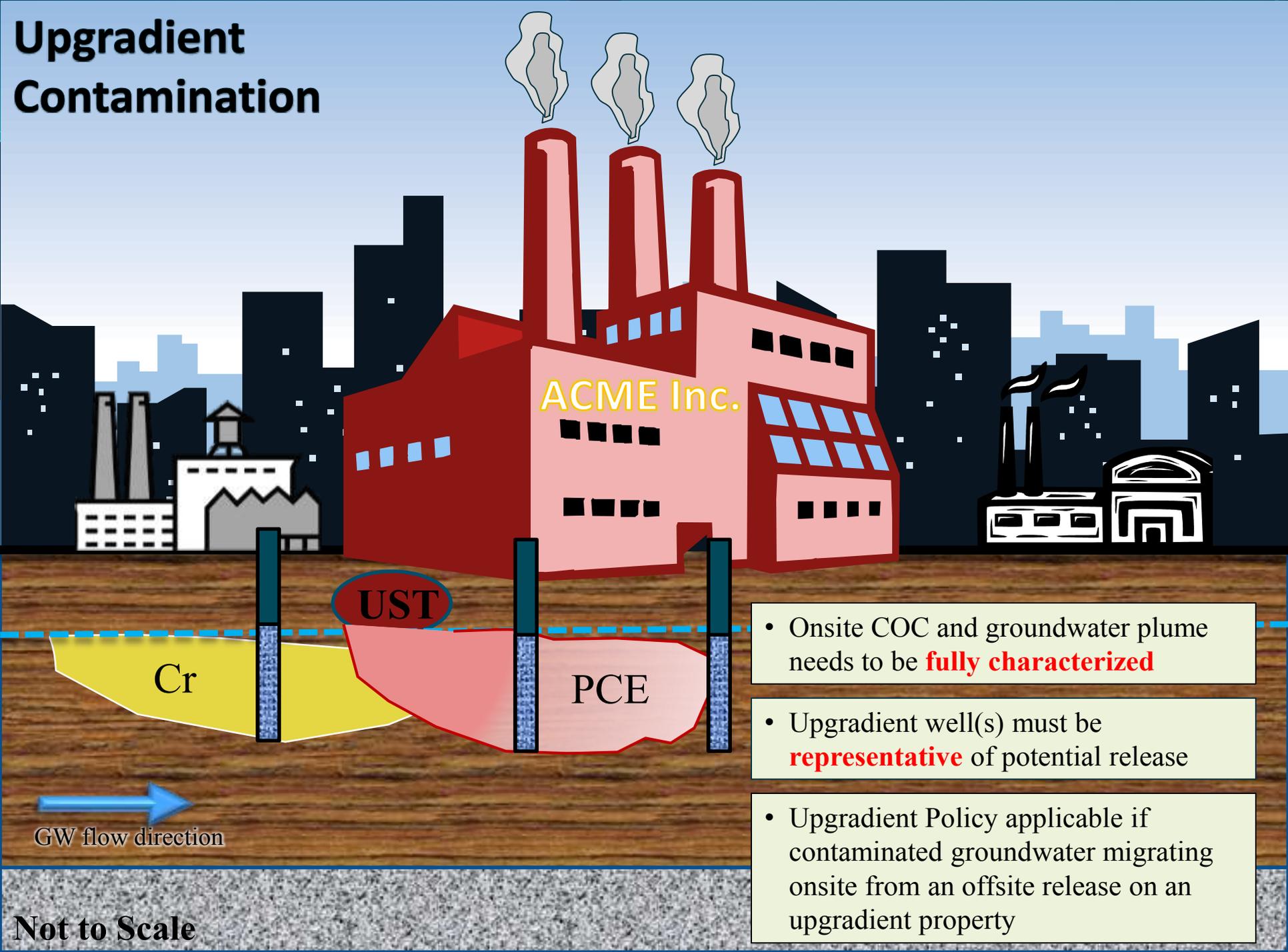
Not to Scale

# Policy on Upgradient Contamination

- ◆ In accordance with the Remediation Standard Regulations (RCSA Section 22a-133k-1 through 133k-3),
- ◆ Down gradient property owner is not responsible for remediating groundwater contamination flowing onto his or her property from another site
- ◆ As long as the contamination is present solely as a result of the off-site source(s).

This policy became effective on August 28, 1997.

# Upgradient Contamination



- Onsite COC and groundwater plume needs to be **fully characterized**

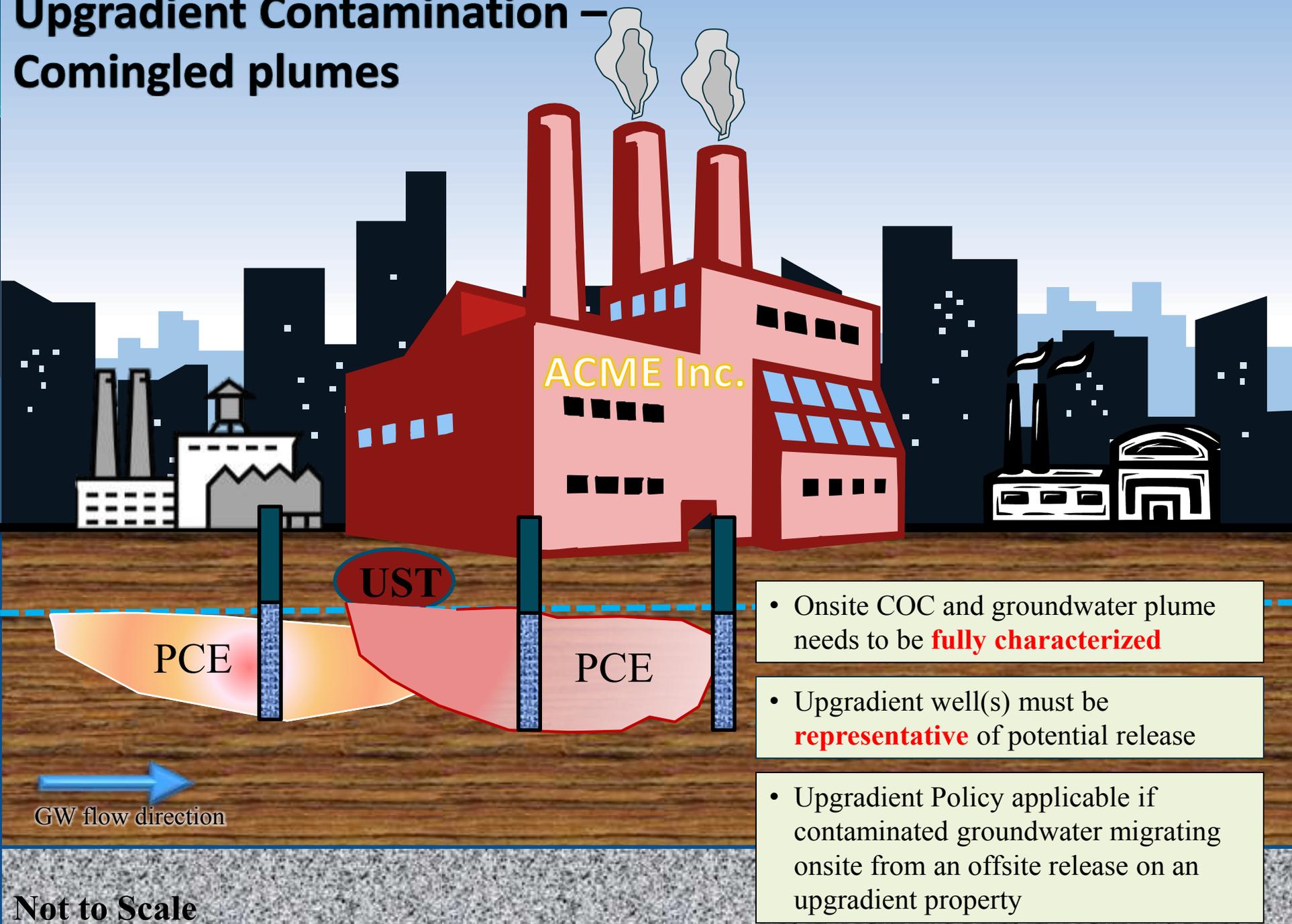
- Upgradient well(s) must be **representative** of potential release

- Upgradient Policy applicable if contaminated groundwater migrating onsite from an offsite release on an upgradient property

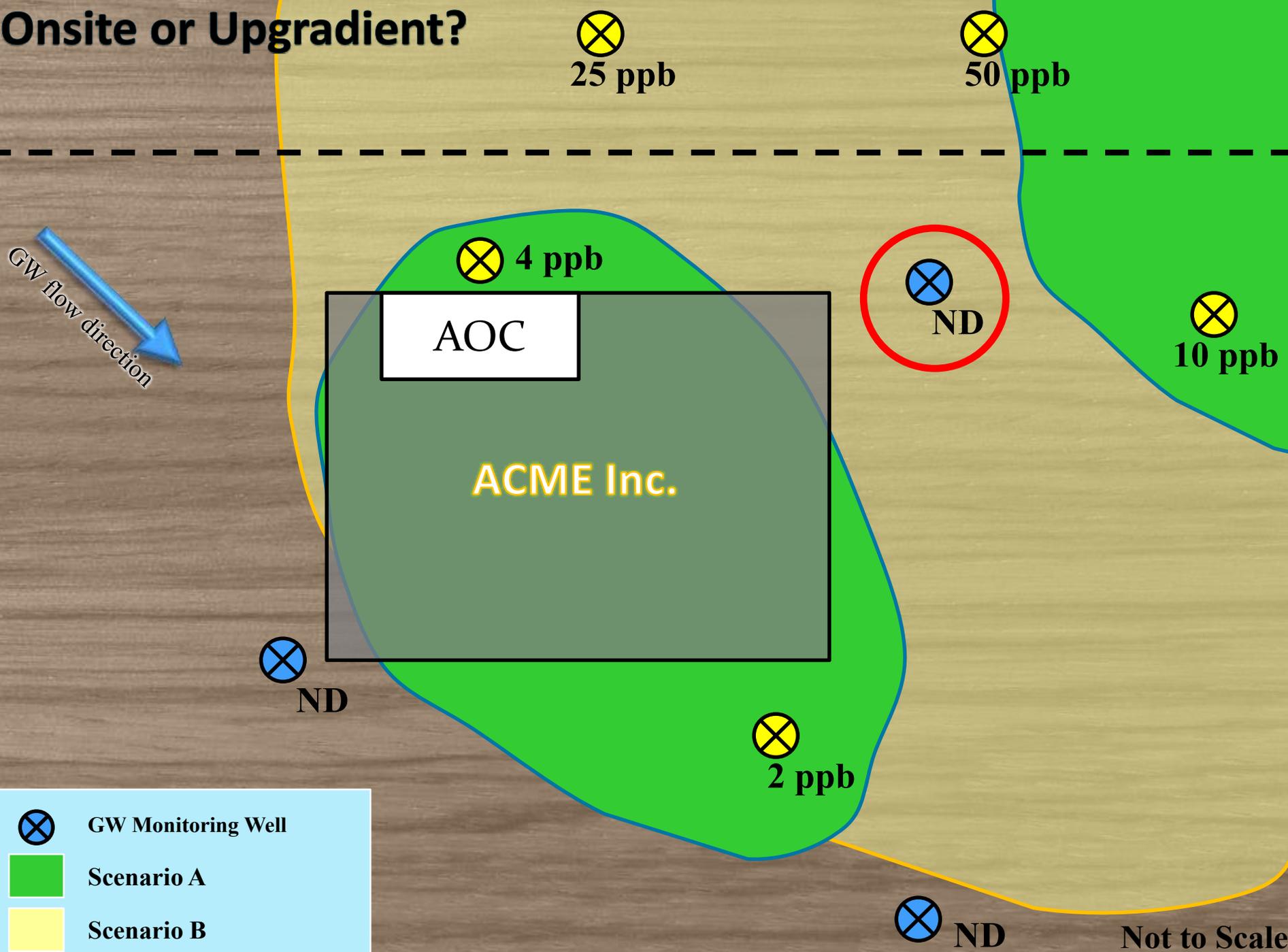
GW flow direction

Not to Scale

# Upgradient Contamination – Comingled plumes



# Onsite or Upgradient?



- GW Monitoring Well
- Scenario A
- Scenario B

Not to Scale

# First Exception in a GA Area

When certain conditions are met:

- ◆ a public water system is available within 200 feet of property line
- ◆ not an aquifer protection area
- ◆ not within area of influence of public supply well

# Second Exception in a GA Area

If prior to active remediation, the maximum concentration in the plume was less than or equal to the GWPC:

- ◆ The plume must be diminishing or in a steady state
- ◆ Source removed
  - Expected groundwater will be restored, achieving GWPC in the short term

# Groundwater Remediation Goal in GB Area

- ◆ Remediate the groundwater plume to concentration that does not interfere with any existing uses of the ground water
- ◆ Must consider that drinking water wells or other domestic uses may be present even though municipal water supply available
- ◆ If groundwater used for domestic purposes need to remediate to GWPC

## Question 1

When should a potable water receptor survey be conducted?

