Monitored Natural Attenuation (MNA) Guidance Document & Ground Water Remedial Action Permit (GW RAP) Guidance Document Training

January 31, 2023

Elizabeth Ayres & Gillian Schwert, Moderators
Contaminated Site Remediation & Redevelopment Program
Training Committee

Contact Information

- **Monitored Natural Attenuation Guidance Document**

  Alexander Shelkonovzeff, Environmental Specialist

  Bureau of Remedial Action Permitting

  Alexander.Shelkonovzeff@dep.nj.gov

- **Ground Water Remedial Action Permit Guidance Document**

  Michael Gaudio, Bureau Chief

  Bureau of Remedial Action Permitting

  Michael.Gaudio@dep.nj.gov

Continuing Education Credits

SRP Licensing Board has approved

2.5 Technical & 1 Regulatory CECs

for this Training Class

Attendance Requirements:

- **Webinar participants**: must be logged-in for the entire session and answer 3 out of 4 poll questions (randomly inserted in the presentation)

CECs: What's the Process?

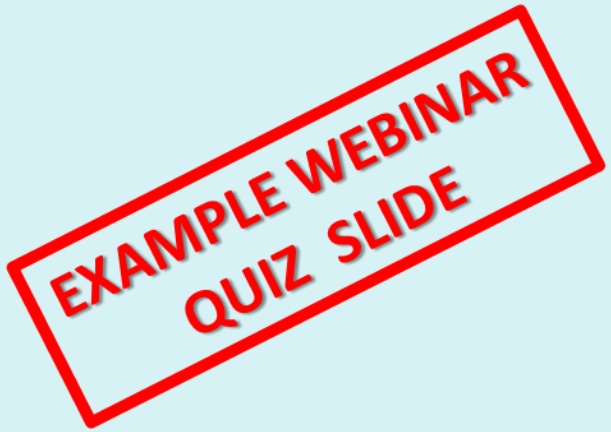
Since the SRPL Board has approved CECs for the course:

- DEP compiles a list of "webinar" participants eligible for CECs and provides the list to the LSRPA
- LSRPA will email eligible participants a link to an LSRPA webpage with certificate access instructions
- Certificates are issued by the LSRPA after paying a *$25 processing fee*

Test Your Knowledge

MNA stands for:

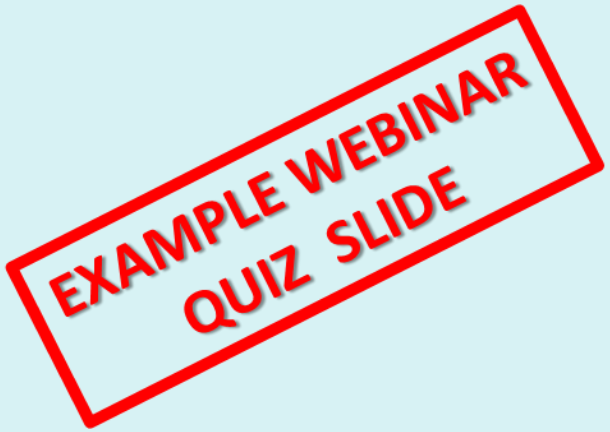
A. Mostly Not Attenuated
B. Monitored Natural Attenuation
C. Might Never Attenuate



Test Your Knowledge

MNA stands for:

A. Mostly Not Attenuated
B. **Monitored Natural Attenuation**
C. Might Never Attenuate



Question and Answer Segments

- Questions will be read aloud by the moderator as time permits
- Any questions that are not addressed during the presentation will be answered via email

Chat Function

- Please use the chat to advise the Department of technical issues with the presentation
- Please do not use the chat function to comment on presentations or to answer other attendee's questions

Remember!

Please fill out the Course Evaluation here:

https://www.surveymonkey.com/r/2XF667R

NJDEP Monitored Natural Attenuation (MNA) & Ground Water Remedial Action Permit (GW RAP) Guidance Document Training

January 31, 2023
Course Number: 2023-002

LSRPs: 2.5 Technical and 1 Regulatory CECs

NJ Licensed Site Remediation Professionals Association

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Upcoming LSRPA Courses & Events

- **February 2, 2023 – Aspiring Professional Series**

  Session II of Understanding Risks and Liabilities (Risk Management/Insurance)

  Instructor: Dan Borgna, Environmental & Construction (Dale Group Insurance Brokerage)

  Moderator: Andrew Wadden (HDR, Inc.)

- **February 16, 2023 – Aspiring Professional Series**

  Session III of Understanding Risks and Liabilities (LSRP Practitioner's Perspective)

  Instructor: William P. Call, P.G., LSRP, PennJersey Environmental Consulting

  Moderator: Alex Saltzman, LSRP (French & Parrello, PA)

Visit LSRPA.org for details and registration

Upcoming LSRPA Courses & Events

- **February 21, 2023 –Member Regulatory Roundtable**
  Remedial Action Workplans

  Instructor: Dudley Warner, LSRP Consulting
  Moderator: Mark Pietrucha, LSRP, Woodard & Curran

- **February 23, 2023 – Geographic Information Systems (GIS) for Environmental Professionals**

  Instructor: Eric Slaff, Principal, eSlaff LLC

- **February 28, 2023 – Women in Environmental, Construction, Architecture and Engineering Professions**

  Presented by: BCONE, NJ LSRPA, NJ SWEP, NYCBP

Visit LSRPA.org for details and registration

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Monitored Natural Attenuation (MNA) Guidance Document : Background & Introduction

January 31, 2023

Alexander Shelkonovzeff, Environmental Specialist
Bureau of Remedial Action Permitting
Contaminated Site Remediation & Redevelopment Program

MNA Stakeholder Committee

- MNA Stakeholder Committee formed in 2010
- Purpose: To provide detailed technical information on the use of MNA as a remedial action for sites with contaminated ground water in New Jersey
- MNA Stakeholder Committee reconvened and began work on the updated MNA Guidance Document in 2020

MNA Stakeholder Committee Members

New Jersey Department of Environmental Protection Representatives:

- Alexander Shelkonovzeff, Co-chair
- Matthew Turner, Co-chair (Retired)
- Christopher Blake
- Ann Charles
- Joel Fradel
- Dominik Hudyka
- Mary Anne Kuserk

External Representatives:

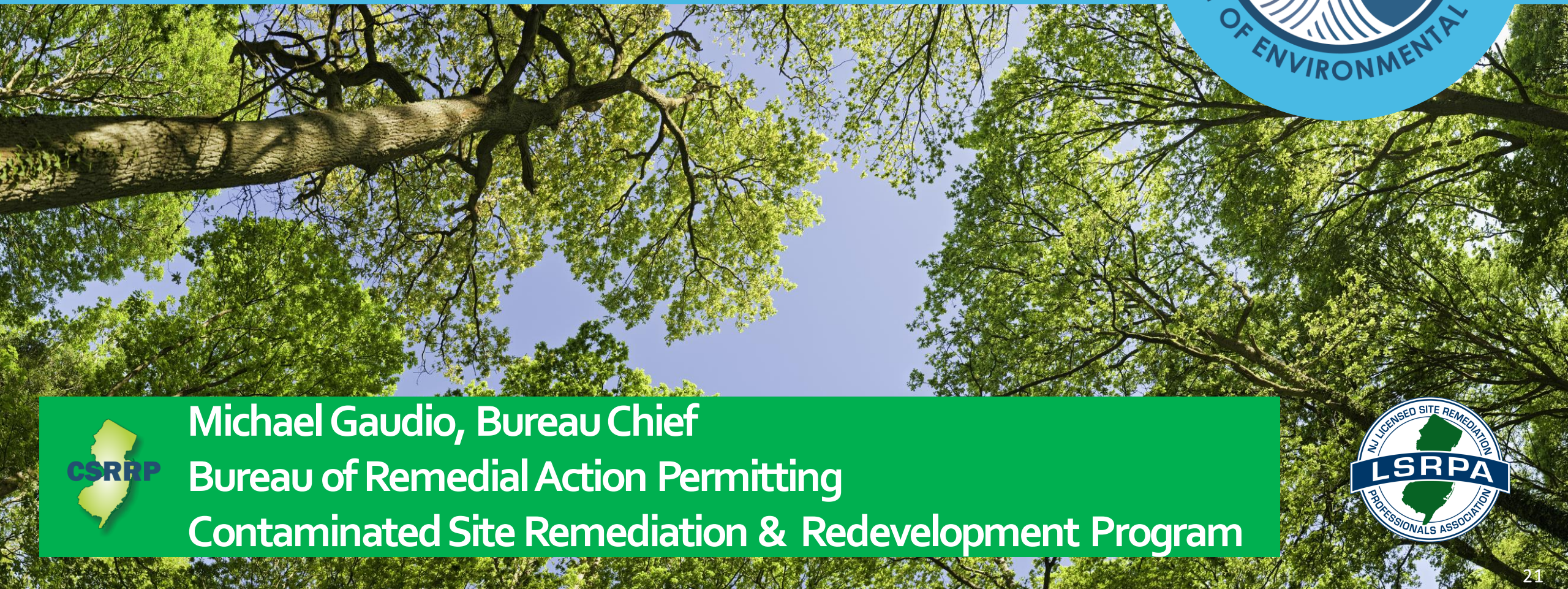
- Steve Posten, Co-chair, WSP USA Environment & Infrastructure Inc.
- David Bausmith, AEI Consultants
- Liliana Cecan, Envirotactics, Inc.
- Julian Davies, Sovereign Consulting, Inc.
- Jim Kearns, Kinder Morgan
- Rich Lake, Geo-Technology Associates, Inc.
- B.V. Rao, EG&R Engineering PC

Background

- **Monitored Natural Attenuation Guidance Document revised from Version 1.0 (March 2012) to Version 2.0 (September 2022)**
- **Changes to document include:**
  - New section added to document titled “Non-Decreasing Levels of Ground Water Contamination” to address the use of MNA for low level stable plumes
  - Clarified that the primary line of evidence should include both a reducing plume boundary and reducing contaminant concentration or mass
  - Clarified that data used to support MNA should be from samples collected after all active remediation is completed and the aquifer has had time to reach an equilibrium

Ground Water Remedial Action Permit (RAP) Guidance Document: Background & Introduction

January 31, 2023



Michael Gaudio, Bureau Chief
Bureau of Remedial Action Permitting
Contaminated Site Remediation & Redevelopment Program

RAP Stakeholder Committee

- RAP Stakeholder Committee formed in 2017
- Purpose: Identify ways to make the RAP process more transparent, efficient, and effective, which includes revising forms, guidance documents, and recommended rule changes as appropriate
- RAP Stakeholder Committee created new RAP Applications and Forms (May 2019), updated the Soil and Ground Water Remedial Action Protectiveness/Biennial Certification Forms (May 2021), and revised the Soil RAP Guidance Document (May 2022)
- RAP Stakeholder Committee began work on the Ground Water RAP Guidance Document in November 2021

RAP Stakeholder Committee Members

New Jersey Department of Environmental Protection Representatives:

- Michael Gaudio, Chairperson
- Christopher Blake
- Joel Fradel
- Robert Hawke
- Michael Infanger
- Lynne Mitchell
- Gary Sanderson (Retired)

External Representatives:

- Caryn Barnes, LSRP, Langan Engineering & Environmental Services, Inc.
- Julian Davies, LSRP, Sovereign Consulting, Inc.
- John Engdahl, Ridge Environmental Management LLC
- Mark D. Fisher, LSRP, The ELM Group
- Bill Hose, LSRPA
- Rayna Laiosa, PSEG Services Corporation
- Rich Lake, LSRP, Geo-Technology Associates, Inc.
- Neil Rivers, LSRP, Langan Engineering & Environmental Services, Inc.
- Chad Smith, PBF Holding Company LLC
- Kathleen F. Stetser, LSRP, GEI Consultants, Inc.

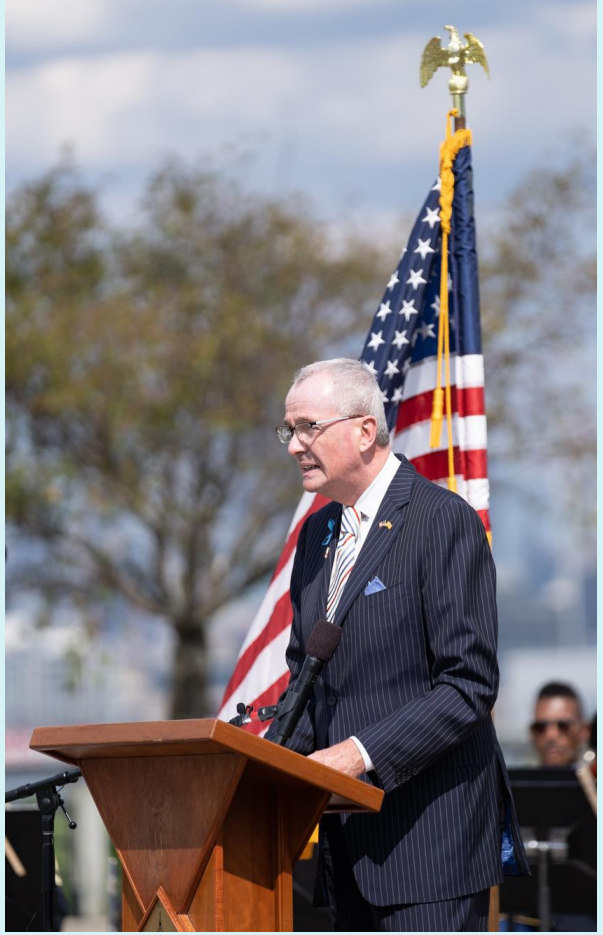
Background

- Ground Water RAP Guidance Document revised from Version 1.0 (October 2017) to Version 2.0 (December 2022)
- Updated to clearly indicate when a Ground Water RAP Application should be submitted and by whom, and to assist the user in navigating the various steps in the Ground Water RAP process
- Targets common deficiencies with Ground Water RAP Applications
- Format now conforms with other NJDEP guidance documents
- New Sections/Appendices and existing Sections updated/expanded

Highlights

Table of Contents

Appendices



Thank you and enjoy the training!

Monitored Natural Attenuation Lines of Evidence

January 31, 2023

Stephen Posten
WSP USA Environment & Infrastructure Inc.

Lines of Evidence for MNA

- Three stages (primary, secondary, tertiary)
- Progressively more detailed levels of data collection and analysis
  - Examples of the need for more thorough analysis:
    - Observed data characteristics (e.g., data variability)
    - Site conditions (e.g., physical constraints limit optimal monitoring network)

Table 2

Lines of Evidence

Primary Line of Evidence	Secondary Line of Evidence	Tertiary Line of Evidence
Plume Behavior - stable or shrinking plume and Contaminant Trends - decreasing levels	Geochemical Conditions	Microbiological and Isotopic Studies

Primary Line of Evidence: Plume Behavior

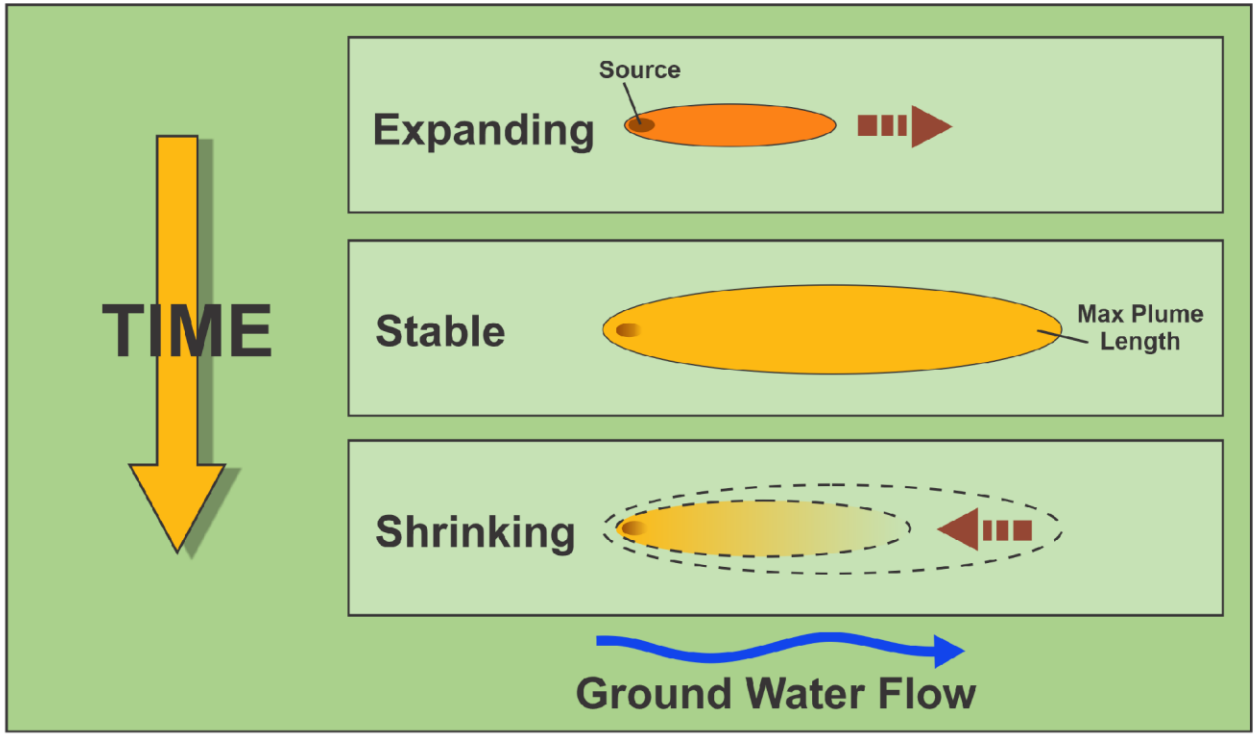
I. **Shrinking:** with decreasing plume boundaries over time and sentinel well concentration remains below the ground water quality standards.

II. **Stable:** if the plume boundaries remain the same over time and sentinel well concentration remains below the ground water quality standards.

III. **Expanding:** if the plume boundaries are increasing over time or if a sentinel well becomes impacted above the ground water quality standards.

Figure 3

Plume Behaviors



Source: Adapted from Figure 3.2 Washington State DOE (2005) – Adapted from Newell and Connor (1997)

Primary Line of Evidence: Trends in Contaminant Concentration or Mass

- **Graphical Analysis**
  - Plots of concentration versus time at individual monitoring wells
  - Plots of concentration versus distance (downgradient monitoring wells) over time
  - Can define degradation rate constants (as necessary)*
- **Spatial Analysis**
  - Solute Transport Modeling (e.g., BIOSCREEN)
  - Contaminant Mass (e.g., "Ricker Method"; Appendix C, Section A)
- **Statistical Analysis (Appendix E)**
  - Regression Analysis
  - Non-Parametric Tests (Mann-Kendall, Mann-Whitney U, Sen Test)
  - Special treatment usually necessary for non-detect results
- **Mass Flux and Mass Discharge (Appendix C, Section B)**
  - Complex sites or sites with perimeter monitoring constraints

*

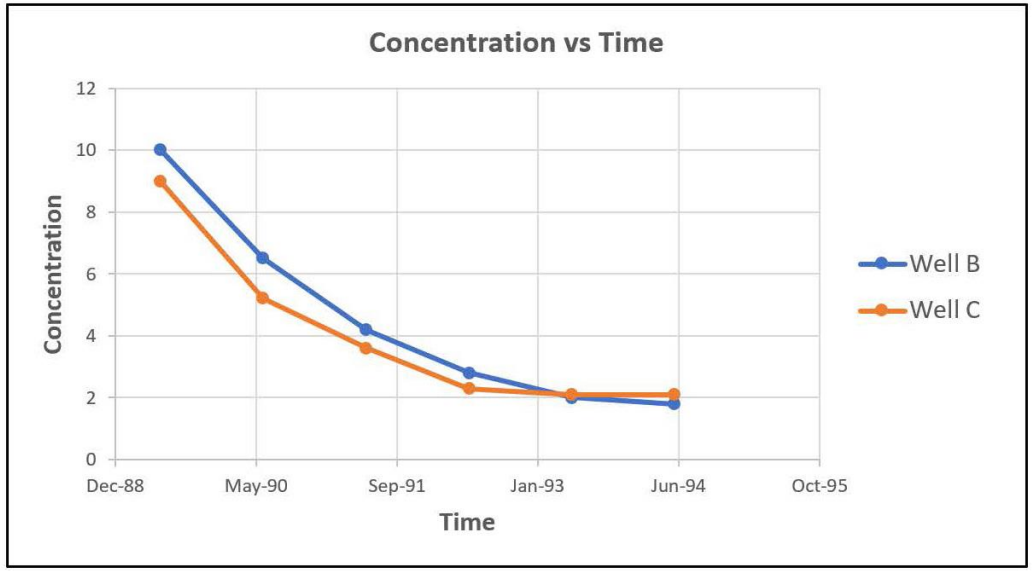
(1) Calculation of First-Order Rate Constants for Monitored Natural Attenuation Studies (Newell, et al; EPA/540/S-02/500; November 2002)

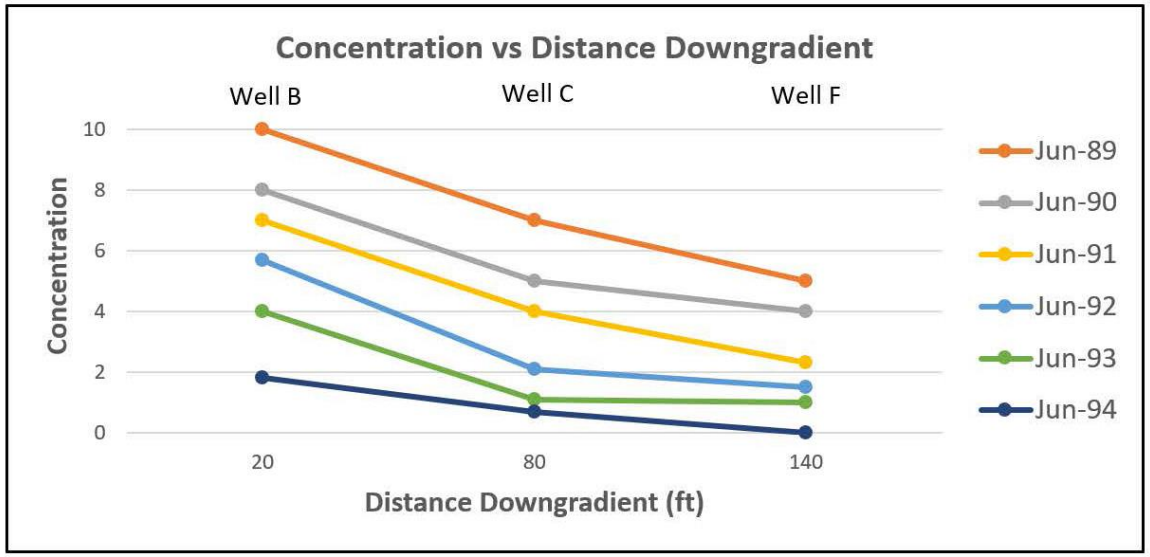
(2) An Approach for Evaluating the Progress of Natural Attenuation in Groundwater (esp. Appendix A) (Wilson; EPA/600/R-11/204; December 2011)

Primary Line of Evidence: Graphical Analysis

Figure 5

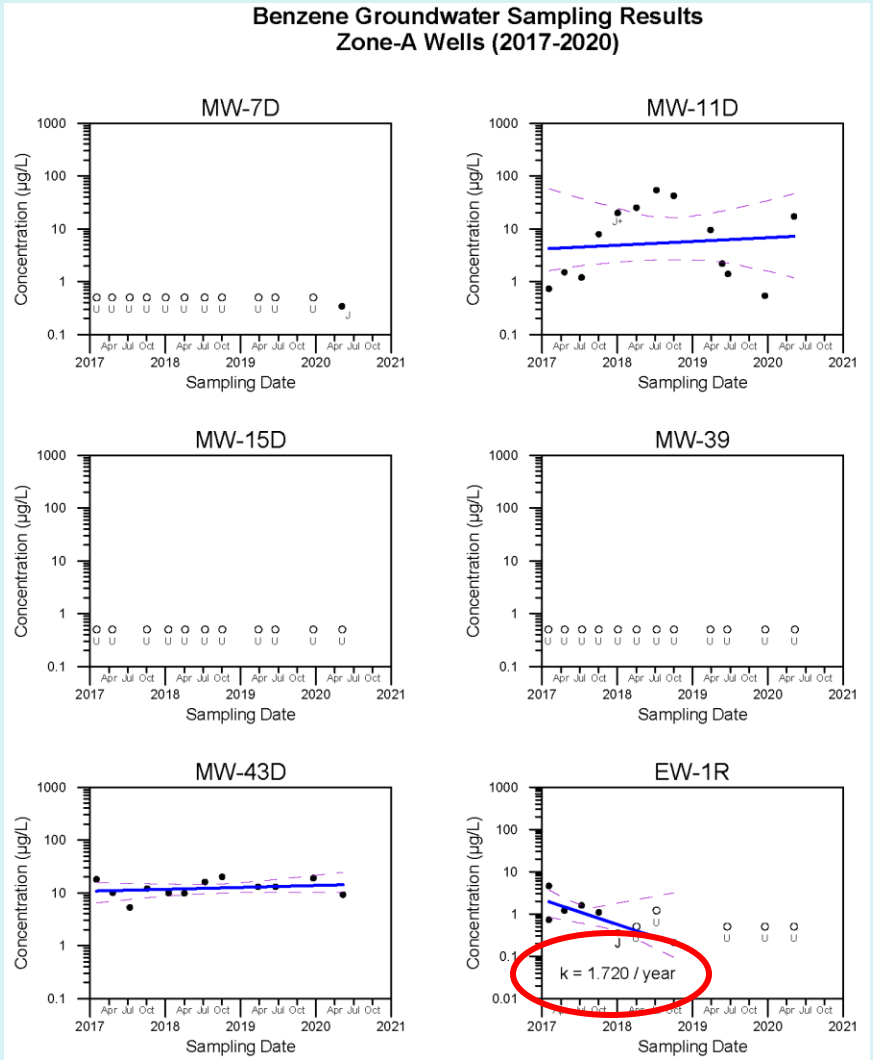
Contaminant Concentration Plots

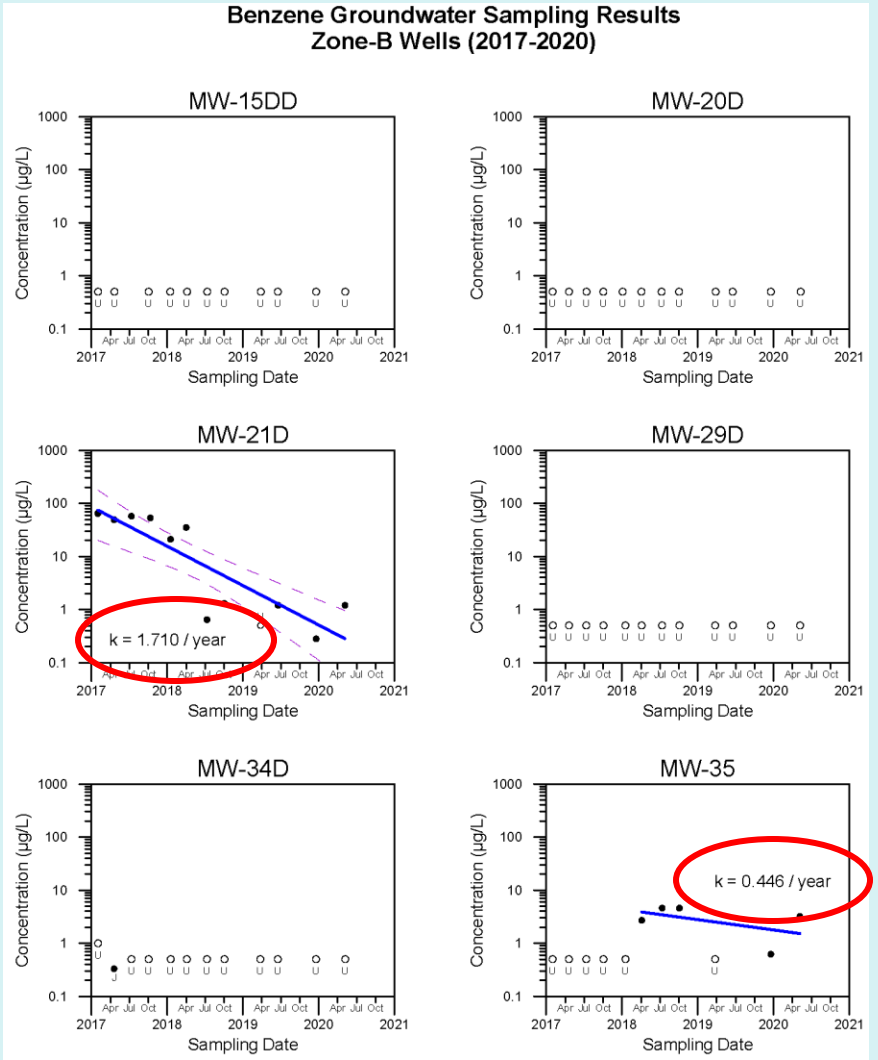




Source: Adapted from Wiedemeier et al., 2000

Primary Line of Evidence: Graphical Analysis

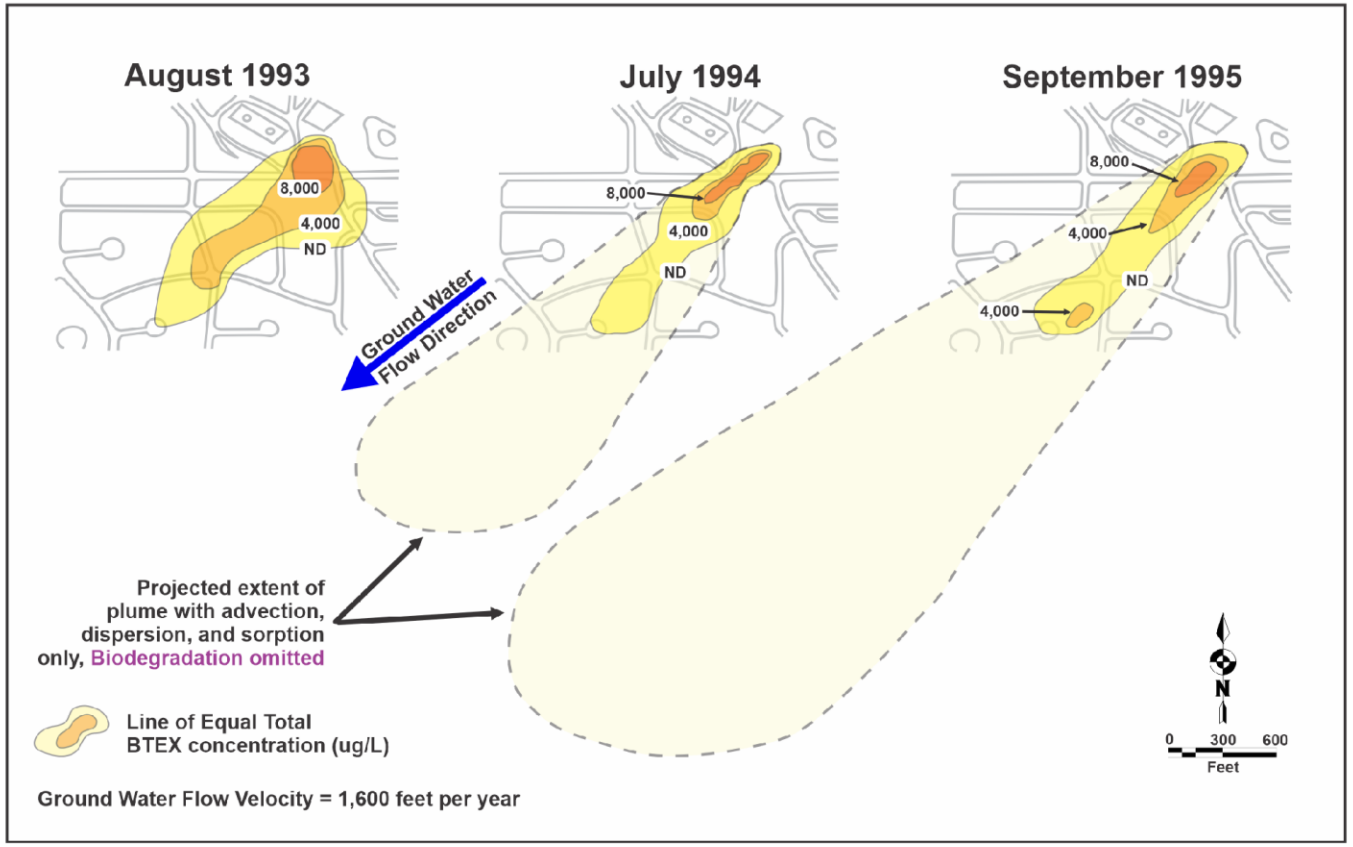




Primary Line of Evidence: Spatial Analysis (BIOSCREEN)