- a. In a GA area where public water is available
- b. When there is a drinking water well within 500 ft of the groundwater plume
- c. When the drinking water classification is GB but public water is not available
- d. When the groundwater is impacted regardless of groundwater class

## Question 1

When should a potable water receptor survey be conducted?

- a. In a GA area with public water is available
- b. When there is a drinking water well within 500 ft of the groundwater plume
- c. When the drinking water classification is GB but public water is not available
- d. **When the groundwater is impacted regardless of groundwater class**

## WATER SUPPLY WELL RECEPTOR SURVEY GUIDANCE DOCUMENT

Regardless of any groundwater classification, if at any time during the site investigation the conceptual site model (CSM) developed in accordance with the SCGD indicates an **existing groundwater plume migrating off-site or the potential for polluted groundwater to migrate off-site**, a water supply well receptor survey is to be completed in accordance with this guidance.

## Question 2

What is the remediation criteria for a PCE groundwater plume at a site with a GA groundwater classification?  
GWPC for PCE equals 5.0  $\mu\text{g/L}$ .

- a. Background
- b. 2.5  $\mu\text{g/L}$
- c. 5.0  $\mu\text{g/L}$

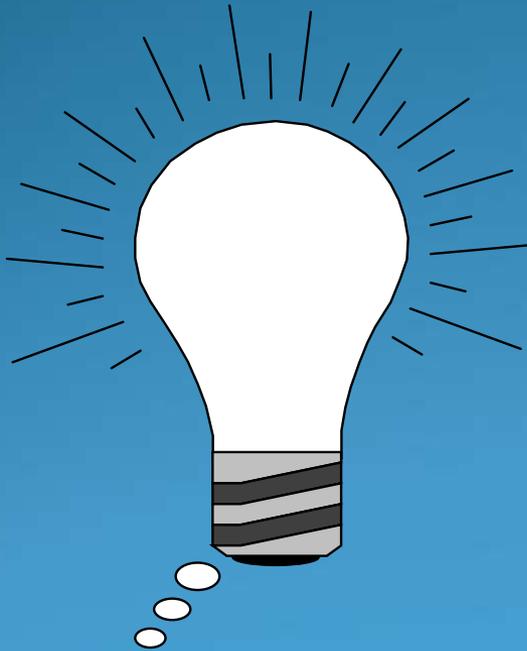
## Question 2

What is the remediation criteria for a PCE groundwater plume at a site with a GA groundwater classification? GWPC for PCE equals 5.0 µg/L.

- a. **Background**
- b. 2.5 µg/L
- c. 5.0 µg/L

**22a-133k-3(a)(2)** – Remediation of a groundwater 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.

# Ground Water Protection Criteria



Q & A

# Surface Water Protection Criteria

- ◆ SWPC Located in Appendix D in RSRs
- ◆ Groundwater **plume** which discharges to a surface water body must be remediated to surface water protection criteria

# Development of SWPC

- ◆ Based on State's Ambient Water Quality Criteria & applied dilution factor
- ◆ No dilution applied for wetlands and water bodies w/ intermittent flow  
(no water = no dilution)

# Exceptions to SWPC

- ◆ The remediation goal of a groundwater plume for surface water protection is the chronic aquatic life criteria in Table 3 of the Water Quality Standards IF
  - the plume discharges to a wetland or an intermittent stream
  - the areal extent of the plume occupies more than 0.5% of the upstream drainage basin

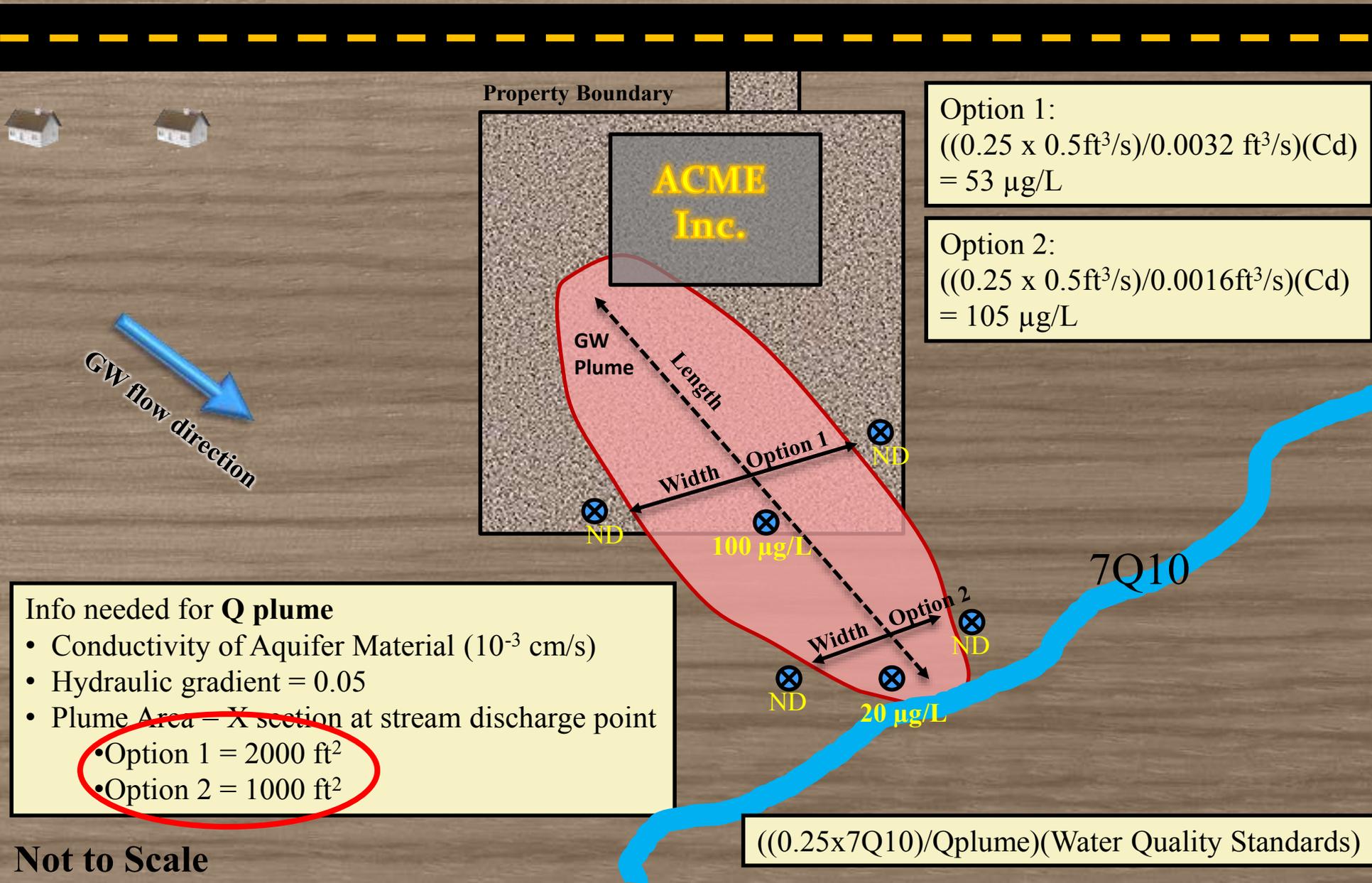
# Alternative SWPC

(Self-Implementing Calculation)

$((0.25 \times 7Q10)/Q_{\text{plume}})$  (Appendix D criteria\* in Water Quality Standards)

- ◆ \* the lower of human health or aquatic life criteria
- ◆ “7Q10” means the lowest 7 consecutive day mean stream discharge rate with a recurrence interval of 10 years

# Alternative SWPC



Option 1:  
 $((0.25 \times 0.5 \text{ ft}^3/\text{s}) / 0.0032 \text{ ft}^3/\text{s})(\text{Cd})$   
 $= 53 \text{ } \mu\text{g/L}$

Option 2:  
 $((0.25 \times 0.5 \text{ ft}^3/\text{s}) / 0.0016 \text{ ft}^3/\text{s})(\text{Cd})$   
 $= 105 \text{ } \mu\text{g/L}$

Info needed for **Q plume**

- Conductivity of Aquifer Material ( $10^{-3} \text{ cm/s}$ )
- Hydraulic gradient = 0.05
- Plume Area – X section at stream discharge point
  - Option 1 = 2000  $\text{ft}^2$
  - Option 2 = 1000  $\text{ft}^2$

$$((0.25 \times 7Q10) / Q_{\text{plume}})(\text{Water Quality Standards})$$

Not to Scale

# Site-Specific SWPC

(Requiring Commissioner's Approval)

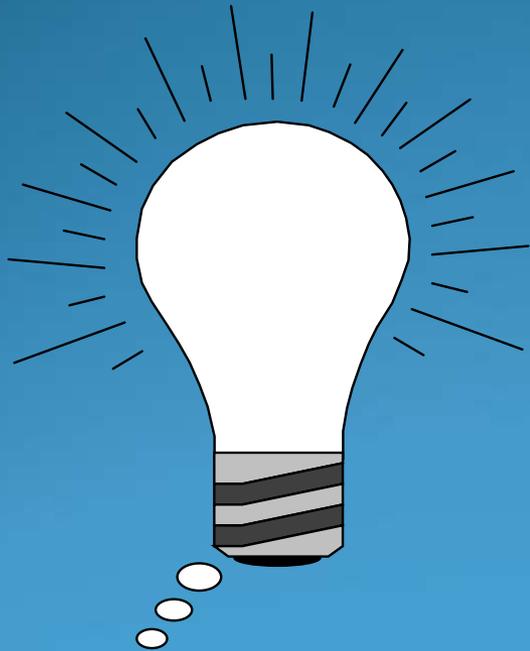
- ◆ 7Q10
- ◆ Other surface water and groundwater discharges within ½-mile upstream
- ◆ Instream water quality
- ◆ Flow rate of plume discharge
- ◆ Any other information requested by the Commissioner

# Tidal Influenced Water Bodies

- ◆ No self implementing option available for alternative surface water protection criteria
  - ◆ No applicable 7Q10 in tidal influences water bodies
  - ◆ Tidal Flow needs to be calculated
- ◆ Tidal Flats: no water = no dilution
- ◆ Any other information requested by the Commissioner



# Surface Water Protection Criteria



Q & A

# Volatilization Criteria

# Volatilization Criteria – Basic Concepts

- ◆ Groundwater plumes polluted with VOCs can pose risks to indoor air quality
- ◆ VOCs in groundwater volatilize at water table and accumulate in soil vapor
- ◆ Soil vapor can be drawn in or diffuse into buildings