Figure 4

Comparison of Projected vs. Actual Plume Migration

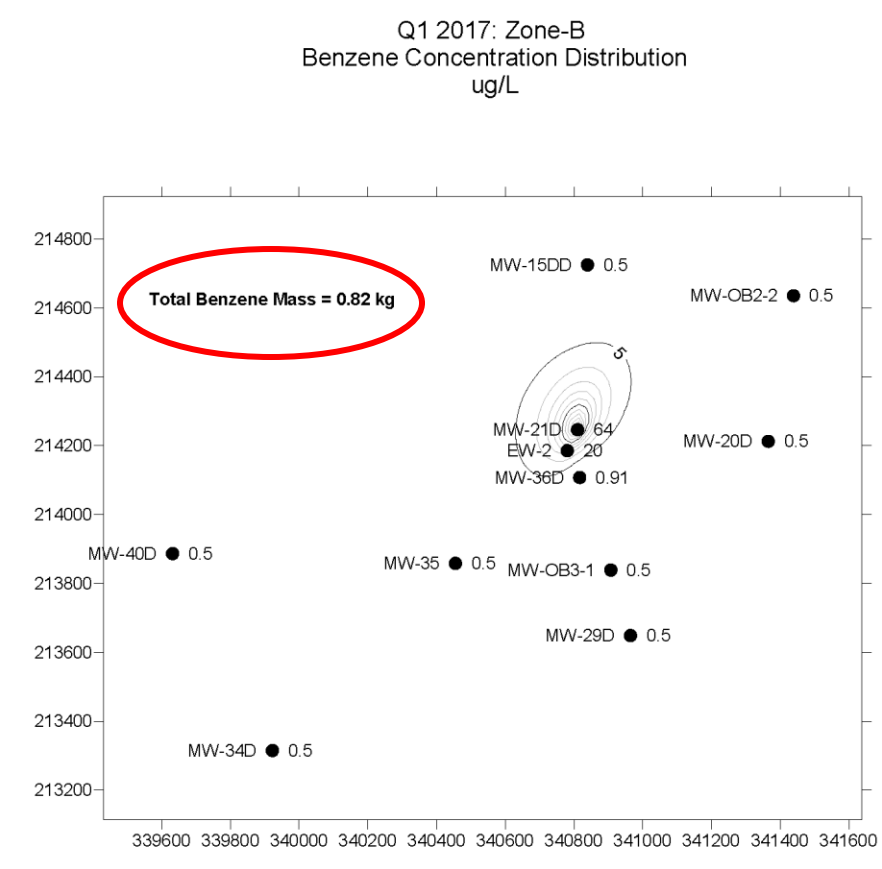


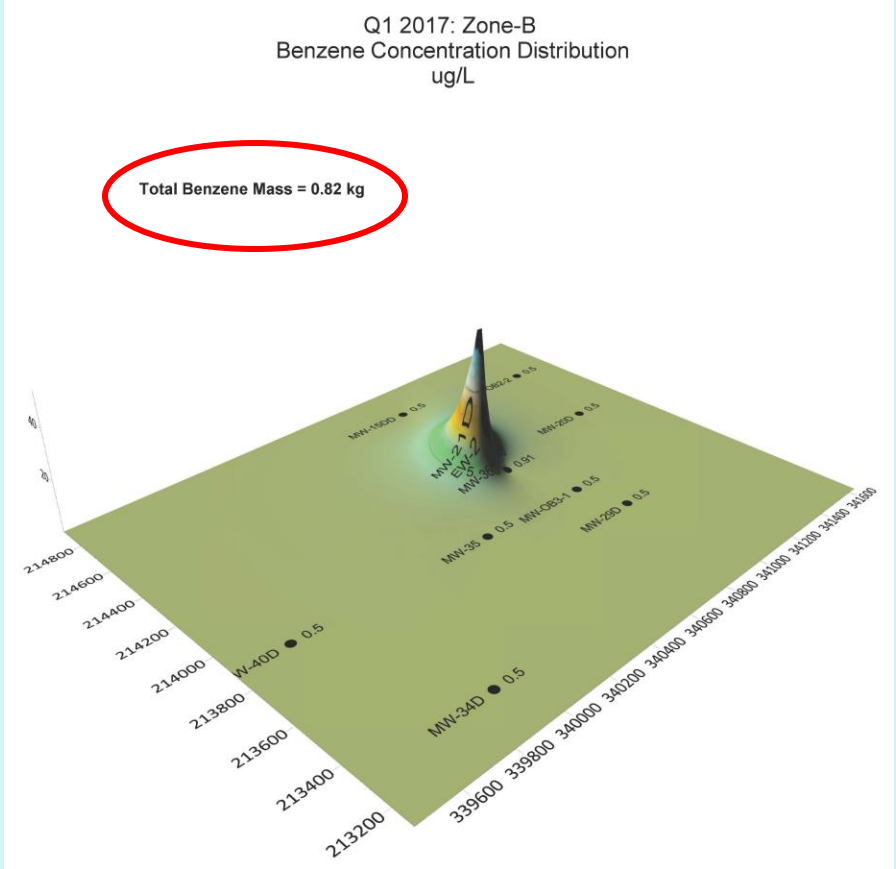
Source: Adapted from Wiedemeier et al., 2000

Example illustrates where site characterization has included adequate collection of site-specific aquifer data (hydraulic conductivity, hydraulic gradient, porosity, organic carbon content), allowing for representative solute transport modeling to support the presence of effective biodegradation

Primary Line of Evidence: Spatial Analysis ("Ricker Method")

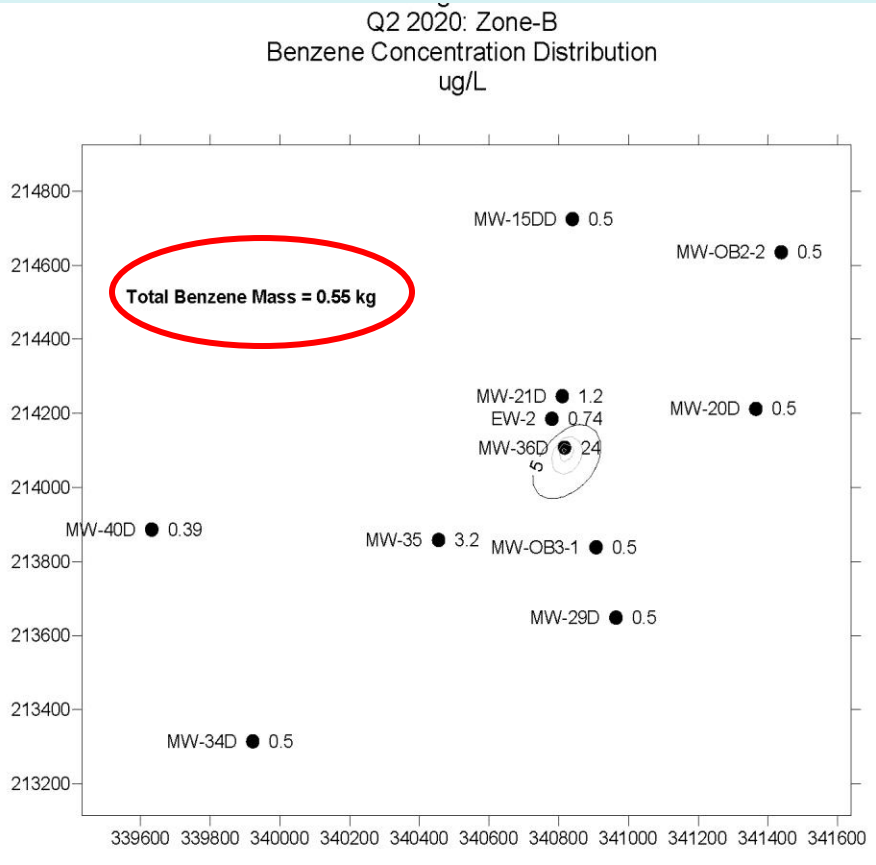
1: Initial Conditions Following Remediation

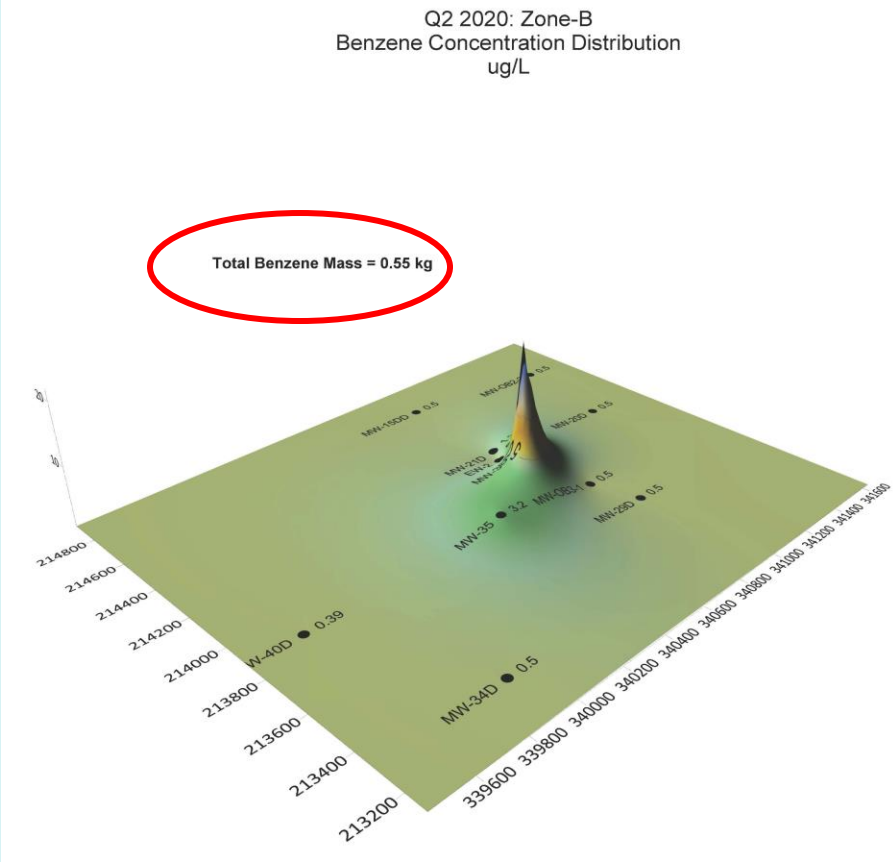




Primary Line of Evidence: Spatial Analysis ("Ricker Method")

2: Conditions After 24 Months





Test Your Knowledge #1

Spatial analysis is a primary line of evidence.

A. True
B. False

Test Your Knowledge

Spatial analysis is a primary line of evidence.

A. **True**

B. False

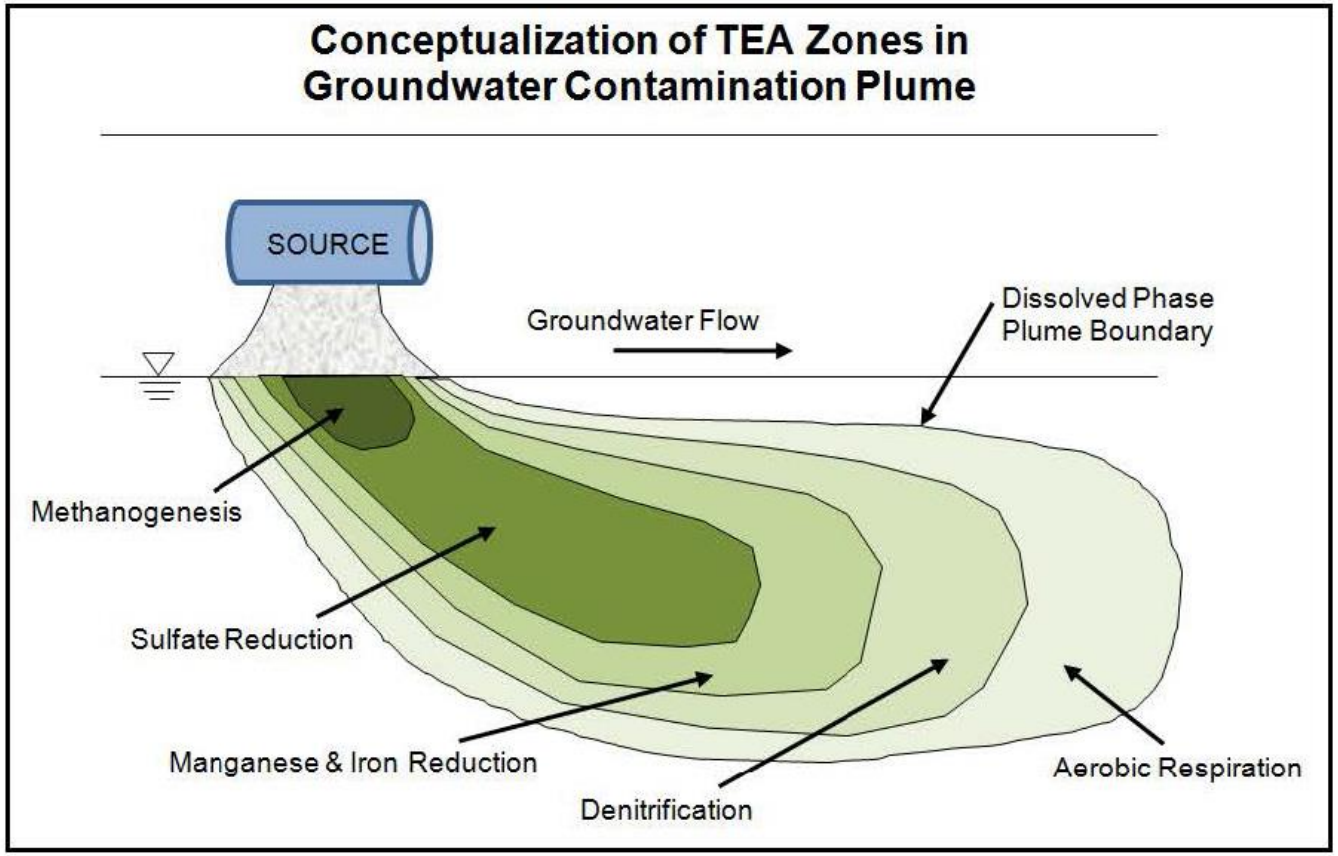
Secondary Line of Evidence: Geochemistry

- Under anaerobic conditions, organic contaminants can serve as the electron acceptors or electron donors during biodegradation redox processes
  - Anaerobic reductive bioremediation relies on the presence of biologically available organic carbon (organic substrate or electron donor). Organic carbon generates and sustains anoxic conditions by consuming oxygen (via aerobic respiration) as well as other electron acceptors, during its biodegradation. For example, chlorinated solvents such as trichloroethene (TCE) serve as electron acceptors and undergo reductive dechlorination under anaerobic conditions in the presence of an electron donor
  - Anaerobic oxidative bioremediation relies on other electron acceptors such as nitrate or sulfate for direct microbial metabolic oxidation of a contaminant serving as the electron donor. This approach applies to non-chlorinated hydrocarbon compounds (fuels) where oxygen has already been depleted

www.enviro.wiki

Secondary Line of Evidence: Geochemistry

Figure 6



Secondary Line of Evidence: Geochemistry

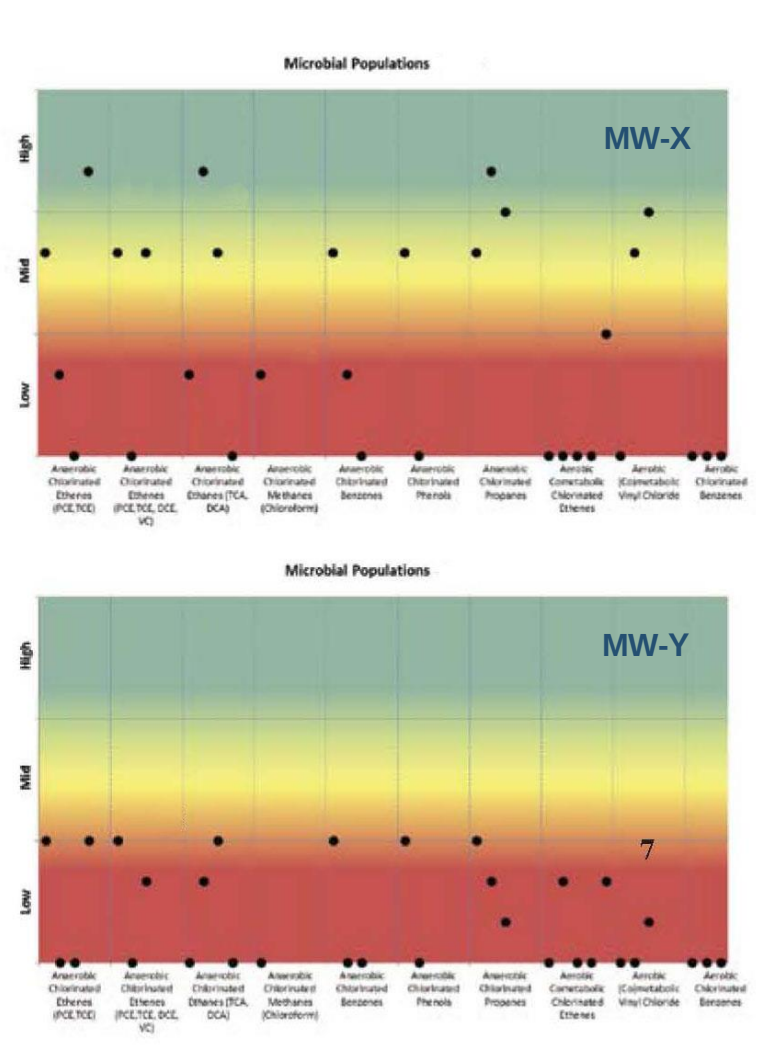
Table 3

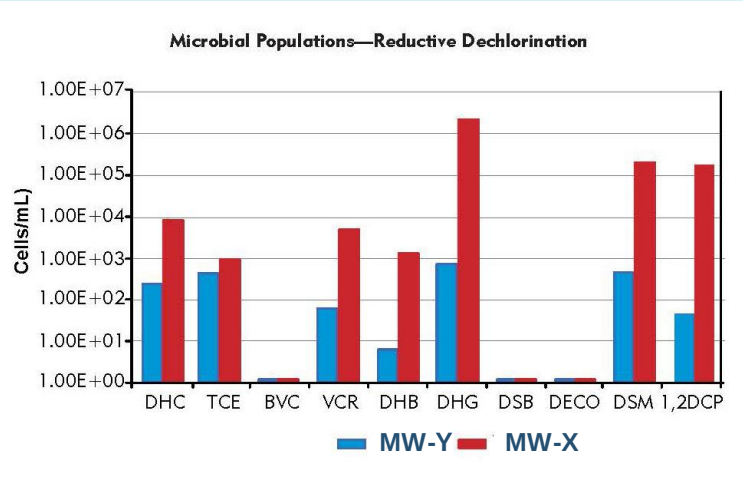
Geochemical Parameters Important to Anaerobic Degradation

Geochemical Parameter / Analyte	Data Use	Trend in Analyte Concentration During Biodegradation	Values Indicative of Degradation	Terminal Electron Accepting Process Causing Trend
Dissolved Oxygen	Concentrations less than about 0.5mg/L generally indicate an anaerobic pathway.	Decreases	< 0.5 mg/L	Aerobic Respiration
Nitrate	Electron acceptor for microbial respiration in the absence of oxygen	Decreases	< 1 mg/L	Denitrification
Fe^{2+}	Indication of Fe^{3+} reduction during microbial degradation of organic compounds in the absence of dissolved oxygen, nitrate, and Mn(IV).	Increases	> 1 mg/L	Fe^{3+} Reduction
Sulfate(SO_4^{2-})	Electron acceptor for anaerobic microbial respiration	Decreases	< 20 mg/L	Sulfate Reduction
Methane	The presence of methane suggests organic carbon degradation via methanogenesis	Increases	> 0.5 mg/L	Methanogenesis
Alkalinity	General water quality parameter used (1) to measure the buffering capacity of ground water, and (2) as a marker to verify that all site samples are obtained from the same ground water system.	Increases	> 2 times background	Aerobic Respiration, Denitrification, Reduction. Fe^{3+} Reduction, Sulfate Reduction
Oxidation reduction potential (ORP)	The ORP of ground water reflects the relative oxidizing or reducing nature of the ground water system. ORP is influenced by the nature of the biologically mediated degradation of organic carbon.	Decreases	< -100 mV	Aerobic Respiration, Denitrification, Reduction, Fe^{3+} Reduction, Sulfate Reduction, Methanogenesis
pH	Aerobic and anaerobic processes are pH-sensitive		Range of 5 to 9	
Chloride	General water quality parameter used as a marker to verify that site samples are obtained from the same ground water system. Final product of chlorinated solvent reduction	Increases	> 2 times background	Reductive Dechlorination or Direct Oxidation of Chlorinated Compound

Source: Adapted from Guidance on Developing a Monitored Natural Attenuation Remedial Proposal for Chlorinated Organics in Ground Water, North Carolina Hazardous Waste Section, October 4, 2000

Tertiary Line of Evidence: Microbiological Tools (MBT)





- Quantify Microbial Populations:
  - Bacteria (e.g., *Dehalococcides*)
  - Functional genes (e.g., vinyl chloride reductase)
- Evaluate Relevance:
  - Presence of contaminant-specific degraders
  - Concentration/density (>10^6 optimal)

Tertiary Line of Evidence: Compound Specific Isotope Analysis (CSIA)

- **CSIA Basics**
  - Each element has a set number of protons and electrons but can have a different number of neutrons (resulting in different mass)
    - Carbon: ^{12}C (↑ stable), ^{13}C (↓ stable) and ^{14}C (↓ radioactive)
    - Chlorine ^{35}Cl (↑ stable), ^{36}Cl (↓ radioactive) and ^{37}Cl (↓ stable)
  - CSIA only measures the stable isotopes (relative to a fixed standard)

(↑ = More Prevalent in the Environment / ↓ = Less Prevalent in the Environment)

Tertiary Line of Evidence: Compound Specific Isotope Analysis (CSIA)

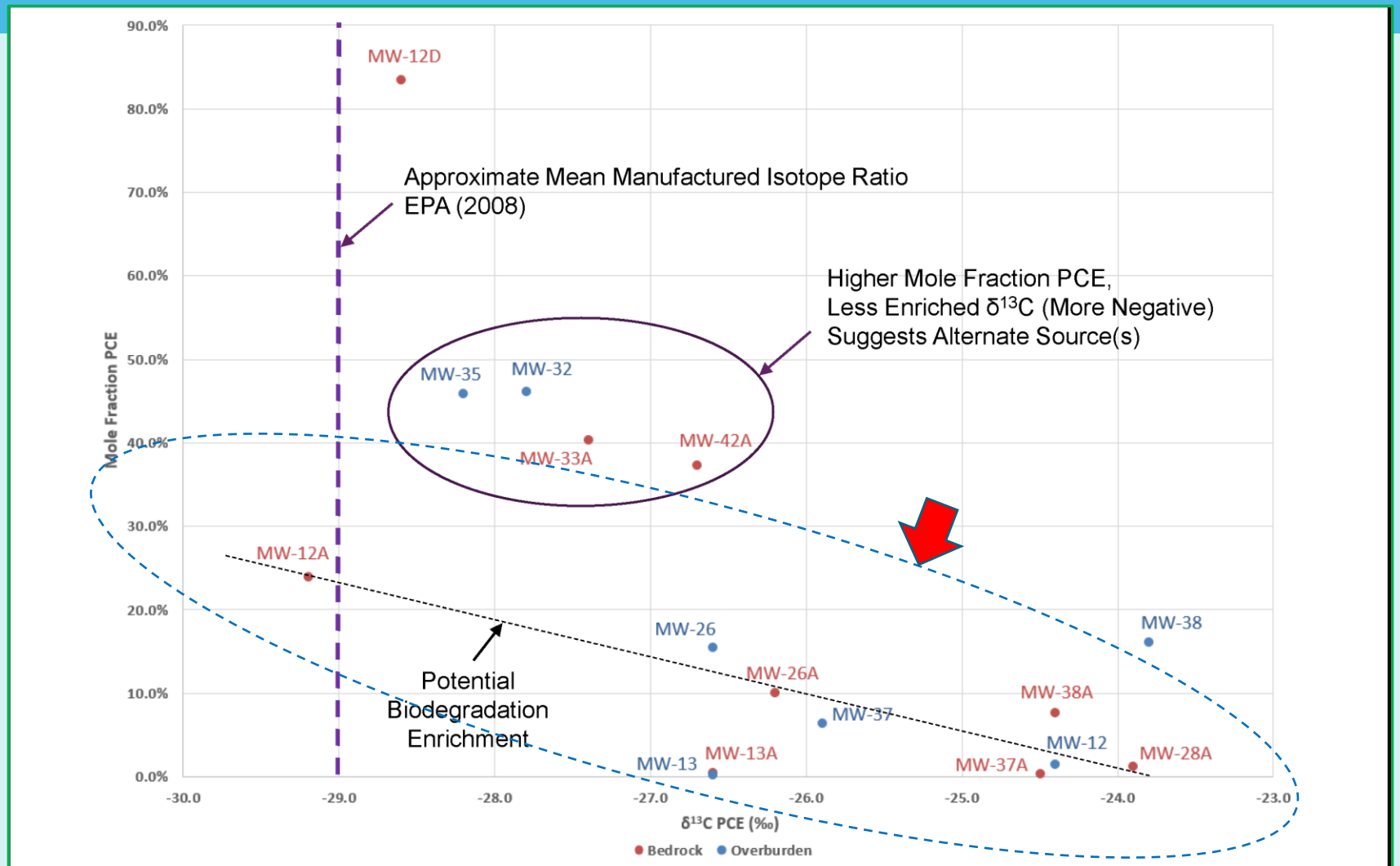
- **CSIA Reporting**
  - Isotopes measured as ratio ($^{12}C/^{13}C$), and then relative to the isotopic ratio of an international standard using the "delta" (δ) formula representing units of parts per thousand (o/oo) or "per mil"
- **CSIA Reporting Example**
  - **$\delta^{13}C$ = -29 per mil (typical of undegraded PCE)**
    - This means that in the sample, the $^{13}C/^{12}C$ ratio is 29 per mil or 2.9 percent lower than the ratio in the international standard

Tertiary Line of Evidence: Compound Specific Isotope Analysis (CSIA)

- **Isotopic Fractionation (change in isotopic ratio over time)**
  - Most pronounced with breaking of chemical bonds (biodegradation: PCE > TCE)
    - No significant fractionation from dilution, diffusion or volatilization
  - Less energy required to break a bond between a light isotope (^{12}C) than a heavier isotope (^{13}C) = slower reaction rates for heavier isotopes
  - Over time, pooling of heavier isotope in reactant (PCE) and pooling of lighter isotopes in product (TCE); PCE becomes "enriched" with ^{13}C relative to ^{12}C (isotopic ratio becomes more positive: -29 → -25)

- **CSIA is definitive relative to the presence of biodegradation processes (as well as the differentiation of sources)**
    - Note that certain types of active remediation (ISCO) can result in carbon isotope enrichment (~3 o/oo) at the source, so that baseline source and downgradient CSIA sampling and analysis should be performed prior to remediation if the investigator wishes to apply standard evaluation techniques

Tertiary Line of Evidence: Compound Specific Isotope Analysis (CSIA)



Note: Potential biodegradation enrichment line is conceptual to show expected correlation between decreasing mole fraction and increasing $\delta^{13}C$

Non-Decreasing Levels of Ground Water Contamination

- New Section 6.1.2.4:
  - In some cases, a remediation is conducted, and contaminant concentrations are observed to decrease over time to an asymptotic level that lies above the applicable remediation standard without evidence of a further declining trend. For example, back diffusion of contaminants from low permeability lenses or formations into more permeable deposits can result in non-decreasing levels of ground water contamination. [With a few exceptions] MNA may still represent an acceptable remedy in these cases when contamination poses no risk to human health and the environment

Non-Decreasing Levels of Ground Water Contamination

- **Requirements:**
  - No receptors are impacted or threatened
  - All sources of ground water contamination have been identified and remediated
  - Contaminants in ground water have been delineated to the Ground Water Remediation Standards
  - The ground water data set is representative of ground water elevation fluctuations
  - A minimum of eight rounds of ground water data has been collected from key monitoring wells following source removal
  - Asymptotic ground water contaminant levels are within an order of magnitude of the respective NJDEP Ground Water Quality Standards (GWQS), Interim Specific Ground Water Quality Criteria (ISGWQC) or Interim Generic Ground Water Quality Criteria (IGGWQC)

Non-Decreasing Levels of Ground Water Contamination

Attachment 2 of 2011 RAO Guidance (ver. 1.4)

TABLE 1: Guidance Concentrations (in parts per billion, ppb) for Ground Water Constituents. These Guidance Concentrations can be used only through a variance and these Guidance Concentrations are not to be used as default ground water remediation standards.

Contaminant	Existing GWRS or interim criterion or MCL (in ug/l or ppb) (6)	Added Factor (10x) Demonstrated No Threat to Receptors (1)
Tetrachloroethene	1	10
Trichloroethene	1	10
Cis-1,2-dichloroethene	70	700
Vinyl chloride	1	10
1,1,1-trichloroethane	30	300
1,1-dichloroethylene	1	10
Carbon tetrachloride	1	10
Methylene chloride	3	30
Benzene	1	10
Toluene (2)	600	(1000)
Ethylbenzene (2)	700	(1000)
Xylenes (total) (2)	1000	(1000)
MTBE (3)	70	140
TBA (3)	100	200
Petroleum TICs (ind)(4)	100	1000
Petroleum TICs (total) (4)	500	5000
Arsenic (5)	3	30
Iron (5)	300	3000
Lead (5)	5	50
Mercury (5)	2	20

MNA Technical Guidance Version 2.0

The asymptotic ground water contaminant levels are within an order of magnitude of the respective NJDEP Ground Water Quality Standards (GWQS), Interim Specific Ground Water Quality Criteria (ISGWQC) or Interim Generic Ground Water Quality Criteria (IGGWQC)

MNA/GW RAP Guidance Document Training

January 31, 2023

Questions?

Ground Water Remedial Action Permit (RAP) Applications, Forms and Process, & Common Deficiencies

January 31, 2023

Michael Gaudio, Bureau Chief
Bureau of Remedial Action Permitting
Contaminated Site Remediation & Redevelopment Program

Ground Water RAP Forms

- RAP Initial Application – Ground Water
- RAP Modification Application – Ground Water
- RAP Transfer/Change of Property Ownership Application
- RAP Termination Application – Ground Water

Associated Forms:

- RAP Contact Information Change Form
- Remedial Action Protectiveness/Biennial Certification Form – Ground Water
- CEA/WRA Fact Sheet Form
- Ground Water Monitoring Plan Spreadsheet

Notable Changes to the RAP Applications/Forms

Section B of the Initial Ground Water RAP Application:

2. The appropriate Initial Ground Water RAP Application fee must be enclosed with this application.

	Effective on or Before June 30, 2022	Effective July 1, 2022
Ground Water Natural Attenuation RAP Fee – Initial	$990.00	$1,050.00
Ground Water Active System RAP Fee – Initial	$990.00	$1,050.00

Note: Pay the Ground Water Active System RAP Fee – Initial for a Technical Impracticability (TI) determination.

Section G of the Initial Ground Water RAP Application:

3. Has a Technical Impracticability (TI) Determination been submitted? ☐ Yes ☐ No

   If "**Yes**", complete Section 4.b (Active Remediation) below and provide the location in the RAR (*Section #*) that documents this issue. _____

4. Type of Ground Water Remediation

Notable Changes to the RAP Applications/Forms (cont'd)

Section J of the Initial Ground Water RAP Application:

2. Is there sub-slab soil gas (SSSG) contamination above the NJDEP's Soil Gas Screening Levels (SGSLs) beneath any buildings that require a VI Long-Term Monitoring (LTM) Plan or a VI Change in Use Evaluation Plan, or both? ☐ Yes ☐ No

If "**Yes**", indicate the following:

- ☐ SSSG > SGSL and ≤ 10X NJDEP SGSL (VI LTM Plan pursuant to Table 6-2 of the VIT Guidance)
- ☐ SSSG > 10X NJDEP SGSL (VI LTM Plan pursuant to Table 6-2 of the VIT Guidance)
- ☐ SSSG > NJDEP Residential SGSL for Non-Residential Structure (VI Change in Use Evaluation Plan)

As indicated in Section F above, an electronic copy of the VI LTM Plan or the VI Change in Use Evaluation Plan, or both should be attached (see RAP Application instructions for this question that includes the recommended VI LTM Plan). The VI LTM Plan and VI Change in Use Evaluation Plan should clearly identify the building(s) and/or structure(s), including the address and block and lot of each impacted property.