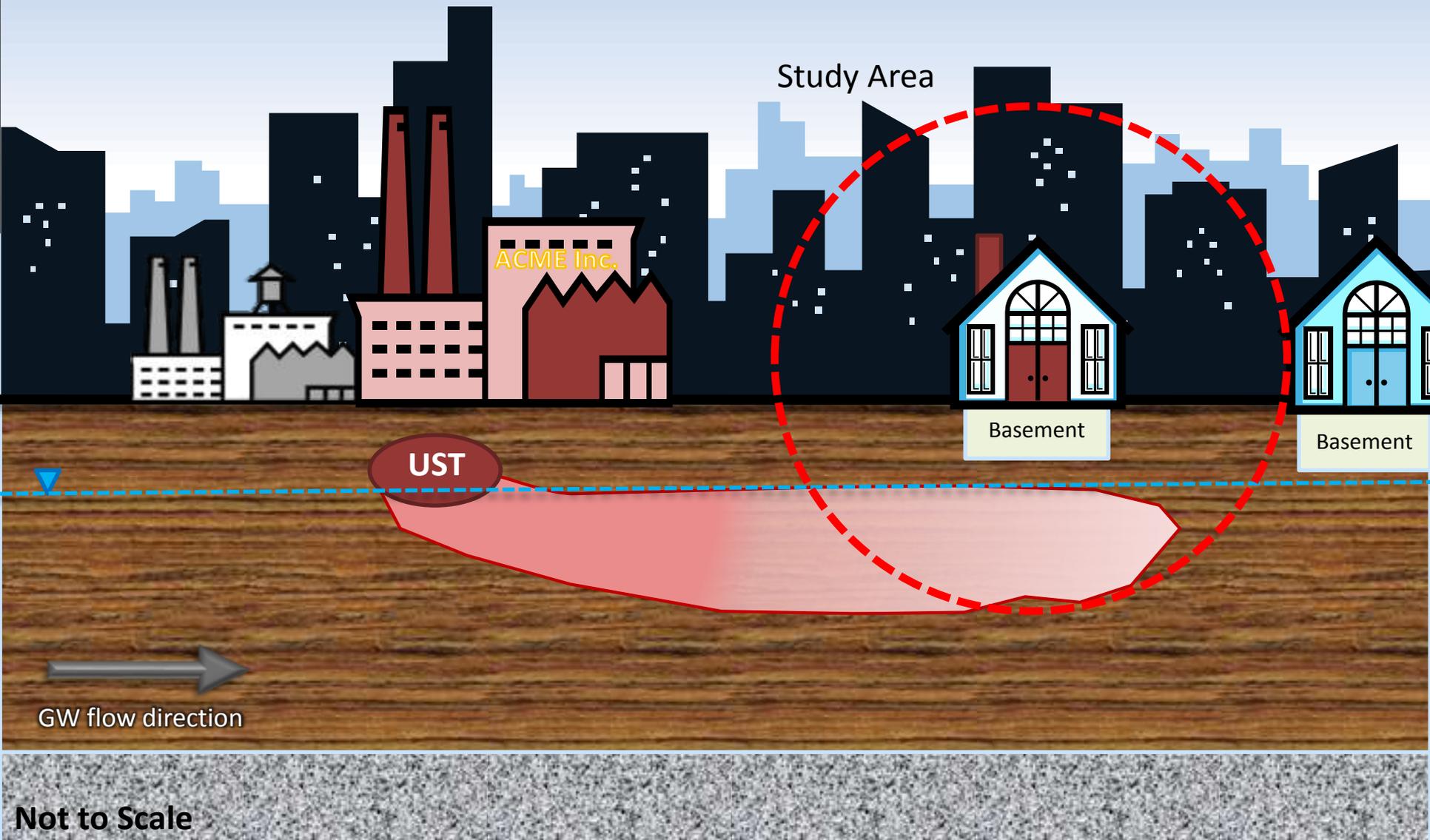
# General Volatilization Criteria Requirements

- ◆ Groundwater within 15 feet of the ground surface (or within 15 feet beneath the lowest level of a building) shall be remediated to the residential volatilization criteria

# Exceptions to Groundwater Volatilization Criteria

- ◆ If the building is used solely for industrial or commercial activity and an ELUR is in place ensuring no residential use, then groundwater shall be remediated to the industrial/commercial volatilization criteria

# Conceptual Model of Vapor Intrusion



Study Area

ACME Inc.

UST

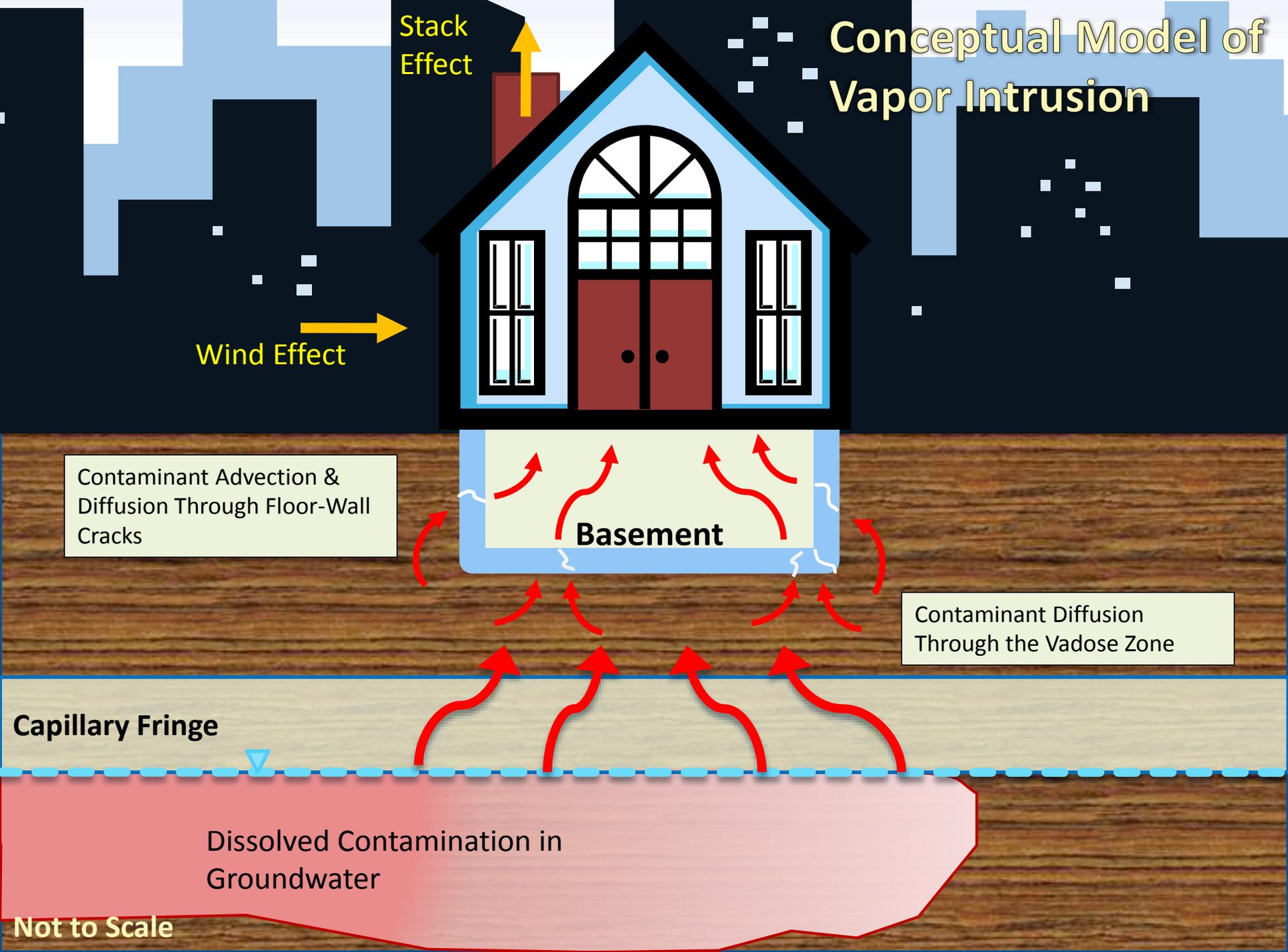
Basement

Basement

GW flow direction

Not to Scale

# Conceptual Model of Vapor Intrusion



Stack Effect

Wind Effect

Contaminant Advection & Diffusion Through Floor-Wall Cracks

Basement

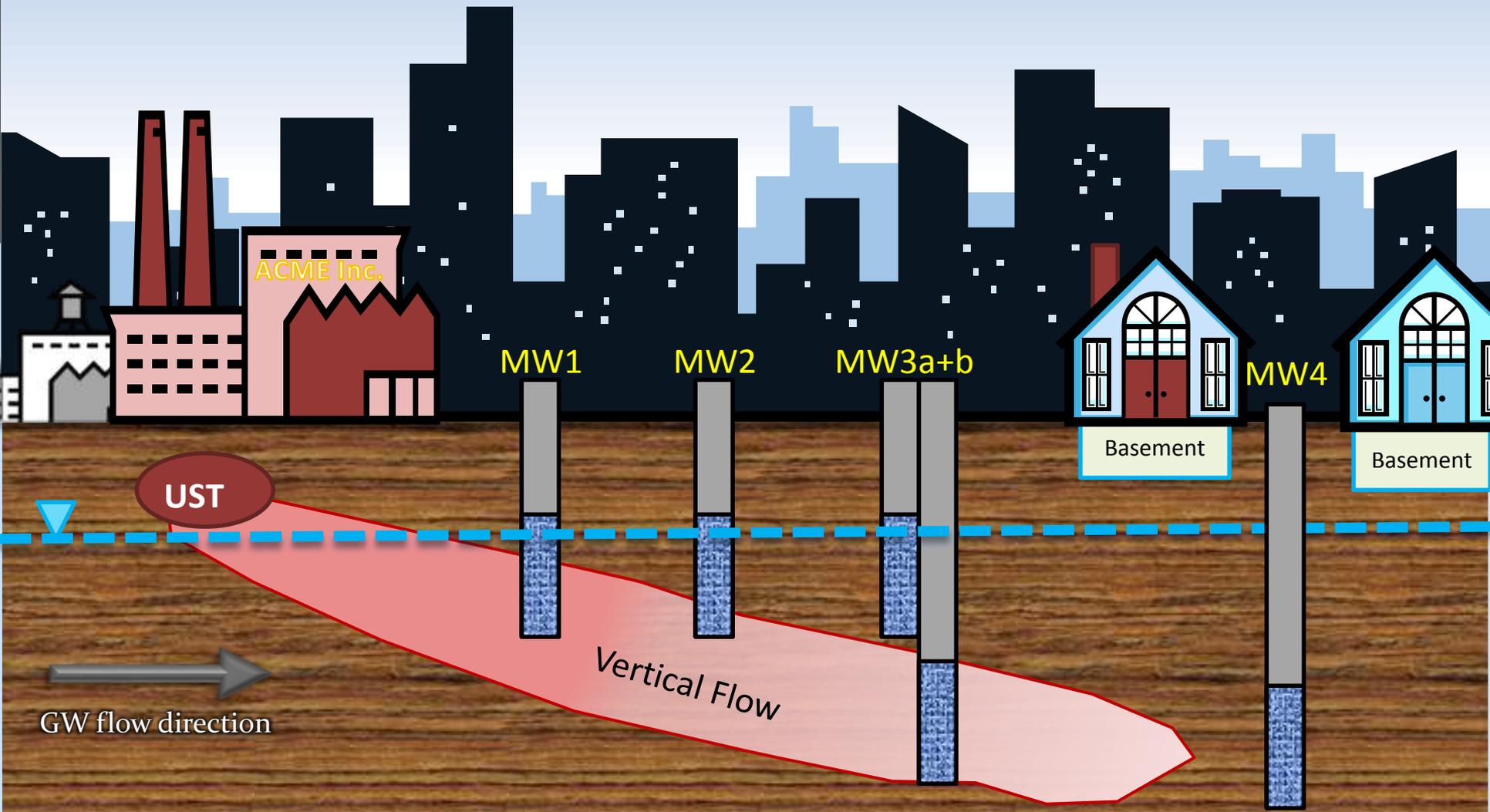
Contaminant Diffusion Through the Vadose Zone

Capillary Fringe

Dissolved Contamination in Groundwater

Not to Scale

Risk from vapor intrusion only pertains when groundwater is polluted with VOCs at the water table – Standard wells (with representative screens bisecting the water table) are required to demonstrate compliance



Not to Scale

# Alternative Demonstration of Compliance for Volatilization Criteria

- ◆ If soil gas *beneath a building* is below the residential vapor criteria, no remediation is required
- ◆ If soil gas *beneath a building* is below the industrial/commercial vapor criteria, and the building is not used for residential activities then no remediation is required (ELUR must be recorded)

# Exception to Volatilization Criteria – Mitigation

- ◆ Remediation of groundwater is not required if measures acceptable to the Commissioner are taken to prevent the migration of vapors into any overlying building
- ◆ System must be maintained and monitored
- ◆ Notice must be provided to the Commissioner (includes description of plume, description of mitigation, plan for monitoring and maintenance, and a map showing plume, building and mitigation system)
- ◆ Notice needs to be provided w/ proper transmittal form – on DEEP website