Ground Water RAP Applications Common Deficiencies

- Ground water contamination is not horizontally and vertically delineated to the Remediation Standards pursuant to N.J.A.C. 7:26E-4.3
- Modeling is not acceptable at the remedial action stage and clean (below the applicable Remediation Standard) sampling is required; see the NJDEP Policy Statement: Interpretation of Technical Requirements for Site Remediation requirement to "complete the remedial investigation"

Tip: Discuss how delineation is complete in the RAR and Section K (Other Information) of the RAP Application, and provide a map(s) showing the clean sampling points in all directions, including receptors

GW RAP Guidance Document: Sections III.1.e and 2.e

Ground Water RAP Applications Common Deficiencies (cont'd)

- Lack of or no explanation regarding:
  - Variances from rules
  - Deviations from guidance documents
- Lack of multiple lines of evidence to support independent professional judgment

Tip: Explanation/discussion of the above is needed within the RAR and Section K (Other Information Provided) of the RAP Applications

GW RAP Guidance Document: Sections II.i and VII.2.c

Ground Water RAP Applications Common Deficiencies (cont'd)

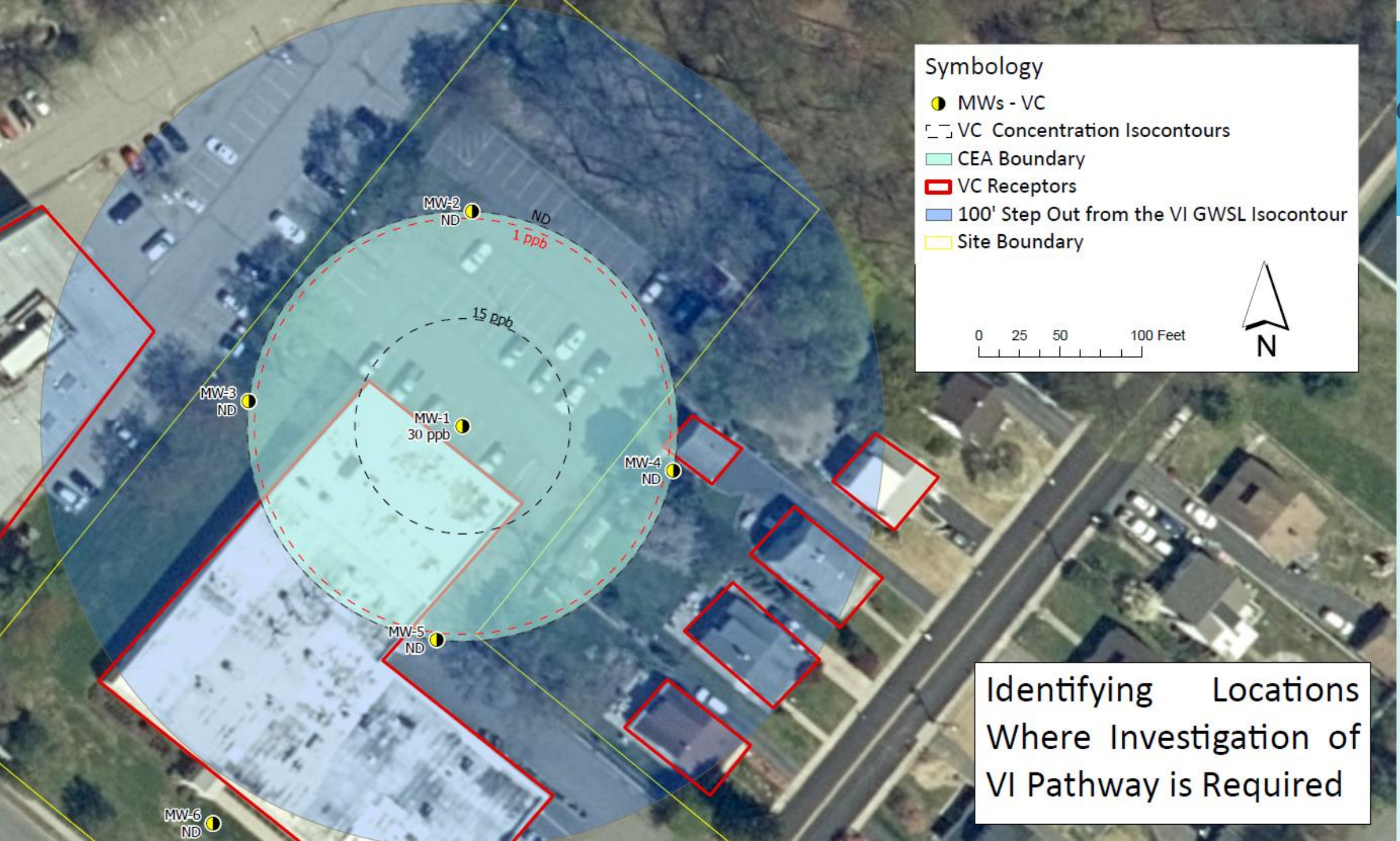
Receptor Evaluation is not complete

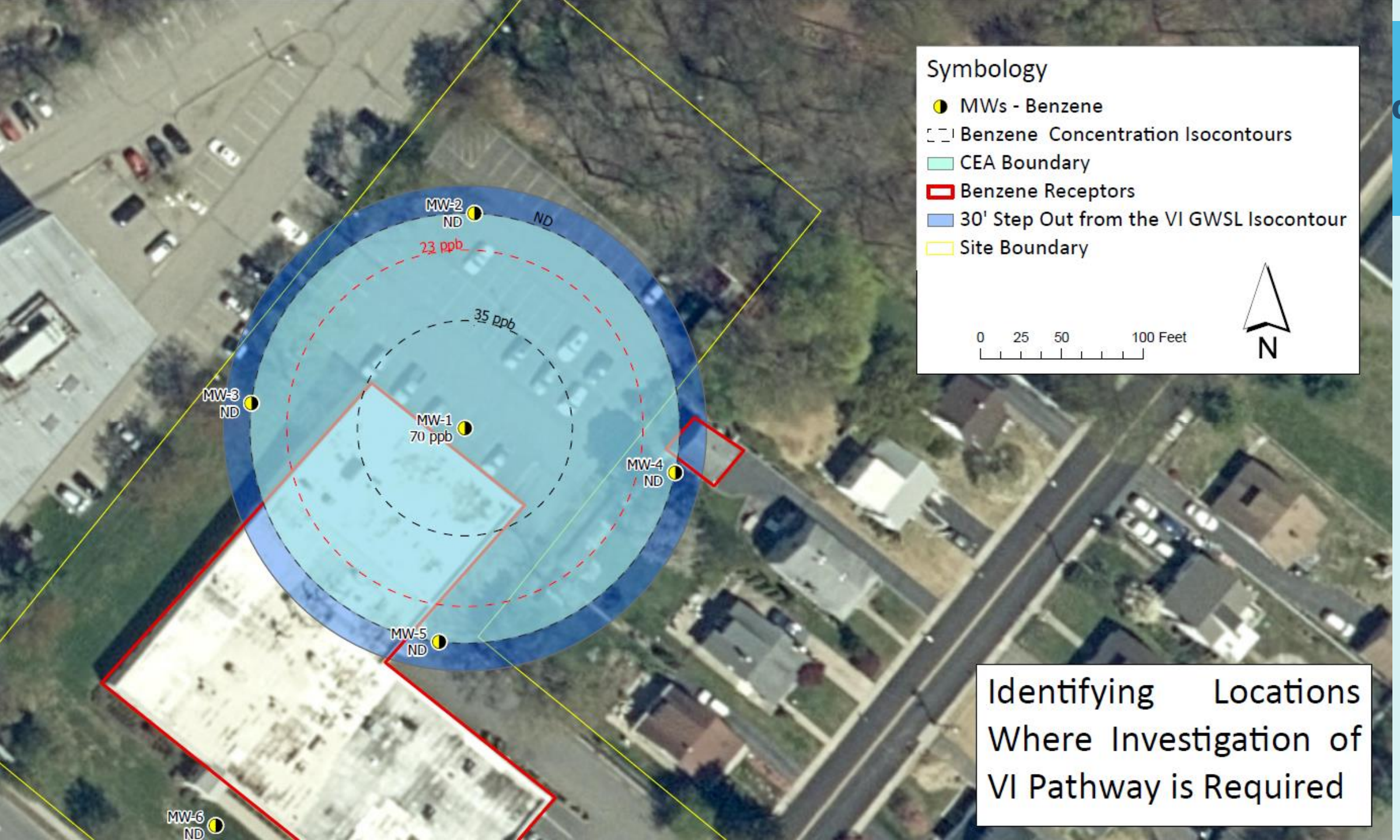
- Door-to-door survey results not provided
- Door-to-door survey incomplete
- Potable or irrigation wells within the sampling trigger distances not sampled
- Vapor Intrusion (VI) Pathway not investigated*

**Trigger distances are applied from the edge of the ground water contaminant plume based on linear interpolation of the ground water data as defined by exceedances of the VI Ground Water Screening Levels. It is not appropriate to apply the VI sampling trigger distance based solely on the location of a monitoring well itself when determining which buildings should be investigated*

Tip: The RAR should focus on the evaluation of receptors and how trigger distances were determined. Remember – when your delineation sampling points are farther from the source area, it could increase the number of receptors to be evaluated

GW RAP Guidance Document: Sections III.1.g and III.2.g


Symbology
MWs - VC
VC Concentration Isocontours
CEA Boundary
VC Receptors
100' Step Out from the VI GWSL Isocontour
Site Boundary
0 25 50 100 Feet
N
MW-2
ND
ND
1 ppb
15 ppb
MW-3
ND
MW-1
30 ppb
MW-4
ND
MW-5
ND
MW-6
ND
Identifying Locations Where Investigation of VI Pathway is Required



CSRRP

Identifying Locations Where Investigation of VI Pathway is Required

Ground Water RAP Applications Common Deficiencies (cont'd)

CEA/WRA Fact Sheet Form issues

- CEA shape not acceptable
- Missing contaminants
- Missing cross-section figures
- GIS compatible map of the CEA Shape is not submitted

Tip: CEA shape should be drawn to clean (below the applicable GWRS) sampling points in all directions and be sure to include all contaminants and required exhibits. Ensure that the email of the GIS compatible map of the CEA Shape is sent to srpgis_cea@dep.nj.gov just prior to submitting the Ground Water RAP Application

GW RAP Guidance Document: Sections V, VII.2.k, and VIII.2.j

Ground Water RAP Applications Common Deficiencies (cont'd)

Ground Water Monitoring Plan (GWMP) issues

- GWMP not included
- No sentinel well(s)
- Not enough wells for triangulation
- Sampling frequency
- GWMP Spreadsheet does not match up with text of RAR

Tip: Keep receptors in mind when submitting the GWMP and support sampling frequency and monitoring well selection in the RAR

GW RAP Guidance Document: Section VII.2.f

Ground Water RAP Applications Common Deficiencies (cont'd)

- Vapor Intrusion Long-Term Monitoring Plan for Structures with sub-slab soil gas contamination missing
- Sub-Slab Soil Gas Contamination > Residential Soil Gas Screening Levels for Non-Residential Structure needs to be part of the RAP to ensure site use does not change

Tip: Don't forget to include VI issues with your Ground Water RAP Application

GW RAP Guidance Document: Sections VII.2.g, VIII.2.h, and XI.2

Test Your Knowledge #2

Modeling the ground water contamination plume boundary is acceptable during the:

A. RA stage
B. RI stage
C. Any stage

Test Your Knowledge

Modeling the ground water contamination plume boundary is acceptable during the:

A. RA stage
B. **RI stage**
C. Any stage

MNA Ground Water RAP Applications Common Deficiencies

MNA is not the appropriate ground water remedial action

- No decreasing trends for contaminants of concern in ground water, which indicates source material may remain
- Not enough ground water sampling events conducted after the last active remedial action at the site
- Evidence of free and residual product remains (i.e., sheen, elevated contaminant levels, etc.); MNA of free and/or residual product is prohibited pursuant to N.J.A.C. 7:26E-5.1(e)

Tip: Make sure RAR supports why MNA is the appropriate ground water remedial action, and conduct post-remedial sampling to demonstrate product no longer exists/has been removed

GW RAP Guidance Document: Sections III.1.b and c and VII.2.c

Appendix 1: Model Table for Historic Ground Water Sampling Results by Monitoring Well

Sample ID & Well Construction Details	Sampling Date	Sampling Method	Monitoring Well Gauging Data				Sampling Results - Contaminants of Concern					Comments (e.g. pre-remedial action, post remedial action, sheen, sampling depth, etc.)
			Top of Casing Elevation (feet)	Depth to Water (feet)	Depth to Product (feet)	Ground Water Elevation						
NJDEP Ground Water Quality Standards												
NJDEP Vapor Intrusion Ground Water Screening Level												
MW-1 (screened __-__ fbg) Overburden or Bedrock (Pick one)												
												Pre-remedial action
												Post-remedial action
MW-2 (screened __-__ fbg) Overburden or Bedrock (Pick one)												
												Pre-remedial action
												Post-remedial action
MW-3 (screened __-__ fbg) Overburden or Bedrock (Pick one)												
												Pre-remedial action
												Post-remedial action

Notes:

Active Ground Water RAP Applications Common Deficiencies

Active ground water remedial action is not the appropriate remedy

- Free product recovery in the form of socks/sorbent pads
- High Intensity Targeted (HIT)/Enhanced Fluid Recovery (EFR) events
- Manual recovery (e.g., bailing) of free product in affected wells

Tip: Make sure the active ground water remedial action addresses the entire extent of the product body and that the Ground Water Monitoring Plan includes post-remedial sampling

Contact BRAP with any questions or request a technical consultation (https://www.nj.gov/dep/srp/srra/technical_consultation/)

GW RAP Guidance Document: Sections III.2.a and VII.2.f

Financial Assurance (FA)

January 31, 2023

Michael Infanger, Supervisor
Bureau of Remedial Action Permitting
Contaminated Site Remediation & Redevelopment Program

Chad Smith, P.G.
Corporate HSE – Remediation and Waste
PBF Holding Company LLC

Financial Assurance Requirements

- Legislative Mandate
  - Site Remediation Reform Act – established permitting program to regulate operation, maintenance, and inspection of engineering or institutional controls
  - N.J.S.A. 58:10C-19 establishes FA
- If you see N.J.S.A. 58:10B-3 (Brownfields) on a document, it is not FA!

Financial Assurance Exemptions

- Government entity
- “Innocent purchaser” (pre-May 2009)
- Childcare/school
- Residences
- Operator of a small business who is performing a remediation at their property
- Note: All parties must have an exemption

FA and Residential Condominium Associations

- **If the Permittee is a residential condominium association**
  - FA mechanism is not required to be secured if documentation of annual association budget reflects amount dedicated to operation, maintenance, and inspection of engineering controls equal to estimated amount required
  - The association should indicate the line item(s) that contain the permit costs

Complete Remedial Action Permit Application

- **Remedial Action Permit Application when engineering control is implemented:**
  - Remediation Cost Review and RFS/FA form
  - Especially Section J or K (for the entity posting FA)
  - Cost estimate
  - **Original** Financial Assurance mechanism
  - **No 1% Surcharge Fees on FA**

FA – Types of Mechanisms

1. **Remediation Trust Fund –** cash held in escrow
2. **Line of Credit –** open line of cash available
3. **Letter of Credit –** promise of cash to a beneficiary (DEP)
4. **Environmental Insurance –** claims based available funds to DEP
5. **Surety Bond –** being allowed prior to rule change

On the Forms Web Page

Remedial Action Permit Forms	Download		Version & Date	Changes Since Last Version
▶ **Financial Assurance (FA)**				
● **Remediation Trust Fund Agreement for FA** - Please see N.J.A.C. 7:26C-5.4 for specific requirements	Remediation Trust Fund Agreement for FA	N.J.A.C. 7:26C-5.4		
● **Line of Credit Agreement for FA** - Please see N.J.A.C. 7:26C-5.6 for specific requirements.	Line of Credit Agreement for FA	N.J.A.C. 7:26C-5.6		
● **Letter of Credit for FA** - Please see N.J.A.C. 7:26C-5.7 for specific requirements.	Letter of Credit for FA	N.J.A.C. 7:26C-5.7		
● **Environmental Insurance Policy** - Please see DEP's regulatory requirements at N.J.A.C. 7:26C-5.5.		N.J.A.C. 7:26C-5.5		
● **Surety Bond** - Please see N.J.S.A. 58:10B-3.i for specific requirements.	Surety Bond			
▶ **Ground Water Monitoring Plan Spreadsheet** You may have to reset your macros security in Excel before it will open/work properly. To reset: In a blank spreadsheet, go to TOOLS, MACROS, SECURITY. Set to MEDIUM. After that, open the spreadsheet, and select the button that says - Enable Macros.	Spreadsheet xls 177 Kb		1.0 - 5/22/2012	
▶ **Model Deed Notice** (Appendix B for the ARRCS Rule)	Model Document doc 108 Kb		5/8/2018	See Update Log
▶ **Model Termination of Deed Notice** (Appendix C for the ARRCS Rule)	Model Document doc 98 Kb		5/8/2018	See Update Log