# Classic Conceptual Model of a Sub-Slab Depressurization System



Not to Scale

# Examples of Classic Sub-Slab Depressurization System Installations

Standard Exterior Installation



Interior Piping



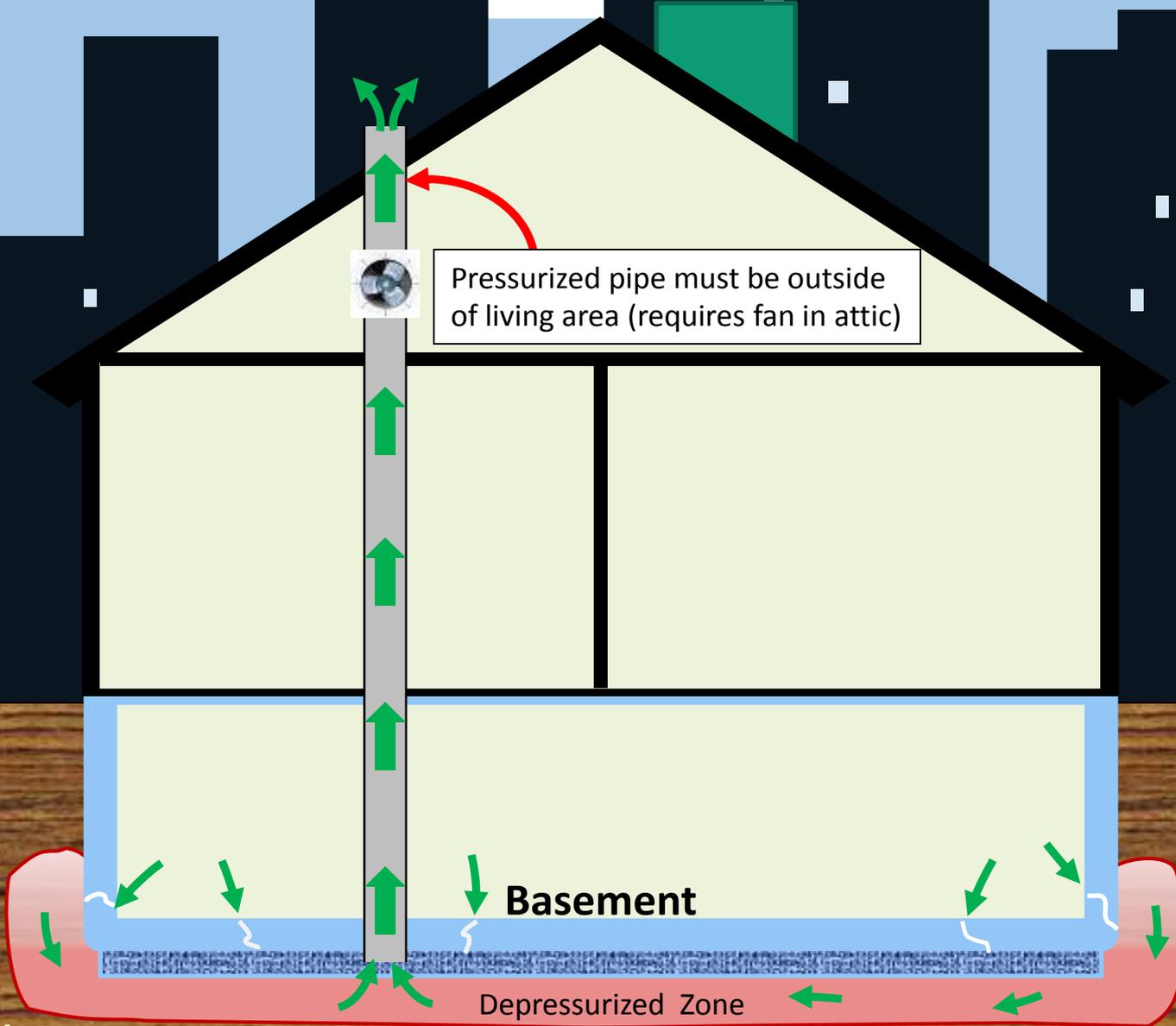
Potential Freezing Issues



Aesthetic Covers



# Alternative Conceptual Model of a Sub-Slab Depressurization System



Not to Scale

# Examples of Alternative Sub-Slab Depressurization System Installations

## Attic Fan Installations



## Roof Vent



## Interior Piping (Closet Space)



# Example of What Not To Do When Installing a Sub-Slab Depressurization System

Fan Mounted in "Living Area"



Vent Location Below Roofline



# Site-Specific Volatilization Criteria (Self-Implementing)

- ◆ May be calculated using the equations in Appendix G
- ◆ For groundwater or soil vapor
- ◆ Some parameters are specified
- ◆ Many are site specific

# Alternative Volatilization Criteria (Requiring Commissioner's Approval)

- ◆ Must demonstrate that vapors do not accumulate in structure at a concentration which would exceed risk of  $10^{-6}$  for any carcinogenic substance and a hazard index of 1 for any non-carcinogenic substance
- ◆ For **multiple substances** cumulative risk cannot exceed  $10^{-5}$  for carcinogenic substances and a cumulative hazard index of 1 for non-carcinogenic substances
- ◆ Will include Department of Public Health as part of the review (will require the use of current toxicology information and exposure pathway assumptions)

# Exemptions

## from the Volatilization Criteria

### ◆ If **no building** exists and either

- 1) ELUR is recorded to ensure no building will be constructed over plume or “best efforts” have been made to obtain such ELUR, *or*
- 2) Commissioner has approved a demonstration that no building can be built, *or*
- 3) Commissioner has approved a demonstration that natural attenuation will reduce concentration over 5 years to below applicable volatilization criteria

# Exemptions from the Volatilization Criteria as a Result of Indoor Air Quality Data

- ◆ Commissioner must approve monitoring plan  
(*use transmittal form*)
- ◆ Plan will be submitted to DPH for review  
(will require the use of current toxicology  
information and exposure pathway  
assumptions)
- ◆ May include measures to control the  
concentration in building

# Compliance with the Volatilization Criteria (with Representative Sampling)

Groundwater – minimum of 4 quarterly samples (representative of seasonal variation) collected over two years ≤ to the applicable criteria (Appendix E, background, or APS/alternative criteria)

# Alternative Compliance with the Volatilization Criteria (with Representative Sampling)

Soil Vapor – samples representative of seasonal variations (heating and cooling)  $\leq$  to the applicable criteria (Appendix F or APS/alternative criteria)

# Recap for Evaluating Compliance with Volatilization Criteria (w/ building)

- ◆ Groundwater results from defined plume compared to default RSR criteria (GW Volatilization Criteria – Compliance)
- ◆ Soil Vapor results compared to default RSR criteria (SV Volatilization Criteria – Alternative Compliance)
- ◆ Undertake mitigation (Exemption)
- ◆ Conduct indoor air monitoring (Exemption)

## Question 1

There is a groundwater plume contaminated with VOCs above the Groundwater Volatilization Criteria (GWVC) in an open (undeveloped) field.

Can soil vapor samples collected from the above the plume be used to demonstrate compliance with the Volatilization Criteria?

## Question 1

There is a groundwater plume contaminated with VOCs above the Groundwater Volatilization Criteria (GWVC) in an open (undeveloped) field. Can soil vapor samples collected from above the plume be used to demonstrate compliance with the Volatilization Criteria?

**No**, the use of soil vapor to demonstrate compliance with the Volatilization Criteria requires that the soil vapor samples be collected from beneath a building:

22a-133k-3(c)(3)(A) “Remediation of a volatile organic substance to the volatilization criterion for ground water shall not be required if the concentration of such substance in **soil vapors below a building** is equal to or less than (i) the residential volatilization criterion for soil vapor...”

## Question 2

During the investigation of a site, groundwater samples and soil vapor samples were collected from beneath the building.

The compliance groundwater samples (4 quarterly samples) were not found to contain any contaminants at concentrations greater than the GWVC, while the soil vapor samples did contain contaminants at concentrations greater than the SVVC.

Should the site be considered to be in compliance with the Volatilization Criteria?

## Question 2

During the investigation of a site, groundwater samples and soil vapor samples were collected from beneath the building. The compliance groundwater samples (4 quarterly samples) were not found to contain any contaminants at concentrations greater than the GWVC, while the soil vapor samples did contain contaminants at concentrations greater than the SVVC. Should the site be considered to be in compliance with the Volatilization Criteria?

**Yes**, the site is in compliance with the Volatilization Criteria.

Comparing groundwater samples to the GWVC is the **primary method** of demonstrating compliance with the Volatilization Criteria, whereas comparing the soil vapor samples to the SVVC is only an **alternative method** from meeting the groundwater requirement.

However, if the vapors aren't coming from the groundwater, they must be coming from somewhere which would need to be considered when developing the conceptual site model. If a soil source is found, it will most likely require remediation based on the soil criteria (and would preclude the use of an environmentally isolated ELUR for the PMC until the soil was remediated to the maximum extent prudent).

## Question 2

During the investigation of a site, groundwater samples and soil vapor samples were collected from beneath the building. The compliance groundwater samples (4 quarterly samples) were not found to contain any contaminants at concentrations greater than the GWVC, while the soil vapor samples did contain contaminants at concentrations greater than the SVVC. Should the site be considered to be in compliance with the Volatilization Criteria?

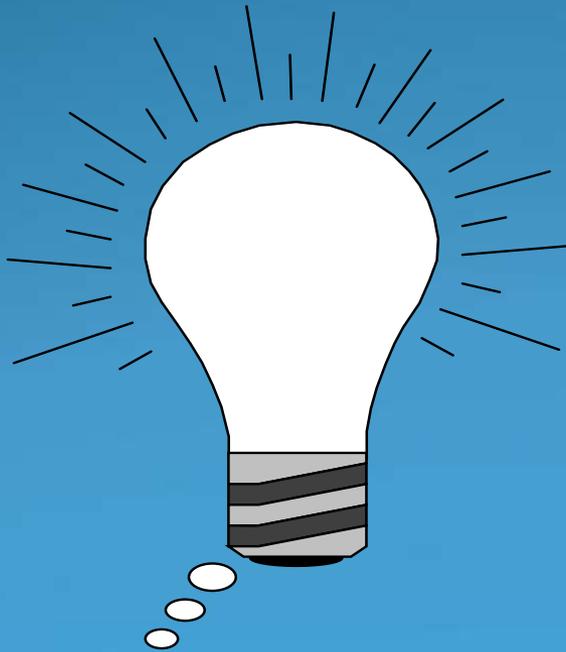
Comparing groundwater samples to the GWVC is the primary method of demonstrating compliance with the Volatilization Criteria:

22a-133k-3(c)(1) “Except as specified in subdivisions (2), (3), (4) and (5) of this subsection, **all 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 is equal to or less than the applicable residential volatilization criterion** for ground water.”

Comparing the soil vapor samples to the SVVC is only an exception from the groundwater requirement:

22a-133k-3(c)(3)(A) “**Remediation of a volatile organic substance to the volatilization criterion for ground water shall not be required if the concentration of such substance in soil vapors below a building is equal to or less than (i) the residential volatilization criterion for soil vapor.**”

# Volatilization Criteria



Q & A

# Groundwater and Compliance Monitoring

# Groundwater Monitoring

- ◆ When should groundwater monitoring be conducted?
- ◆ What is groundwater monitoring designed to determine?
- ◆ When can groundwater monitoring start?
- ◆ What is required prior to conducting monitoring?
- ◆ How long is Compliance monitoring timeframe?

# Groundwater Monitoring - Shall be conducted for

- ◆ Any release area suspected to impact groundwater
- ◆ Any release area remediated
  - If there is a release area there may be a groundwater plume
- ◆ Any identified groundwater plume

# Groundwater Monitoring is designed to determine

- ◆ Effectiveness of soil remediation in preventing pollution of groundwater
- ◆ Effectiveness to render soil environmentally isolated
- ◆ Effectiveness of any remediation taken to eliminate or minimize any risk

# Groundwater Monitoring is designed to determine (cont.)

- ◆ Whether applicable requirements have been met
  - SWPC or Alternative SWPC
  - VolC or Alternative VolC
  - Background or GWPC
  
- ◆ In GB areas whether the plume interferes with any existing use

# DEC Exception for Compliance Monitoring

- ◆ Compliance monitoring does not apply if remediation solely to address DEC exceedances
- ◆ Groundwater monitoring is needed
  - to characterize there is no plume

# DEC Exception for Compliance Monitoring

To demonstrate there is only a DEC exceedance

- ◆ Document that there is no PMC exceedance
- ◆ Groundwater was not impacted by the release
- ◆ No potential for residual contamination to exist below the water table
- ◆ Nature of the release that caused DEC exceedance(s)
- ◆ Remediation of DEC exceedance conducted

# Compliance Monitoring Start After:

- ◆ **Characterization of source of plume complete**
  - Without complete characterization don't know if remediation is necessary hence if compliance monitoring is necessary
- ◆ **Sample locations must also represent extent and degree of plume**
  - Without representative sample locations difficult to characterize plume and determine effectiveness of remediation

# Compliance Monitoring Start After:

- ◆ All remedial actions have been completed
  - Pertains to the specific release area(s) that is relevant to the groundwater plume in question
- ◆ If a site-wide clean up is the goal, or commingled plume, site-wide groundwater monitoring can be performed
  - As long as wells are representative of all releases
  - All remedial actions for the site have been conducted

## Compliance Monitoring Start After:

- ◆ All monitoring events used for compliance must occur “After” remedial actions “have been concluded”
  - This includes all remedial effects of in situ treatments
- ◆ Except other than natural attenuation of groundwater plume or recording an ELUR
  - Pertains to the continued decrease in concentration (attenuation) during Compliance Monitoring not MNA

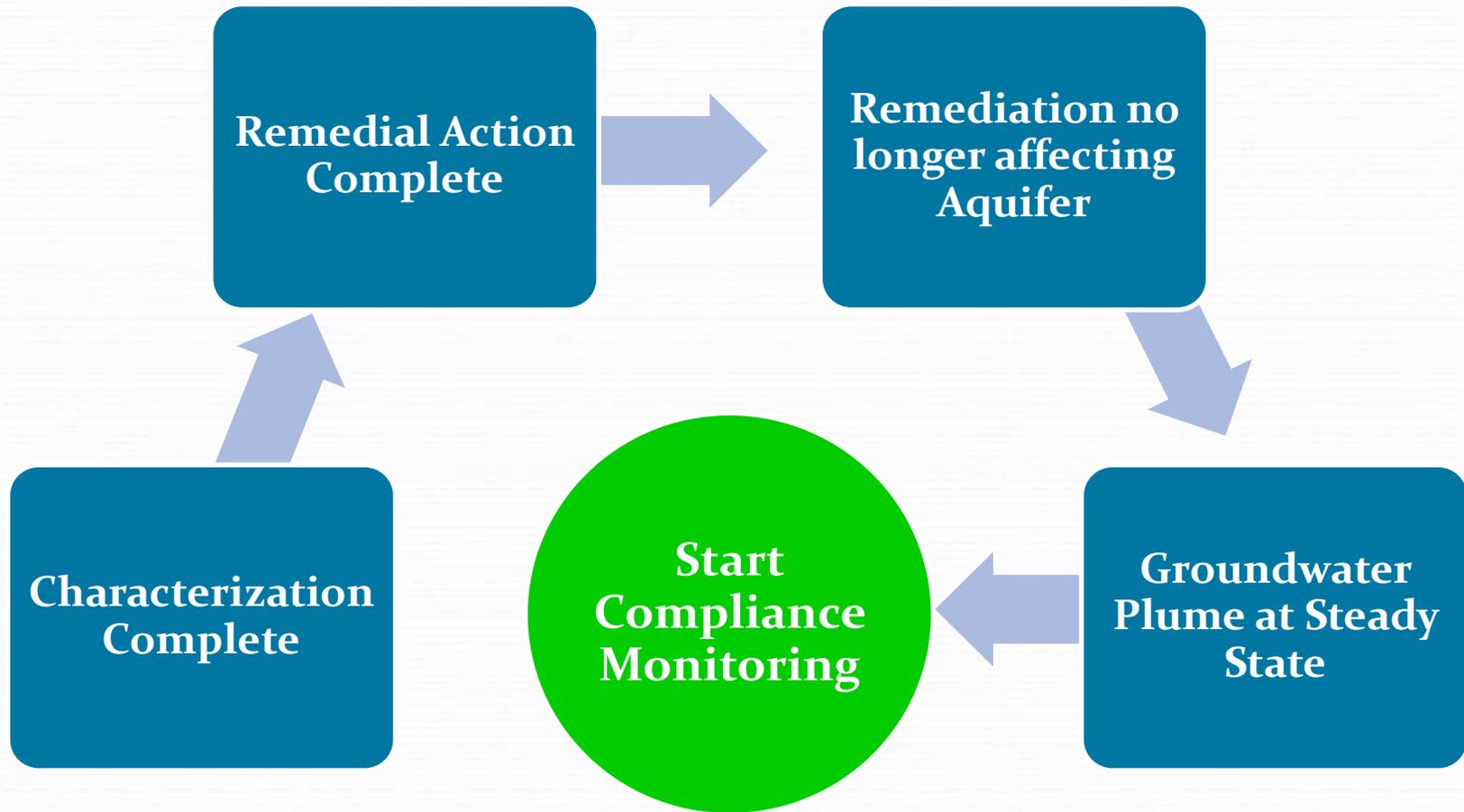
## Compliance Monitoring Start After:

- ◆ **Aquifer is no longer affected by withdrawal or injection**
  - Monitoring wells need to be properly located to detect groundwater conditions both before and after remediation
- ◆ **Geochemical changes from remediation have stabilized**
  - It may be difficult without proper baseline groundwater conditions to conclude the effects of remediation on groundwater conditions have ended and compliance monitoring can commence

## Compliance Monitoring Start After:

- ◆ Concentration is not increasing over-time, except as a result of natural attenuation or seasonal variation
  - This requires knowledge of the groundwater flow direction
  - Proper well screening to determine the three-dimensional extent of the plume
  - Multiple sampling events are needed to document steady state conditions are occurring
  - Increasing concentration cannot occur over-time in any monitoring well representing the plume

# Compliance Monitoring Summary



# Compliance Monitoring Timeframe

After groundwater reached applicable criteria:

- ◆ Compliance monitoring shall be a minimum of **four sampling** events on a quarterly basis within **two years**

Or

- ◆ 95% UCL using 12 consecutive monthly samples

# Compliance Monitoring Timeframe

- ◆ 2 years clock starts after first compliance sampling round
- ◆ Not necessarily consecutive, but representative of seasonal variation
- ◆ Samples must represent all four seasons. Ensures samples cover high and low water table events
- ◆ Allows for access or logistical issues
- ◆ Does not prevent sampling for four quarters over a one year period

# Compliance Monitoring Timeframe

- ◆ If during the first year of compliance monitoring there are exceedances of applicable criteria during one sample round, it may be acceptable to collect another sample during the same quarter the following year. If that sample and three other quarterly samples meet the applicable criteria, compliance monitoring may be complete

as long as:

## **Application of 2-year Compliance Monitoring timeframe**

- ◆ The anomalous exceedance was consistent with the goal of confirming the effectiveness of the soil or groundwater remediation
- ◆ The exceedance can be explained through secondary lines of evidence
- ◆ The difference between the exceedance and the subsequent compliance round is not due to differences in water table elevation, and
- ◆ If compliance is sought for a site-wide closure the exceedance is not due to a new source area

## Commissioner Option

- ◆ Commissioner may approve an alternative method of demonstrating compliance
  - The provision for approval of **“an alternative method for demonstrating compliance”** is to provide the ability to allow use of **innovative approaches** that might be developed in the future

# Compliance Monitoring Recap

- ◆ Need to characterize release and extent of plume
- ◆ Groundwater monitoring still needs to determine the effectiveness of remediation
- ◆ Remediation must be completed
- ◆ Groundwater stabilized prior to compliance monitoring
- ◆ Compliance monitoring is 4 quarters within 2 years of first compliance sample round
- ◆ Post-remedial groundwater monitoring no longer standardized

# Demonstrating Compliance with SWPC

- ◆ Must meet all general compliance requirements
  - All remediation complete
  - Plume reached steady state conditions
- ◆ The applicable SWPC has been met for 4 quarters within 2 years of first compliance sample round

# Demonstrating Compliance with SWPC

## ◆ 1<sup>st</sup> Compliance Point

- 95% UCL
- Representative samples of entire plume
- Use all compliance sampling rounds in calculation
- Replaces Averaging

# Demonstrating Compliance with SWPC

## ◆ 2<sup>nd</sup> Compliance Point

- Concentration of the substance in the plume immediately upgradient of groundwater discharge to surface water body is less than or equal to applicable criteria and plume is at steady state
- “Immediately upgradient”
  - Does not have to be at the edge of the water
  - Could be most downgradient extent of the plume

# Additional Remediation of Groundwater

- ◆ Commissioner has authority to require additional action
- ◆ One example would be if a substance impairs the aesthetic quality of groundwater which is a source of domestic use

## Question 1

Is Compliance Monitoring always necessary following Soil Remediation? (Yes/No)

Is Compliance Monitoring always necessary following natural attenuation to the achieve applicable criteria? (Yes/No)

Is Compliance Monitoring necessary if no remediation was necessary? (Yes/No)

## Question 1

Is Compliance Monitoring always necessary following Soil Remediation?

**No**

(If soil remediation for DEC only no Compliance monitoring is needed)

## Question 1

Is Compliance Monitoring always necessary following natural attenuation to achieve the applicable criteria?

**Yes**

(Natural attenuation is a type of groundwater remediation)

## Question 1

Is Compliance Monitoring necessary if no remediation was necessary?

**No**

(If investigation determine no soil or groundwater impacts compliance monitoring not necessary)

**22a-133k-3(a)(1) Remediation of a groundwater plume shall result in the attainment of...SWPC, VC and background”**

## Question 2

A Chromium plume is emanating from a site exceeding the SWPC. One round of off site samples indicate groundwater is below the SWPC. Does anything more need to be done?

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A Chromium plume is emanating from a site exceeding the SWPC. One round of off site samples indicate groundwater is below the SWPC. Does anything more need to be done?

- a. Nothing more needs to be done
- b. One more round of sampling as long as the average concentration of Chromium plume is still below the SWPC
- c. Additional rounds of sampling are needed until the steady state condition indicates that the portion of the plume that discharges to the water body is below the SWPC

## Question 2

A Chromium plume is emanating from a site exceeding the SWPC. One round of off site samples indicate groundwater is below the SWPC. Does anything more need to be done?

- a. Nothing more needs to be done
- b. One more round of sampling as long as the average concentration of Chromium plume is still below the SWPC
- c. **Additional rounds of sampling are needed until the steady state condition indicates that the portion of the plume that discharges to the water body is below the SWPC**

**22a-133k-3(g)(2)(A)(i)(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 variation

### Question 3

You were collecting annual monitoring and the groundwater finally meets all applicable criteria in December 2014.

If you start compliance monitoring in now March 2016. Can you use the December 2014 round for compliance monitoring?

### Question 3

You were collecting annual monitoring and the groundwater finally meets all applicable criteria in Dec 2014. You start compliance monitoring in March 2016. Can you use the Dec 2014 round for compliance monitoring?

- a. **Yes, because the December 2014 round met criteria**
- b. **Yes, because I will collect 3 more rounds this year representing seasonal variation.**
- c. **No, because by the time collect the remaining 3 round the December 2014 sample round will exceeds two year window for collecting compliance monitoring**

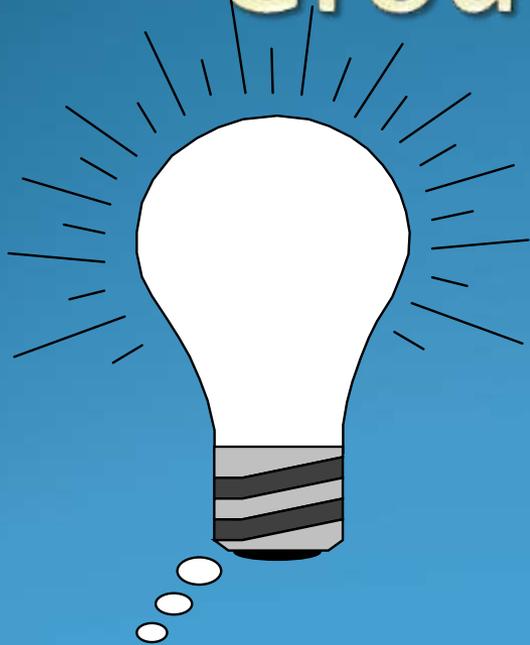
## Question 3

**b. Yes, because I will collect 3 more rounds this year representing seasonal variation.**

**Dec 2014, Spring 2016, Summer 2016, Fall 2016 are within the 2 year window for compliance monitoring.**



# Groundwater Criteria



Q & A

# Technical Impracticability

# Technical Impracticability (TI) of Groundwater Remediation

- ◆ **Exemption from Background** due to Technical Impracticability
  - ◆ Self Implementing
- ◆ **Variance** Due to Technical Impracticability of Groundwater Remediation
  - ◆ Requiring Commissioner's Approval

# Exemption from Background due to Technical Impracticability

- ◆ Remedial goal in a GA area is background:
  - ◆ Measures have reduced the concentration below GWPC but not to background
  - ◆ Technically impracticable to further reduce the concentration to background

THEN:

# Exemption from Background due to Technical Impracticability

- ◆ Exemption not designed to be used if MNA will achieve background in the near future
- ◆ Not an exit from additional monitoring
- ◆ If plume can and will reach background it is expected background is applicable criteria
- ◆ Used when plume is no longer degrading

# Exemption from Background due to Technical Impracticability

- ◆ No further remediation required, as long as
  - ◆ All applicable GW monitoring has been conducted
  - ◆ Understanding of why plume can not meet background
  - ◆ Notice is required

# Technical Impracticability Variance

- ◆ Optional groundwater remedial approach
  - Not a waiver for source area remediation or for addressing potential risks to receptors
  - Still need to addressing the source of the pollution to the maximum extent prudent
  - Mechanism to manage risk where there is no readily available technology to complete remediation
- ◆ Will protect human health and the environment

# Technical Impracticability Variance

## TI Zone

- ◆ Geographic area where groundwater contamination exceed the applicable criteria
- ◆ Contaminant Specific
- ◆ Public Input prior to DEEP approval
- ◆ The Commissioner has to approve TI variance

# Technical Impracticability Variance

## 1<sup>st</sup> Scenario

- ◆ Residual Source
  - ◆ Groundwater impacts resulting from NAPL, smears or discontinuous residuals
  - ◆ Cannot be effectively removed or degraded
  - ◆ Typically applies to DNAPL
  - ◆ Contamination removed to the max extent prudent
  - ◆ Groundwater contamination will not extend outside TI Zone

# Technical Impracticability Variance

## 2<sup>nd</sup> Scenario

- ◆ Persistent Plume
  - ◆ Steady state or slowly diminishing plumes that persist at unacceptable levels
  - ◆ Plume fully characterized (3D)
  - ◆ Will not dissipate within a reasonable timeframe
  - ◆ Source area(s) remediated

# Technical Impracticability Variance

- ◆ What is needed:
  - ◆ Demonstrate reducing plume not technically practicable
  - ◆ Any risk to human health must be eliminated
    - ◆ Plan to eliminate future human health risks
  - ◆ Certification that notice has been provided to each property owner overlying the plume
  - ◆ Notice must be provided to the Local Health Director
  - ◆ Apply for reclassification to GB
  - ◆ Map showing areal extent of plume
  - ◆ Anything else requested by Commissioner

# Technical Impracticability Variance

- ◆ Recording of an ELUR may be required
  - ◆ Best efforts to ensure that each property owner records an ELUR which ensures that the subject plume will not be used for a drinking water supply.
- ◆ Once the source area(s) has been addressed to the maximum extent prudent, the TI Variance may be suitable to support a final verification

# Technical Impracticability Variance

- ◆ Possible long-term obligations
  - ◆ Five year status reports
  - ◆ Continuation of O & M
  - ◆ Long-term monitoring program
  - ◆ Land use monitoring inspections
  - ◆ Receptor updates
  - ◆ Financial assurance for any continued monitoring needs

## Question 1

Are you planning on using TI provision in the future?