Environmental Insurance Policies

- No model document: evaluated on case-by-case basis
- Must comply with N.J.A.C. 7:26C-5.5
- NJDEP must be the insured (or listed as being able to make a claim)
- No exclusions or deductibles
- Old policies will usually need to be changed (or riders added)

Estimating FA Amount

- **Costs of maintaining the engineering control including:**
  - Maintenance/upkeep, inspections, materials, monitoring
  - Biennial reporting, and permit fees
- **Value is calculated over the duration of the engineering control**
  - Permanent Engineering control (e.g., a cap) is represented as 30 years
  - An Active Remediation system is represented by the amount of time the system will be in operation

Calculating FA Amount

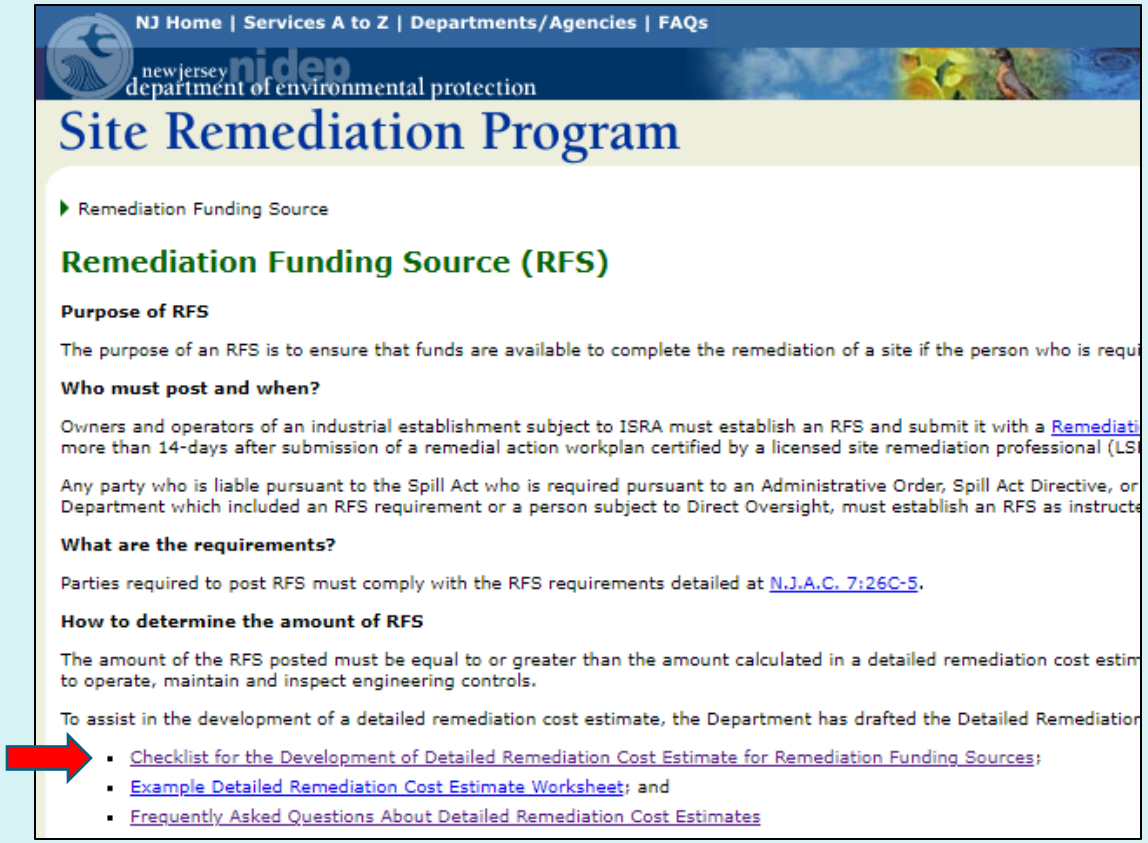
- **Includes the full cost to operate, maintain, and inspect all engineering controls that are part of any remedial action over the life of the permit**

- **N.J.A.C. 7:26C-5.3(c)**
  - Engineering Control: any physical mechanism to contain or stabilize contamination or ensure the effectiveness of a remedial action
- **For a Ground Water RAP, examples where FA would be required:**
  - Active ground water pump and treat system
  - In-Situ injections to maintain permeable reactive barrier
  - Sub-slab Depressurization System (SSDS)
  - Point of Entry Treatment (POET) permit

Calculating FA Amount

- Develop life-cycle scope for remedial action
- Utilize project cost estimates (e.g., vendor bids), or remediation cost estimating software
- Don't overlook:
  - Biennial reporting and permit fees (annual fee and termination application fee)
  - Utilities and waste disposal
  - Monitoring well and treatment system decommissioning costs
- See "Checklist for the Development of Detailed Remediation Cost Estimates for Remediation Funding Sources"

Calculating FA Amount



NJ Home | Services A to Z | Departments/Agencies | FAQs

newjersey department of environmental protection

Site Remediation Program

Remediation Funding Source

Remediation Funding Source (RFS)

Purpose of RFS

The purpose of an RFS is to ensure that funds are available to complete the remediation of a site if the person who is requ

Who must post and when?

Owners and operators of an industrial establishment subject to ISRA must establish an RFS and submit it with a Remediati more than 14-days after submission of a remedial action workplan certified by a licensed site remediation professional (LS

Any party who is liable pursuant to the Spill Act who is required pursuant to an Administrative Order, Spill Act Directive, or Department which included an RFS requirement or a person subject to Direct Oversight, must establish an RFS as instructe

What are the requirements?

Parties required to post RFS must comply with the RFS requirements detailed at N.J.A.C. 7:26C-5.

How to determine the amount of RFS

The amount of the RFS posted must be equal to or greater than the amount calculated in a detailed remediation cost estim to operate, maintain and inspect engineering controls.

To assist in the development of a detailed remediation cost estimate, the Department has drafted the Detailed Remediation

- Checklist for the Development of Detailed Remediation Cost Estimate for Remediation Funding Sources;
- Example Detailed Remediation Cost Estimate Worksheet; and
- Frequently Asked Questions About Detailed Remediation Cost Estimates

https://www.nj.gov/dep/srp/rfs/rfs_cost_estimate_checklist.pdf

Checklist for the Development of Detailed Remediation Cost Estimates for Remediation Funding Sources

This checklist is intended to be used as a tool in developing a detailed remediation cost estimate for the purposes of establishing and maintaining a remediation funding source. It is not required to be submitted to the Department. The detailed remediation cost estimate is required to report the estimated cost to **complete** the remediation. As such, all remediation phases, through issuance of a final remediation document, must be represented for all areas of concern. In addition, costs associated with operation, maintenance, and inspection must be incorporated into the estimate until Financial Assurance has been established with a remedial action permit or it has been documented that an engineering control will not be incorporated in the final remedial action. The detailed remediation cost estimate shall also include the Department's fees and oversight costs.

Operation, Maintenance and Inspection of Engineering Controls

Media: SOIL

- ☐ Cost to Operate and Maintain Engineering Controls (includes, but not limited to):
  - ☐ Periodic Cap Repair (paving, new clean fill, etc.) and/or Fence Maintenance/Repair etc.
- ☐ Inspection of Engineering Controls
- ☐ Preparation of Biennial Certification and DEP Forms

Media: GROUND WATER

- ☐ Cost to Operate and Maintain Engineering Controls (includes, but not limited to):
  - ☐ Sampling & Analysis
  - ☐ Treatment System Maintenance Cost (including permits, utilities, disposal, etc.)
  - ☐ Public Owned Treatment Works fees
- ☐ Inspection of Engineering Controls
- ☐ Vapor Intrusion Systems – Operation, Maintenance, and Inspection
- ☐ Preparation of Biennial Certification and DEP Forms
- ☐ Remedial System Shut Down, Decommissioning, and Monitoring Well Abandonment

Calculating FA Amount

- **Example 1: Active Permit – ground water pump and treat in perpetuity**

Active System Groundwater RAP Cost Estimate (in perpetuity)	Yearly Costs	30-year Costs
Operate/Maintain Engineering Controls		
Groundwater System O&M (wells, pumps, piping)	$ 80,000	$ 2,400,000
Treatment System O&M	$ 40,000	$ 1,200,000
Utilities	$ 10,000	$ 300,000
Waste Disposal	$ 5,000	$ 150,000
Performance Monitoring		
Groundwater Sample Collection	$ 40,000	$ 1,200,000
Laboratory Analysis	$ 10,000	$ 300,000
Data Evaluation	$ 7,500	$ 225,000
Waste Disposal	$ 2,500	$ 75,000
Administrative Requirements		
Project Management and LSRP Oversight	$ 15,000	$ 450,000
Biennial DEP Report ($15,000 every 2 years)	$ 7,500	$ 225,000
Active GW RAP Annual Fee	$ 420	$ 12,600
Total Cost Estimate	**$ 217,920**	**$ 6,537,600**

*Note: Costs are fictitious and solely for example purposes

Calculating FA Amount

- **Example 2: MNA Permit - SSDS for VI with expected 12-year duration**

MNA RAP w/ SSDS Cost Estimate (12 year duration)	Yearly Costs	Total Costs
MNA Monitoring and Evaluation		
MNA Groundwater Sampling and Analysis	Not included in FA Estimate	
Vapor Mitigation System		
Operation, Maintenance and Inspection	$ 3,000	$ 36,000
Long Term Monitoring	$ 2,500	$ 30,000
Utilities	$ 500	$ 6,000
Administrative Requirements		
Project Management and LSRP Oversight	$ 2,000	$ 24,000
Biennial DEP Report ($4,000 every 2 years)	$ 2,000	$ 24,000
MNA GW RAP Annual Fee	$ 420	$ 5,040
One-Time Project Closeout Costs		
VI mitigation termination sampling		$ 2,500
System decomissioning		$ 1,000
MNA GW RAP Termination Fee		$ 525
Total Cost Estimate		**$ 129,065**

*Note: Costs are fictitious and solely for example purposes

Present Value Calculations

- **Amount posted for FA may follow the formula:**
- $ amount to be posted = FA Value / **(discount rate)**^{time}
- **(discount rate) is actual interest rate or published value**
- Federal OMB Circular A-94, Appendix C
- $(amount to be posted) = $129,065 / **(**1.026**)**$^{\mathbf{12}}$ = $94,850

Amendments of Financial Instruments

- Remediation Trust Fund Agreements
  - Amendments allowed pursuant to Section 16
  - Just as easy to submit a new agreement
- Line of Credit – a new document will usually be required
- Surety Bond / EIP – check with provider

LETTERS OF CREDIT

- Most Common Form of FA
- *Irrevocable* Standby Letter of Credit
- Any change requires an amendment
- Almost all amendments require DEP approval
- Ask bank to add PI number to amendment!

Site-Specific Questions?

For site-specific questions

on Financial Assurance, please contact:

Michael Infanger

Michael.Infanger@dep.nj.gov

MNA/GW RAP Guidance Document Training

January 31, 2023

Questions?

MNA/GW RAP Guidance Document Training

January 31, 2023

BREAK

Non-Decreasing Levels of Ground Water Contamination with Case Study

January 31, 2023

Alexander Shelkonovzeff, Environmental Specialist
Bureau of Remedial Action Permitting
Contaminated Site Remediation & Redevelopment Program

Liliana Cecan, Ph.D., PE
Envirotactics, Inc.

Asymptotic Ground Water Contaminant Trends & Applicability of MNA

- Sometimes, even when both soil and ground water remediation were conducted at the Site, ground water contaminant concentrations reached **asymptotic levels** – above the applicable remediation standards but without decreasing contaminant concentrations trends

- MNA may still represent an appropriate remedy when ground water contamination is present in low concentrations that exceed applicable remediation standards but poses no risk to human health and the environment

Asymptotic Ground Water Contaminant Trends & Applicability of MNA

- **Some examples of these situations:**
  - Back diffusion of contaminants from low permeability lenses or formations into more permeable deposits (clay layer should be sampled)
  - Perched aquifers with limited flow
  - Capped sited with low infiltration

Contaminant trends are fitting a curve that is substantially linear and approaches zero slope

Asymptotic Ground Water Contaminant Trends & Applicability of MNA

- **This situation**
  - Can occur when remedial efforts have produced their maximum, practical benefit in terms of lowering the concentration of contaminants and
  - Serves as justification for termination of corrective action

When to Use MNA while Contaminant Concentrations are Non-decreasing

The plume is stable, and

i. No receptors are impacted or threatened:

- Potable wells
- Well head protection areas
- Surface water
- Vapor intrusion to indoor air
- Ecological

When to Use MNA while Contaminant Concentrations are Non-decreasing

ii. All sources of ground water contamination have been identified and remediated, including:

- Free product
- Residual product
- Smear zones
- Migration to ground water exposure pathway

When to Use MNA while Contaminant Concentrations are Non-decreasing

iii. The site is a candidate for monitored natural attenuation:

- Delineation is complete
- Appropriate number and placement of sentinel wells
- No free or residual product
- Sources have been addressed
- Enough data to support MNA

When to Use MNA while Contaminant Concentrations are Non-decreasing

iv. The ground water data set is representative of, and not influenced by, the ground water elevation fluctuations, such as:

- Seasonal
- Tidal
- Water-Use Changes

When to Use MNA while Contaminant Concentrations are Non-decreasing (cont'd)

v. The person responsible for conducting the remediation has:

- Collected a minimum of eight (8) rounds of ground water data from key monitoring wells following source removal. Four (4) should be consecutive quarterly samples
- Attempted to demonstrate a decreasing trend of contaminant concentrations in ground water

When to Use MNA while Contaminant Concentrations are Non-decreasing (cont'd)

vi. The asymptotic ground water contaminant levels are within an order of magnitude (OOM) of the respective:

- NJDEP Ground Water Quality Standards (GWQS)
- Interim Specific Ground Water Quality Criteria (ISGWQC)
- Interim Generic Ground Water Quality Criteria (IGGWQC)

Other Things to Consider when Using Non-Decreasing Trends Section of Guidance

- **MNA for a plume demonstrating a stable trend may not be appropriate when:**
  - Contaminant concentrations are in the part per million (ppm) range for volatile organics, and an evaluation of effective solubility (N.J.A.C. 7:26E-1.8) demonstrates that product may remain

Example: ethylbenzene and toluene can reach product levels in a BTEX plume when applying the 10X values and evaluation using effective solubility calculations

Other Things to Consider when Using Non-Decreasing Trends Section of Guidance

- **MNA for a plume demonstrating a stable trend would not be appropriate when:**
  - dealing with contaminants expected to degrade quickly, which have a short half-life, but continue to be present at multi-ppm concentrations

This includes some volatile organic compounds such as Ethylbenzene, Toluene, and Xylenes

Test Your Knowledge #3

MNA while contaminant levels are non-decreasing can be appropriate if:

A. A minimum of 8 rounds of ground water data has been collected
B. Contaminants are delineated
C. All sources of contamination have been identified and remediated
D. All of the above

Test Your Knowledge

MNA while contaminant levels are non-decreasing may be appropriate if:

A. A minimum of 8 rounds of ground water data has been collected
B. Contaminants are delineated
C. All sources of contamination have been identified and remediated
D. **All of the above**

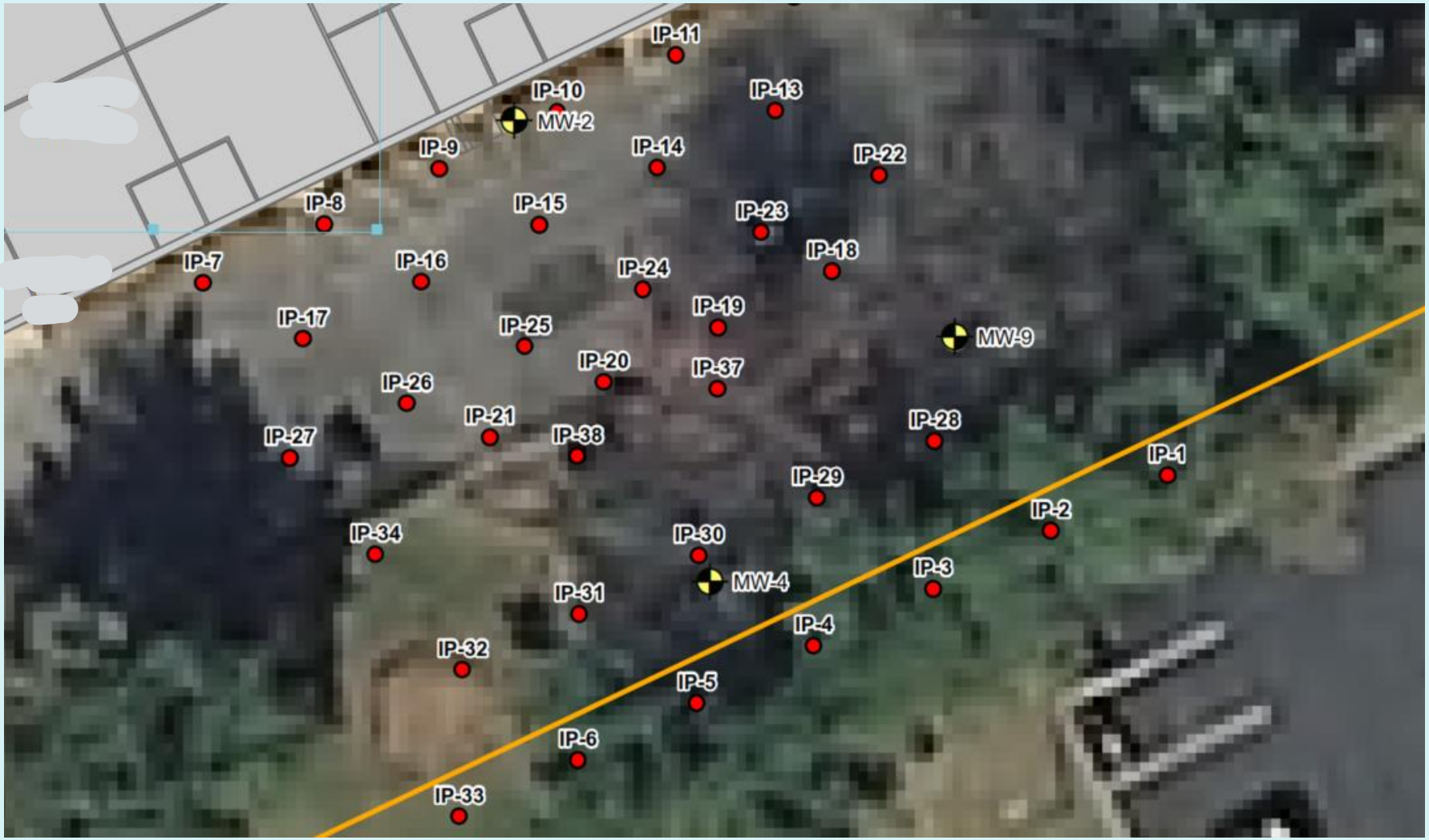
Case Study – Dry Cleaner Overview

- The Constituents of Concern (COCs) at the Site are Tetrachloroethene (PCE) and Trichloroethene (TCE)

- To remediate soil and groundwater contamination at the Site:

  - The ingestion-dermal and inhalation pathways addressed via excavation
  - The migration to ground water (MGW) pathway was addressed via in-situ treatment utilizing Hydrogen Release Compound (HRC), a simple, passive, low-cost, and long-term treatment option for in-situ anaerobic bioremediation of chlorinated hydrocarbons (CHs)

Case Study – Dry Cleaner
2013 HRC Injection



Case Study – Dry Cleaner
PCE & TCE Contamination

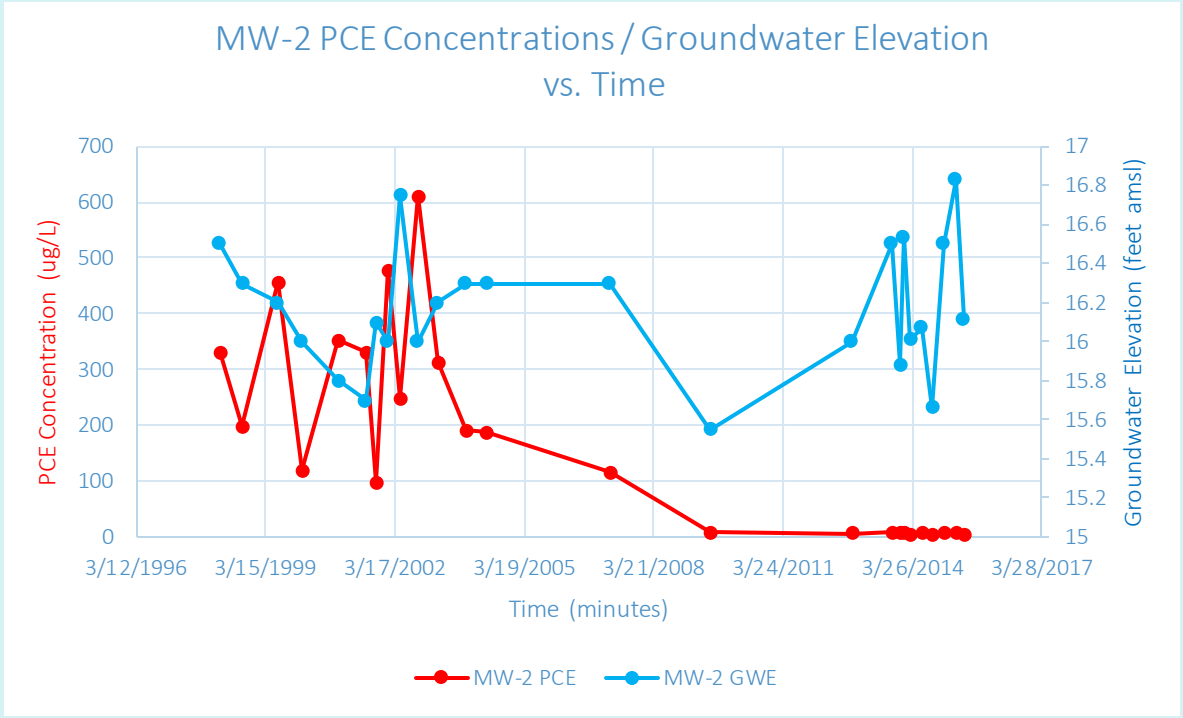
HRC injections were completed on

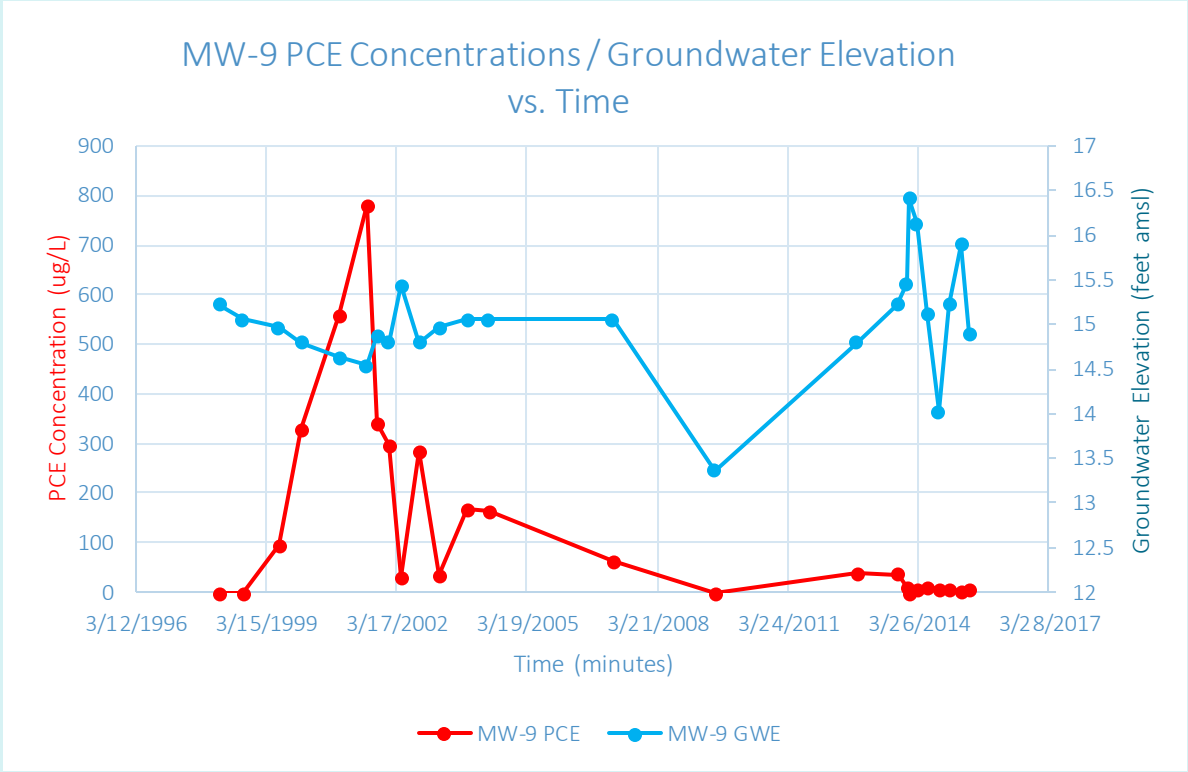
- 11/5/13
- 11/6/13
- 11/7/13
- 11/8/13
- 11/11/13

Well	Date	Well Casing Elevation	DTW	GWE	PCE	TCE
2021 NJDEP Ground Water Quality Standard (ug/L)					1	1
2021 NJDEP Vapor Intrusion GW Screening Levels (ug/L)					36	3
MW-2	2/13/1998	24	7.5	16.5	330	4.2
MW-2	9/1/1998	24	7.7	16.3	200	3.1
MW-2	6/24/1999	24	7.8	16.2	456	13.7
MW-2	1/11/2000	24	8	16	120	ND
MW-2	11/20/2000	24	8.2	15.8	353	8.98
MW-2	7/11/2001	24	8.3	15.7	330	9.02
MW-2	10/10/2001	24	7.9	16.1	97.3	ND
MW-2	1/9/2002	24	8	16	479	11.8
MW-2	4/29/2002	24	7.25	16.75	250	ND
MW-2	9/24/2002	24	8	16	610	21.7
MW-2	3/12/2003	24	7.8	16.2	313	7.57
MW-2	11/5/2003	24	7.7	16.3	192	5.96
MW-2	5/4/2004	24	7.7	16.3	189	7.88
MW-2	3/8/2007	24	7.7	16.3	115	4.04
MW-2	7/14/2009	24	8.45	15.55	10.3	1.3
MW-2	10/22/2012	24	8	16	9.5	1.09
MW-2	10/1/2013	24	7.5	16.5	10.2	1.07
MW-2	12/16/2013	24	8.12	15.88	8.12	2.17
MW-2	1/13/2014	24	7.46	16.54	7.46	5.5
MW-2	3/11/2014	24	7.99	16.01	3.37	3.7
MW-2	6/11/2014	24	7.93	16.07	9.69	3
MW-2	9/10/2014	24	8.34	15.66	3.94	9.11
MW-2	12/16/2014	24	7.5	16.5	10.3	3.6
MW-2	3/30/2015	24	7.17	16.83	7.9	3.27
MW-2	6/1/2015	24	7.88	16.12	5	2.1

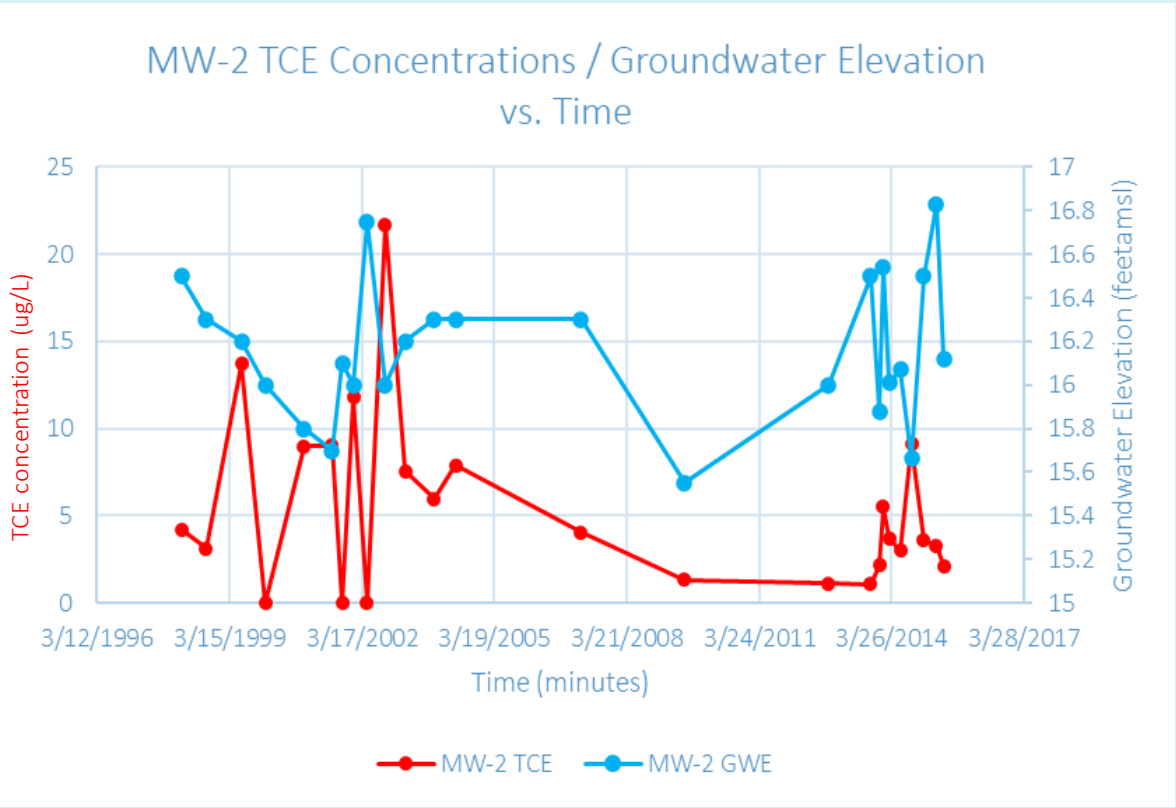
Well	Date	Well Casing Elevation	DTW	GWE	PCE	TCE
2021 NJDEP Ground Water Quality Standard (ug/L)					1	1
2021 NJDEP Vapor Intrusion GW Screening Levels (ug/L)					36	3
MW-9	2/13/1998	21.61	6.39	15.22	NI	NI
MW-9	9/1/1998	21.61	6.56	15.05	NI	NI
MW-9	6/24/1999	21.61	6.64	14.97	94.6	ND
MW-9	1/11/2000	21.61	6.81	14.8	328.4	ND
MW-9	11/20/2000	21.61	6.98	14.63	560	9.35
MW-9	7/11/2001	21.61	7.07	14.54	781	6.49
MW-9	10/10/2001	21.61	6.73	14.88	342	ND
MW-9	1/9/2002	21.61	6.81	14.8	296	3.82
MW-9	4/29/2002	21.61	6.17	15.44	31.8	ND
MW-9	9/24/2002	21.61	6.81	14.8	285	ND
MW-9	3/12/2003	21.61	6.64	14.97	36.4	ND
MW-9	11/5/2003	21.61	6.56	15.05	167	3.52
MW-9	5/4/2004	21.61	6.56	15.05	163	3.9
MW-9	3/8/2007	21.61	6.56	15.05	62.4	0.831
MW-9	7/14/2009	21.61	8.25	13.36	55.2(A) 58.5 (B)	0.892(A) 0.973(B)
MW-9	10/22/2012	21.61	6.81	14.8	38	ND
MW-9	10/1/2013	21.61	6.39	15.22	37.5	ND
MW-9	12/16/2013	21.61	6.15	15.46	10.3	ND
MW-9	1/13/2014	21.61	5.2	16.41	5.3	1.3
MW-9	3/11/2014	21.61	5.48	16.13	7.25	ND
MW-9	6/11/2014	21.61	6.49	15.12	9.9	ND
MW-9	9/10/2014	21.61	7.59	14.02	5.4	ND
MW-9	12/16/2014	21.61	6.39	15.22	5.77	ND
MW-9	3/30/2015	21.61	5.71	15.9	1.92	ND (0.357)
MW-9	6/1/2015	21.61	6.71	14.9	7.2	0.44