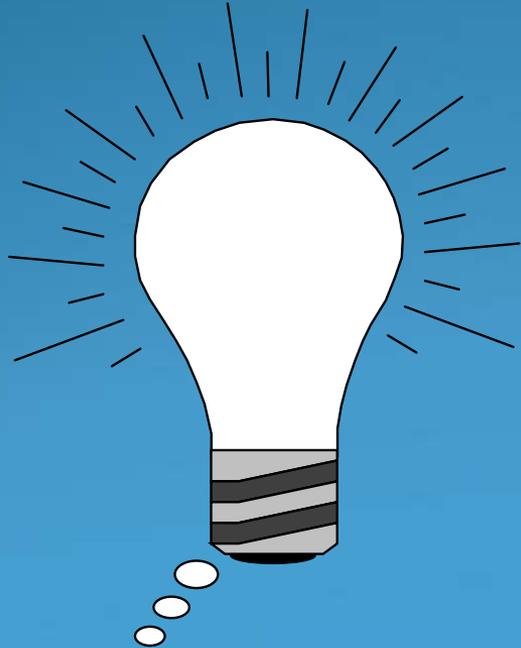
- a) Yes
- b) No
- c) Maybe

## Question 2

If yes or maybe, do you need to read the Technical Impracticability Fact Sheet and Guidance Document?

- a) No, I learned everything I need today
- b) No, I will just call someone at DEEP when I need to know about using a TI.
- c) Yes, I really need to read the TI fact sheet and Guidance document if I am planning to use the TI variance

# Technical Impracticability



Q & A

# Environmental Land Use Restrictions

# Environmental Land Use Restriction (ELUR)

- An ELUR is a **limitation** on the Property to minimize risk of human exposure to pollutants and hazards to the environment by:

Preventing certain types of uses

**or**

Preventing certain activities

# Environmental Use Restrictions

- Regulations of Connecticut State Agencies 22a-133k-1 through 22a-133k-3 (RSRs) and **22a-133q-1** determine the *circumstances* under which an ELUR may be used and provide *templates*
- The remediation of the site must be completed pursuant to the RSRs to record an ELUR

# ELUR

- An ELUR is a binding grant of easement
  - Between the Property owner and the Commissioner of DEEP
- The ELUR is recorded on the municipal land records
  - Recorded by the **Property owner only** because the ELUR will affect the Property
  - “Runs with the land” – survives the sale of the Property, bankruptcy, or foreclosure

# Residential Activity Restriction

- Contaminants  $>$  RES DEC but  $<$  I/C DEC
- Site-wide Restriction

# Inaccessible Soil Restriction

- Addresses DEC > applicable criteria to prevent exposure of/to impacted soil
  - Landscape = 4 feet
  - Paved surfaces = 2 feet
  - Beneath a building or permanent structure\*
  - Beneath paved surface – Urban Fill with metals < 2x applicable DEC criteria

# Environmentally Isolated Soil

- Addresses PMC > applicable criteria to ensure polluted soil will not be exposed to the infiltration of water
  - Beneath a building or
  - Permanent structure\*



# \*Permanent Structure

- Does it do what it is supposed to do?
  - Render soil inaccessible
  - Environmentally isolate soil
- What makes it permanent?
  - i.e. maintained as part of an active facility
- DEC – DEEP Notification
- PMC – DEEP Approval

# Disturbance of Engineered Control

- Following the construction of an approved Engineered Control an ELUR must be recorded to ensure no disturbance of the cap or exposure of the polluted soil
- Stands alone for the purpose of the Engineered Control (no other restrictions applicable)

# Residential Activity

- Groundwater:
  - VOCs > Res VC but < I/C VC
- Soil Vapor:
  - VOCs > Res VC but < I/C VC

# Building Construction

- Addresses VOC plumes in groundwater that exceed VC and are located less than 15 feet from the ground surface.
  - Ensure that no building can be built over the plume.

# Groundwater Use (Technical Impracticability of Groundwater Remediation)

- Following the approval of a TI an ELUR must be recorded to ensure polluted groundwater is not used for drinking or other domestic purposes

# Types of ELURs overview

- Residential Activity Restrictions
  - DEC
  - VC
  - Soil Vapor
- Environmentally Isolated Soil Restriction
  - PMC
- Disturbance of Engineered Control
- Building Construction Restriction
  - VC
- Groundwater Use Restriction (TI)

# ELUR Subject Areas for Case Studies



Property Boundary

Subject Area B

ACME Inc.  
Subject Area C

Subject Area A

Subject Area D



GW flow direction

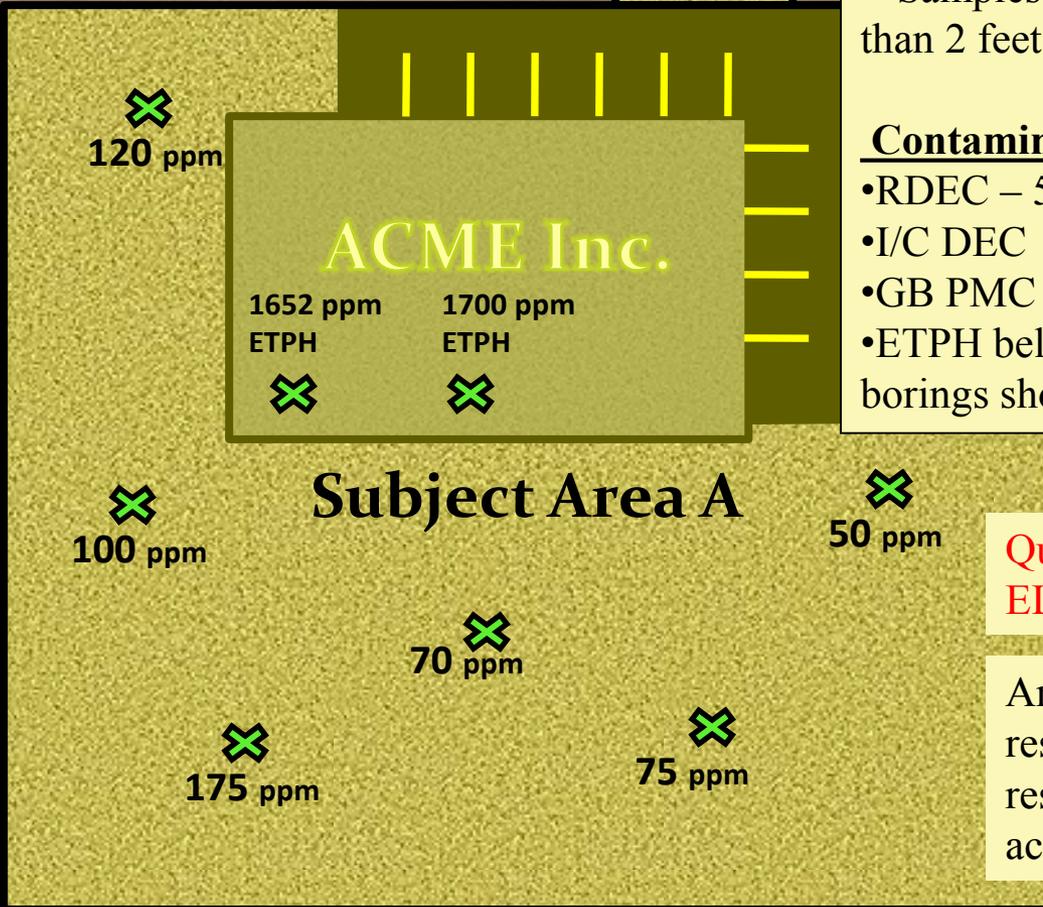
Not to Scale

# ELUR – Case Study #1



GW flow direction

Property Boundary



## Contaminant - Cadmium

- RDEC - 34 ppm
- I/C DEC - 1,000 ppm
- Samples are at a depth of less than 2 feet, below grass

## Contaminant - ETPH

- RDEC – 500 ppm
- I/C DEC - 2,500 ppm
- GB PMC applies – 2,500 ppm
- ETPH below building (not all borings shown)

**Question: What type of ELUR can be used?**

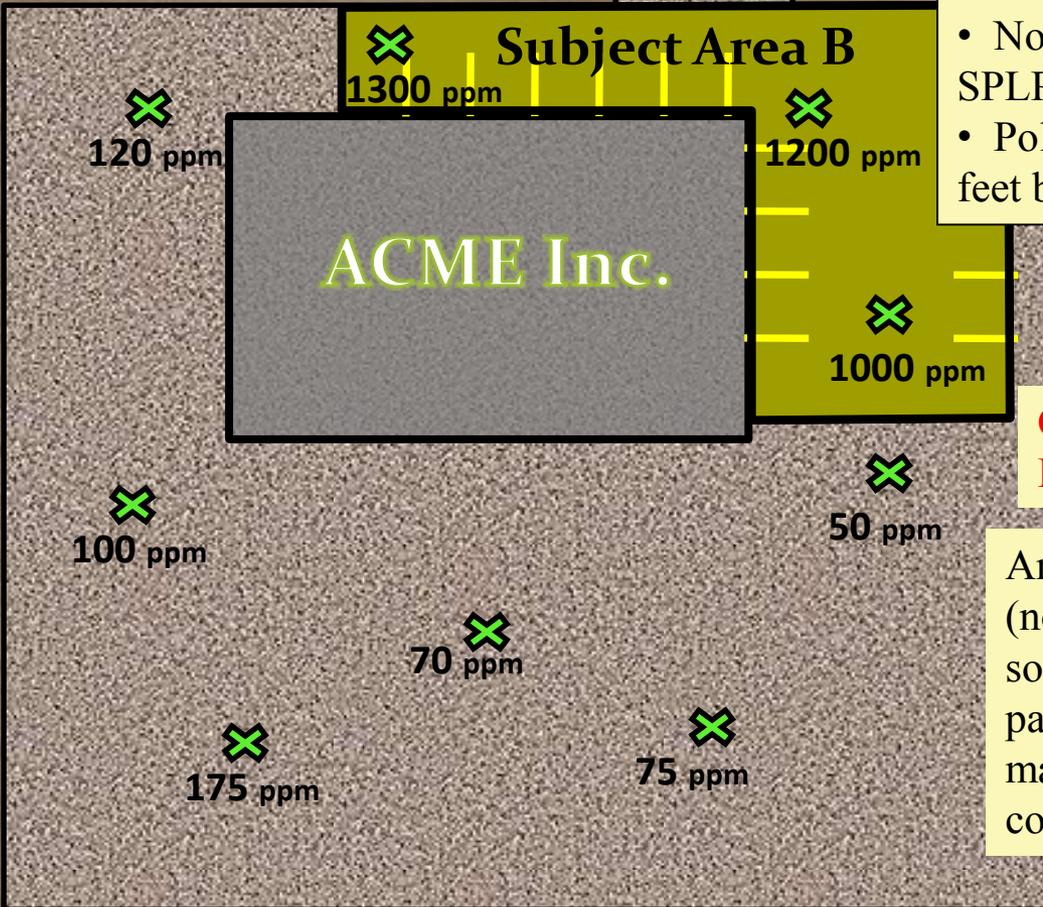
**Answer: Property wide residential activity restriction (residential activity prohibited)**

Not to Scale

# ELUR – Case Study #2a



Property Boundary



## Contaminant – Cadmium

- RDEC - 34 ppm
- I/C DEC - 1000 ppm
- No PMC exceedances by SPLP
- Polluted fill located three feet below pavement

**Question: What type of ELUR can be used?**

**Answer: Inaccessible soil (no exposure of polluted soil or disturbance of pavement, pavement to be maintained in good condition)**

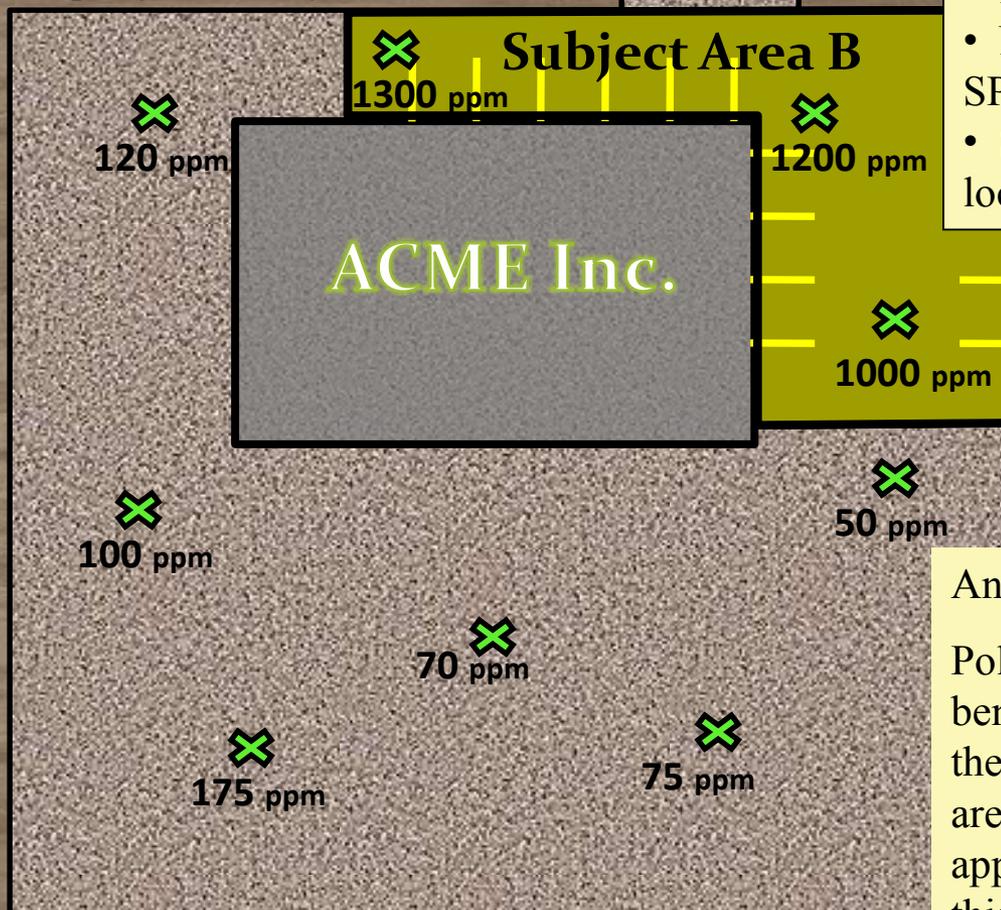
Not to Scale

# ELUR – Case Study #2b



Property Boundary

GW flow direction



## Contaminant – Cadmium

- RDEC - 34 ppm
- I/C DEC - 1000 ppm
- No PMC exceedances by SPLP
- Shallow polluted fill located below pavement

**Question:** What if the contamination is directly beneath the pavement and the site is restricted from Residential use?

**Answer:** Also, inaccessible soil

Polluted fill can be directly beneath pavement as long as the concentrations of metals are not more than 2x the applicable DEC (I/C DEC in this case).

Not to Scale

# ELUR – Case Study #2c



Property Boundary

**Subject Area B**  
1300 ppm

**ACME Inc.**

120 ppm

1200 ppm

1000 ppm

100 ppm

50 ppm

70 ppm

175 ppm

75 ppm

GW flow direction

**Contaminant – Cadmium**

- RDEC - 34 ppm
- I/C DEC - 1000 ppm
- No PMC exceedances by SPLP
- Shallow polluted fill located below pavement

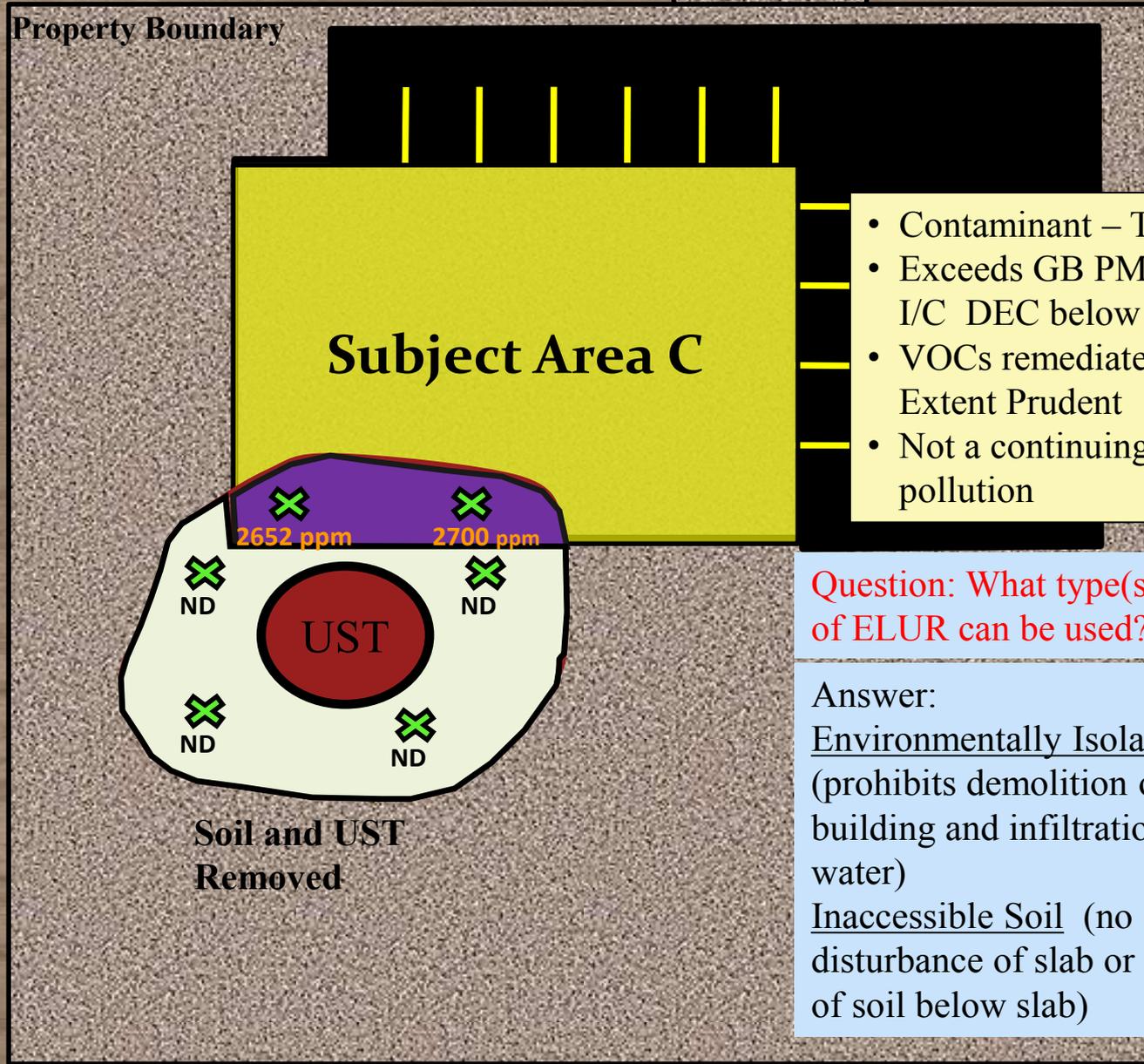
**Question: What if the contamination is directly beneath the pavement and the site is NOT restricted from Residential use?**

**Answer: An Engineered Control for DEC is needed with an ELUR (to prevent disturbance of the EC and exposure of soil)**

In this case, the fill would have concentrations more than 2x the applicable DEC (Res DEC) so could not be rendered inaccessible by pavement alone

Not to Scale

# ELUR – Case Study #3

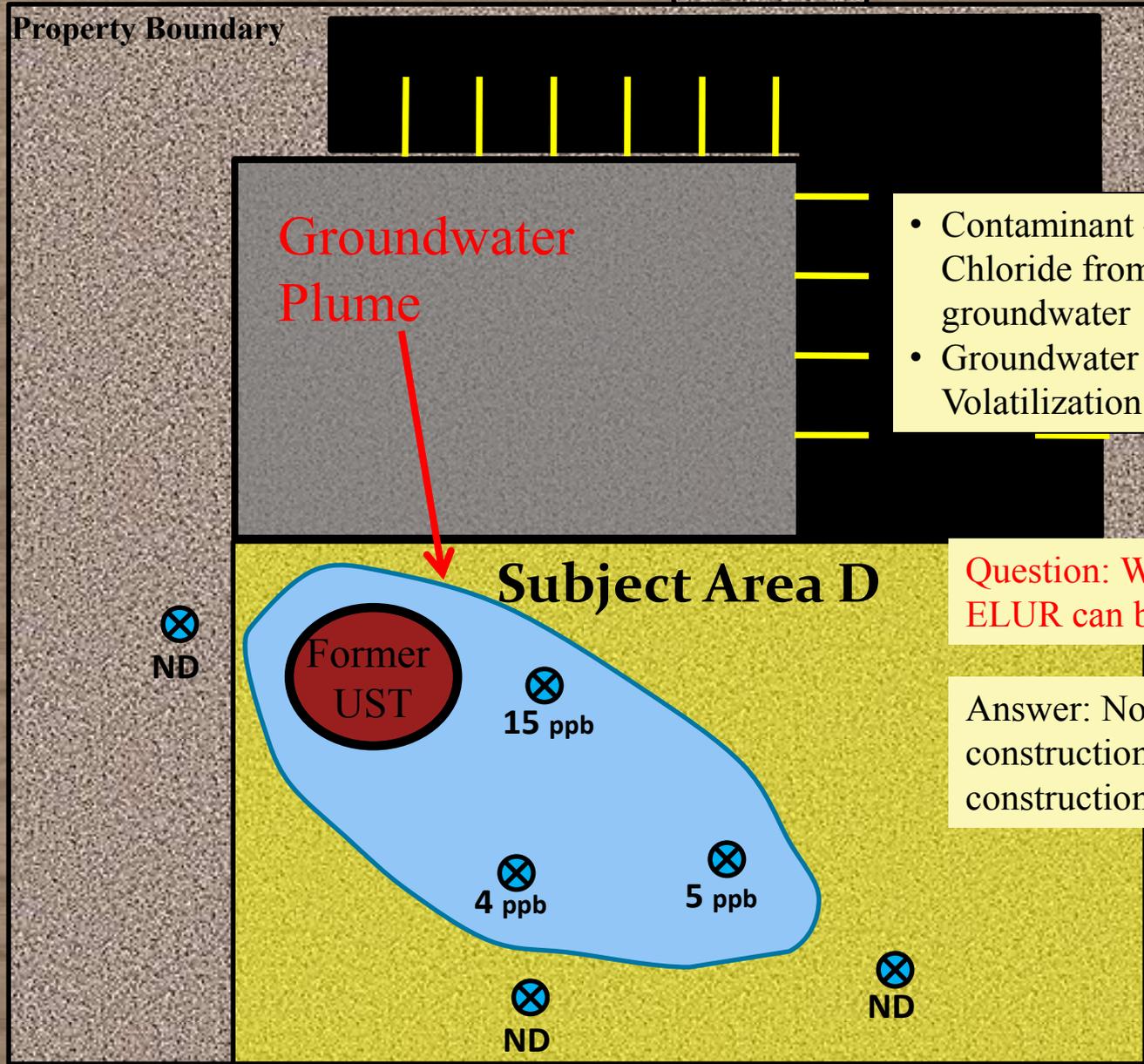


- Contaminant – TPH from UST
- Exceeds GB PMC and I/C DEC below building
- VOCs remediated to Maximum Extent Prudent
- Not a continuing source of pollution

**Question: What type(s) of ELUR can be used?**

**Answer:**  
Environmentally Isolated Soil (prohibits demolition of building and infiltration of water)  
Inaccessible Soil (no disturbance of slab or exposure of soil below slab)

# ELUR – Case Study #4



- Contaminant – Vinyl Chloride from UST in groundwater
- Groundwater exceeds I/C Volatilization Criteria

**Question: What type of ELUR can be used?**

**Answer: No building construction (building construction prohibited)**

Not to Scale

# Proposing an ELUR

- The owner of the Property submits the ELUR Application which includes:
  - Draft Declaration Document (unsigned)
  - Property Description [Exhibit A]
  - Proposed Decision Document [Exhibit B]
    - Description of Engineered Control as applicable
  - Draft A-2 Survey [Exhibit C]  
(the Instructions and Guidance Document provides an **A-2 Survey Checklist** that can be used as a reference)

# Proposing an ELUR (cont.)

- Subordination Agreements and Waiver Requests Form – Analysis of Land Title, A-2 Survey and Property Owner Affidavit

# Subordination Agreements

- A party recording an ELUR must record documents that demonstrate that each person with an interest in the land **irrevocably subordinates** such interest to the ELUR
- Commissioner may waive requirement for subordination agreement for minor interests (**Waiver Approval**)
- A certificate of title verifying recording of the ELUR, waivers, and subordination agreements must be submitted to the Commissioner

# Interests in the Land

- Any right in or potential claim to the Property
  - Includes Mortgages, Liens, Leases, Easements

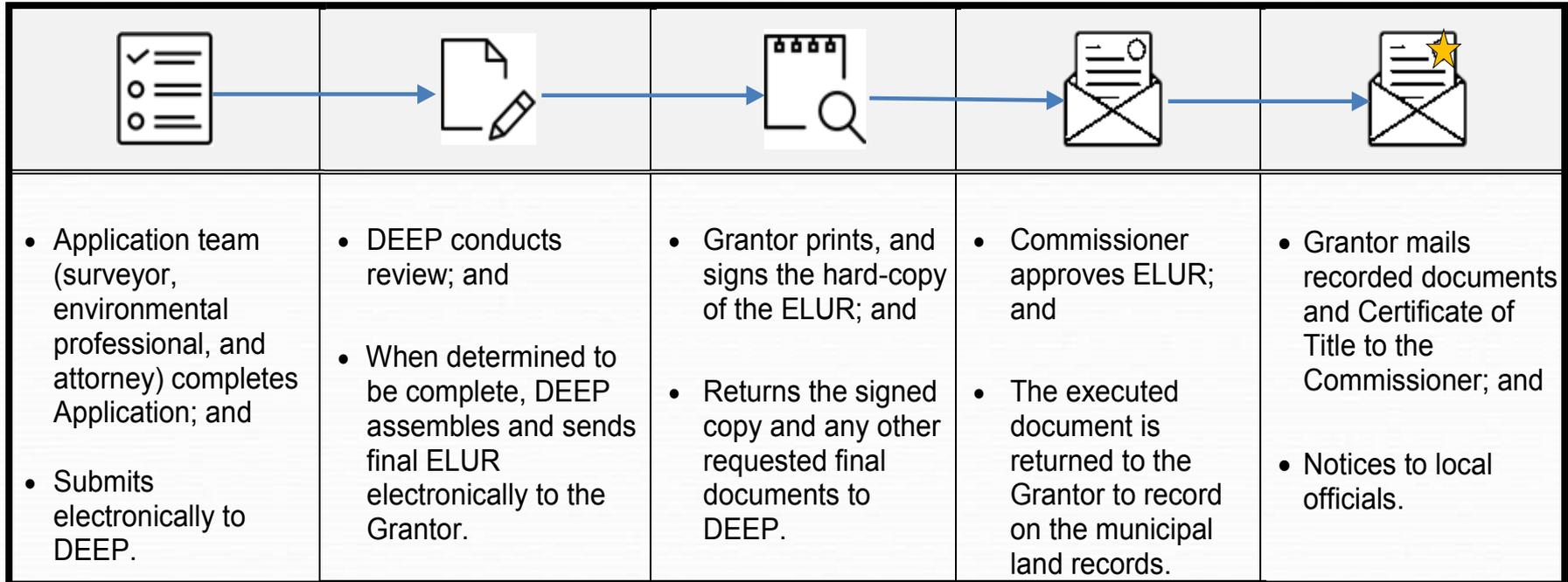
Affects purpose  
of ELUR

Subordination  
Agreement

Does NOT  
Affect purpose  
of ELUR

Waiver  
Request

# Application Review Process



# Public Notice

- Public notice of intent to record an ELUR is required
- Public notice must be published in a newspaper of general circulation
- Must provide a **30 day** comment period
- Comments should be directed to DEEP
- **Public notice is not required** if the sole purpose of the ELUR is to limit the parcel to industrial use and **municipal zoning already limits the parcel to such use**

# Decision Document

- The purpose is to describe in a manner that future owners and tenants can clearly understand:
  - The **types of pollutants** remaining on the site for which the use limitation is necessary
  - The **location** of such pollutants
  - What **activities or land uses** are **prohibited and why** such prohibitions are necessary

# Approval of Decision Document

- Before approving, the Commissioner will consider:
  - All public comments,
  - Whether the restriction will adequately protect human health and the environment, and
  - Whether the restriction is consistent with the RSRs.

# Recording an ELUR

- **Where** - on the municipal land records
- **When** - within 7 days of execution (by both parties)
- **What** -
  - Declaration Document
  - Exhibit A – Property Description
  - Exhibit B – Decision Document
  - Exhibit B – Engineered Control Description (if applicable)
  - Exhibit C – ELUR Survey
  - Documents demonstrating subordination of interests and/or Waiver Approval

# Notice to Local Officials/Others

- Copies of the recorded ELUR must be mailed to:
  - Chief Administrative Officer of the Town
  - Chairman of the Planning/Zoning Commission, the local Director of Health
  - Any person who submitted comments on the ELUR
- Copies of these letters and return receipts should be sent to DEEP within 30 days of recording the ELUR

# Release of an ELUR

- A land owner may be released **in whole** or **in part** from an ELUR with DEEP written approval
- Release must be consistent with RSRs
- Release must be recorded on the land records, unless the Commissioner determines that recordation is not necessary

# Partial Temporary Release

- Temporary release from part of the ELUR

## Examples:

- Utility maintenance – a portion of the ELUR may be released to allow excavation and repair of a utility
- Refitting of a commercial area to accommodate new use
- Requires an approved Soil Management Plan
- Site must be returned to original state, documented in a completion report

# Partial Permanent Release

- Permanent release from part of the ELUR

Example:

- Release area remediation – a portion of the ELUR can be released after a Subject Area has been remediated to no longer require the ELUR
- Requires temporary release (with Soil Management Plan) to perform work
- Area of the site can be developed as desired as long as it does not conflict with remaining portions of the ELUR

# Whole Temporary Release

- Temporary release from the whole ELUR

Example:

- Site Redevelopment – the ELUR may be released to allow redevelopment of the entire site
- Requires an approved Soil Management Plan to perform work
- Site must be returned to original state, documented in a completion report

# Whole Permanent Release

- Permanent release from the whole ELUR

Example:

- Site Remediation/Redevelopment – the entire ELUR may be released after the site is remediated to no longer require the ELUR
- Requires a temporary release (with approved Soil Management Plan) to perform remediation
- Site can be developed with no restrictions since there is no longer an ELUR

# Enforcing an ELUR

- The Commissioner may enforce the ELUR by:
  - Issuing an order
  - Referral to the Attorney General for injunctive relief and civil penalties
- CGS 22a-133p = enforcement authority

# ELUR Application Form

- Completed electronically
- Regulatory language provided; applicant checks appropriate box (but if needed, space is also provided for suggested alternative language)
- Submitted electronically

Please review **Instructions and Guidance Document** before starting an Application



Connecticut Department of  
Energy & Environmental Protection  
Bureau of Water Protection & Land Reuse  
Remediation Division  
79 Elm Street, Hartford, CT 06106-5127  
(860) 424-3705 [www.ct.gov/deep/remediation](http://www.ct.gov/deep/remediation)

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## Instructions and Guidance - Application for Environmental Land Use Restriction for the Commissioner's Review and Approval Revised September 2013

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In accordance with Section 22a-133q-1(d) of the Regulations of Connecticut State Agencies (RCSA), as amended, when submitting a proposed Environmental Land Use Restriction (ELUR) to the Commissioner for review and approval, the owner of the affected parcel of land (the "Property") shall simultaneously submit a completed application furnished by the Commissioner. The [Application for Environmental Land Use Restriction for the Commissioner's Review and Approval Revised September 2013](#) ("Application"), as provided on the CT Department of Energy and Environmental Protection ("Department") [Environmental Land Use Restrictions](#) webpage, has been developed for this purpose. The instructions and guidance contained herein ("Instructions and Guidance") have been developed to assist the applicant during the ELUR application preparation, submittal and approval process.

The Application guides the applicant to submit the information required by RCSA [Section 22a-133q-1](#), as amended, as well as supplemental information needed to help the Department more efficiently and effectively conduct its review. Throughout the Application and the Instructions and Guidance, the information required pursuant to statute or regulation will make use of the terms "must", "shall" and "required". Additional information requested by the Department will use terms such as "may", "should", "important", "recommends" and "suggests".

These Instructions and Guidance do not substitute or supersede the requirements of any relevant statutes or regulations. It is the applicant's responsibility to review and comply with all applicable laws prior to completing the Application.

**Note:** The Application is specific to ELURs that will be reviewed and approved by the Commissioner. For ELURs prepared pursuant to Section 22a-133y of the Connecticut General Statutes (CGS), which will be approved by a Licensed Environmental Professional (LEP), please contact the ELUR Coordinator at [DEEP\\_ELUR@ct.gov](mailto:DEEP_ELUR@ct.gov) for further information.

**Note:** The following Table of Contents (TOC) is included to provide a quick overview of the contents and to help the applicant navigate directly to relevant sections. The headers in the TOC serve as links and the section can be reached by pressing Ctrl-Click. To return to the TOC from within the document, a quick return link is provided in each section.

# ELUR Application Materials

- ELUR materials including the Application, Instructions and Guidance Document, and Supplementary Forms are posted on the DEEP Remediation Division Website.

# ELUR Question #1

During development of the remedial action plan, an easement is discovered for an electric utility line at the location of a proposed Engineered Control. What legal issues should be considered?

Subordination of the easement to the ELUR

## ELUR Question #2

A mortgage is found on a title search for the Property. Does this mortgage have to be subordinated to the ELUR?

Yes. This is because if the bank foreclosed on the mortgage, the ELUR could be cleared from the title of the property.

- The mortgage could also be paid in full and released.

# ELUR Question #3

At various release areas at a GB site, ETPH was found in soil:

- at concentrations ranging from 450 to 1,900 mg/kg
- at depths from 5 to 8 feet below grade

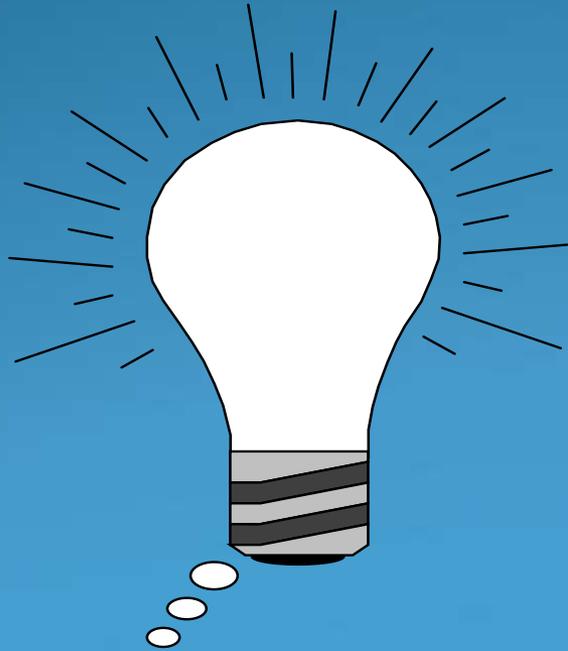
**What type(s) of ELUR are needed?**

Residential prohibition and/or inaccessible soil restriction

# ELUR Question #4

- During the Title Search and Survey review, a property encroachment is identified on the edge of the subject area. The neighbor's shed is partially located within the subject area designated for a Residential Restriction. **How should this be addressed?**
  - Re-evaluate the soil samples collected from this area and potentially redraw the Subject Area boundary.
  - Ask neighbor to move their shed.

# Environmental Land Use Restrictions



Q & A