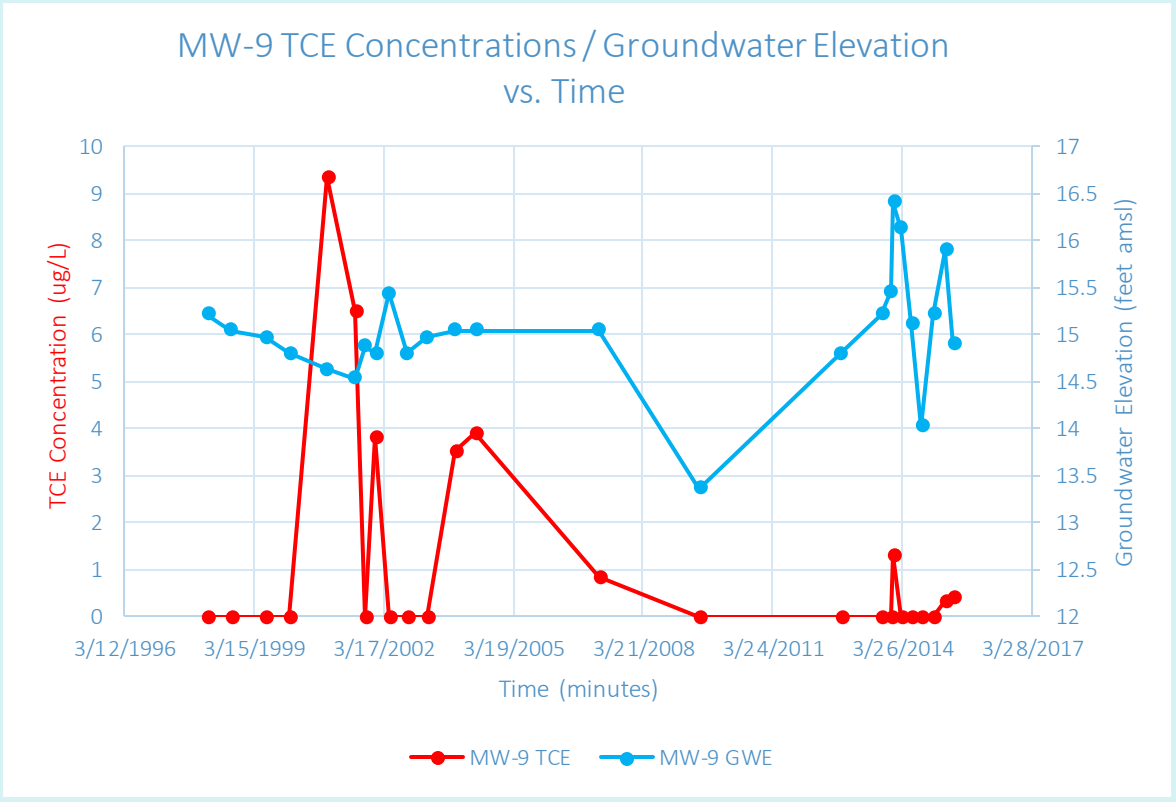
Case Study – Dry Cleaner
Check PCE Temporal Variation vs. GWE



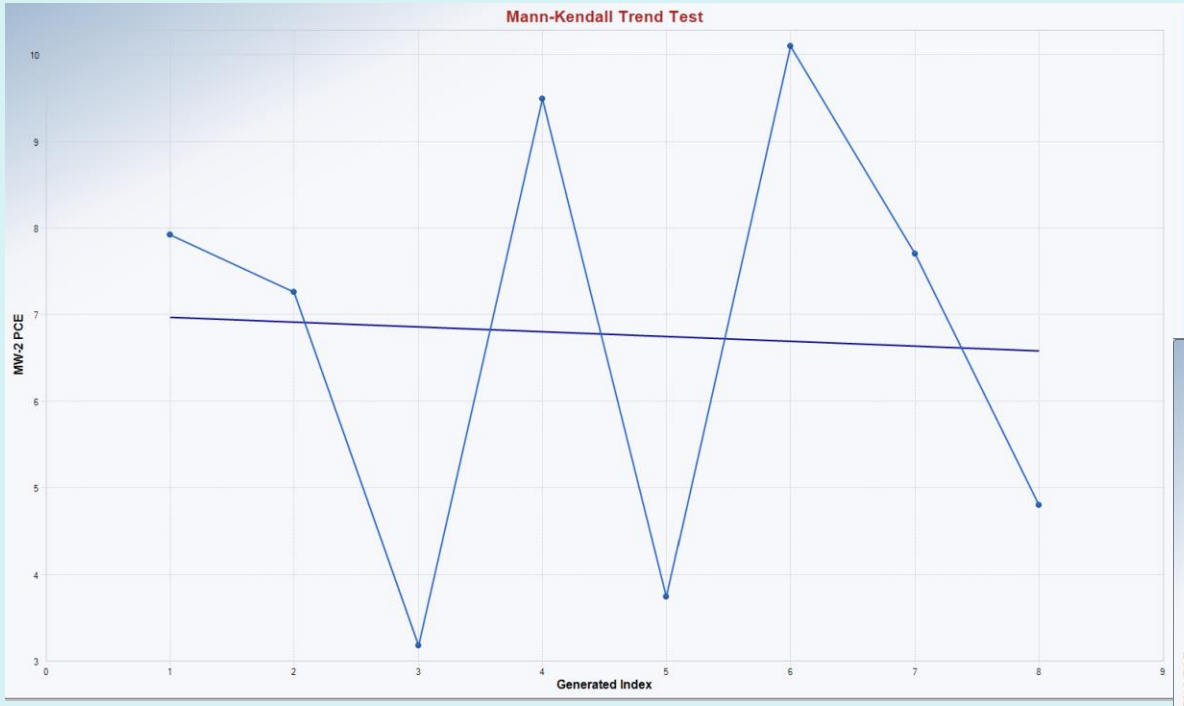


Case Study – Dry Cleaner
Check TCE Temporal Variation vs. GWE



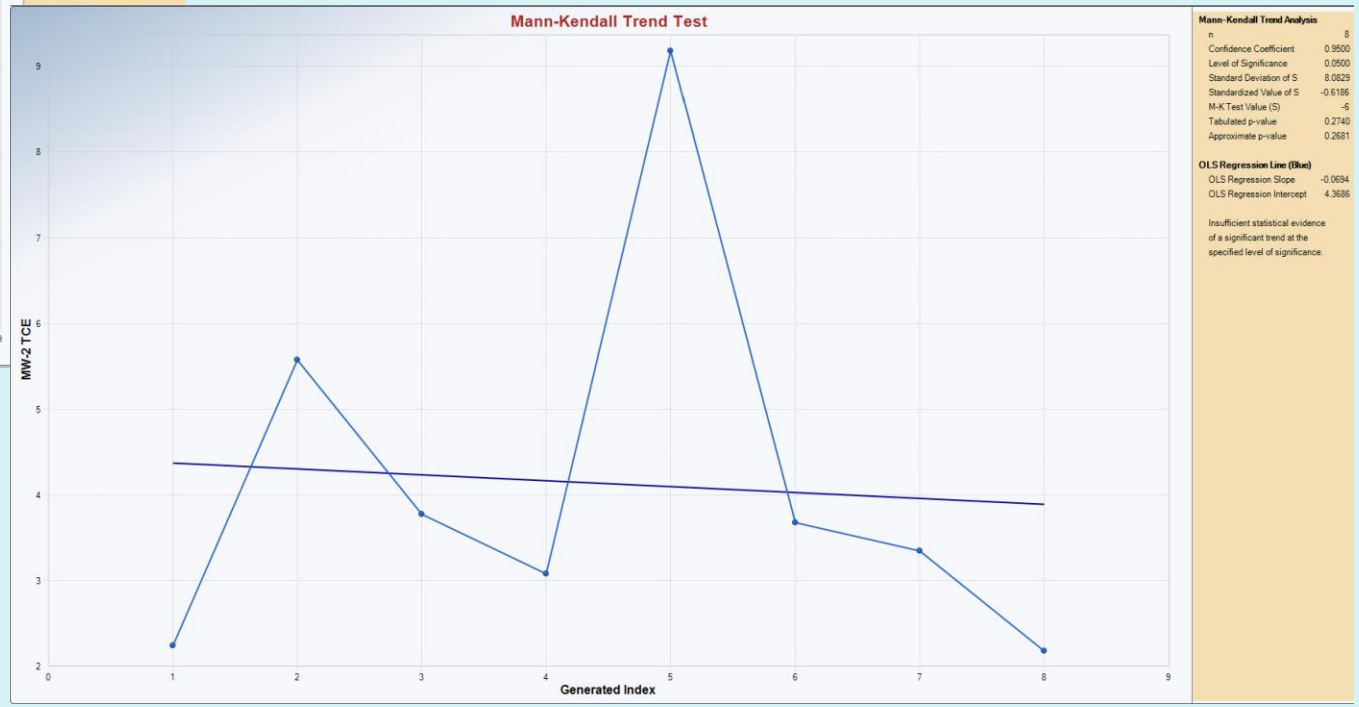


Case Study – Dry Cleaner
Check MW-2 PCE & TCE Trend



Mann-Kendall Trend Analysis	
n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0829
Standardized Value of S	
M-K Test Value (S)	0
Tabulated p-value	0.5480
Approximate p-value	
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0548
OLS Regression Intercept	7.2189

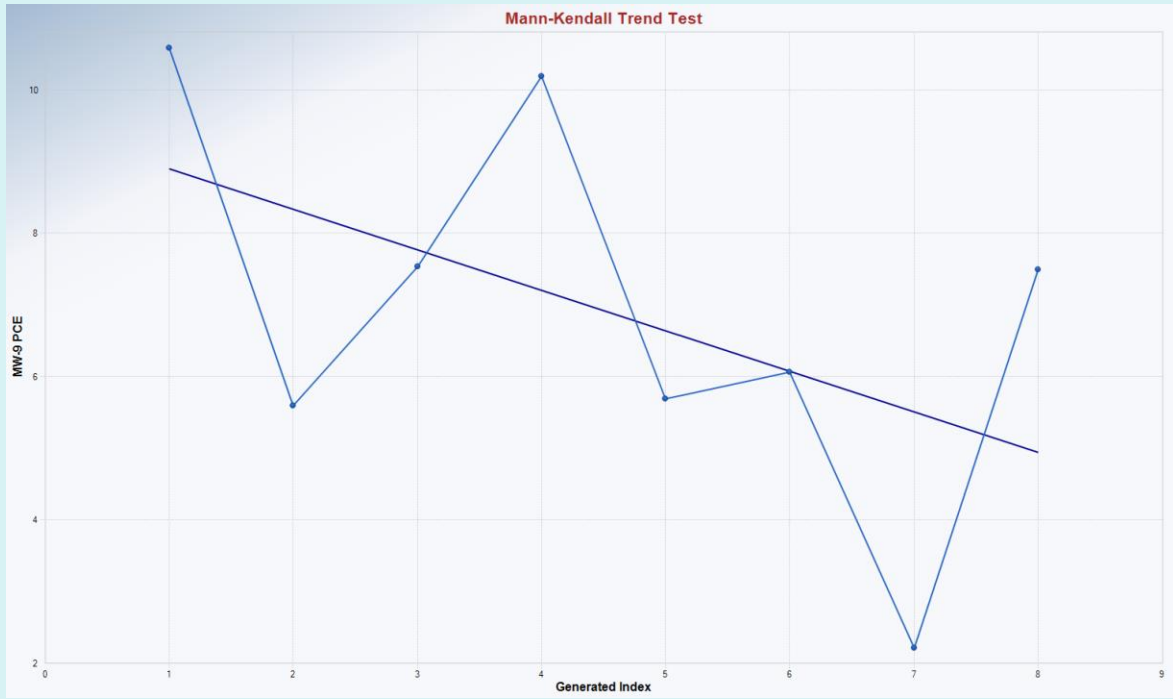
Insufficient statistical evidence of a significant trend at the specified level of significance.



Mann-Kendall Trend Analysis	
n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0829
Standardized Value of S	-0.6186
M-K Test Value (S)	-6
Tabulated p-value	0.2740
Approximate p-value	0.2681
OLS Regression Line (Blue)	
OLS Regression Slope	-0.0694
OLS Regression Intercept	4.3686

Insufficient statistical evidence of a significant trend at the specified level of significance.

Case Study – Dry Cleaner
Check MW-9 PCE & TCE Trend



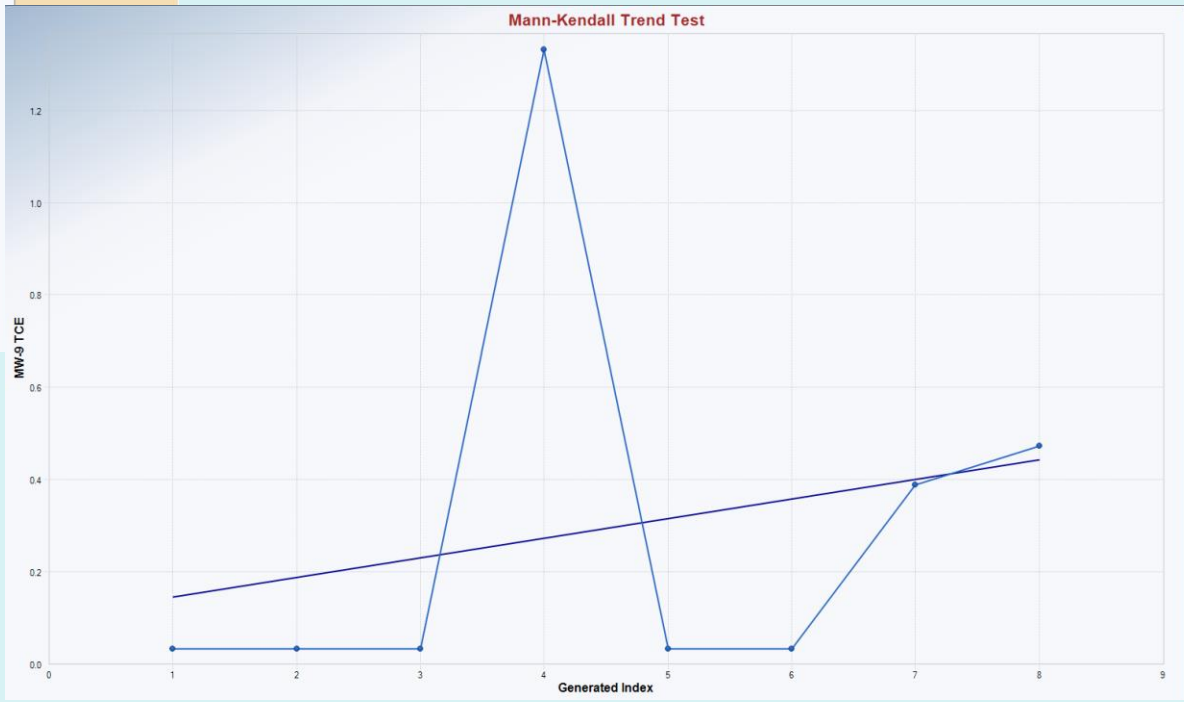
Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	8.0829
Standardized Value of S	-0.8660
M-K Test Value (S)	-8
Tabulated p-value	0.1190
Approximate p-value	0.1932

OLS Regression Line (Blue)

OLS Regression Slope	-0.5660
OLS Regression Intercept	9.1768

Insufficient statistical evidence of a significant trend at the specified level of significance.



Mann-Kendall Trend Analysis

n	8
Confidence Coefficient	0.9500
Level of Significance	0.0500
Standard Deviation of S	6.9761
Standardized Value of S	1.2901
M-K Test Value (S)	10
Tabulated p-value	0.1380
Approximate p-value	0.0985

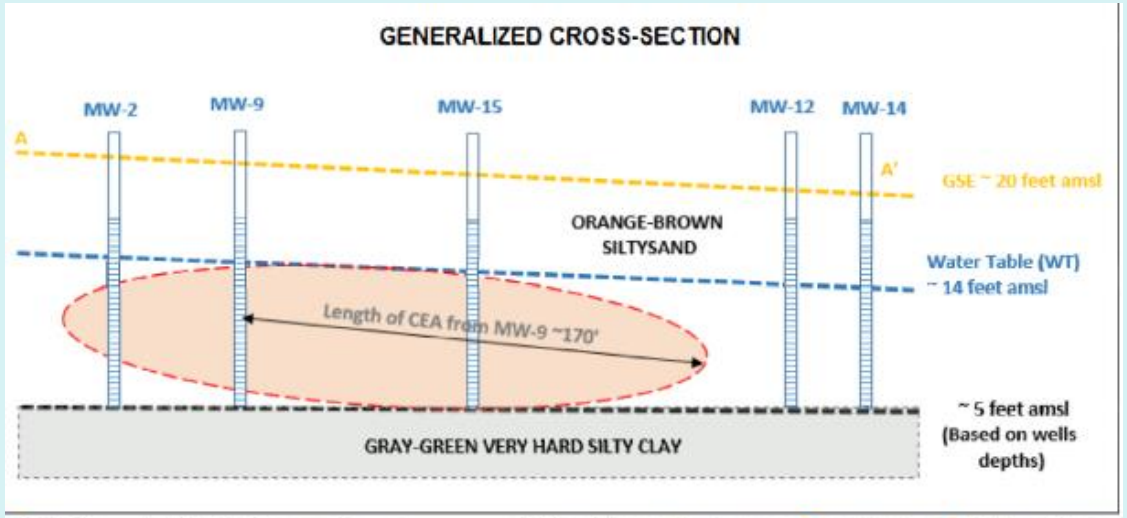
OLS Regression Line (Blue)

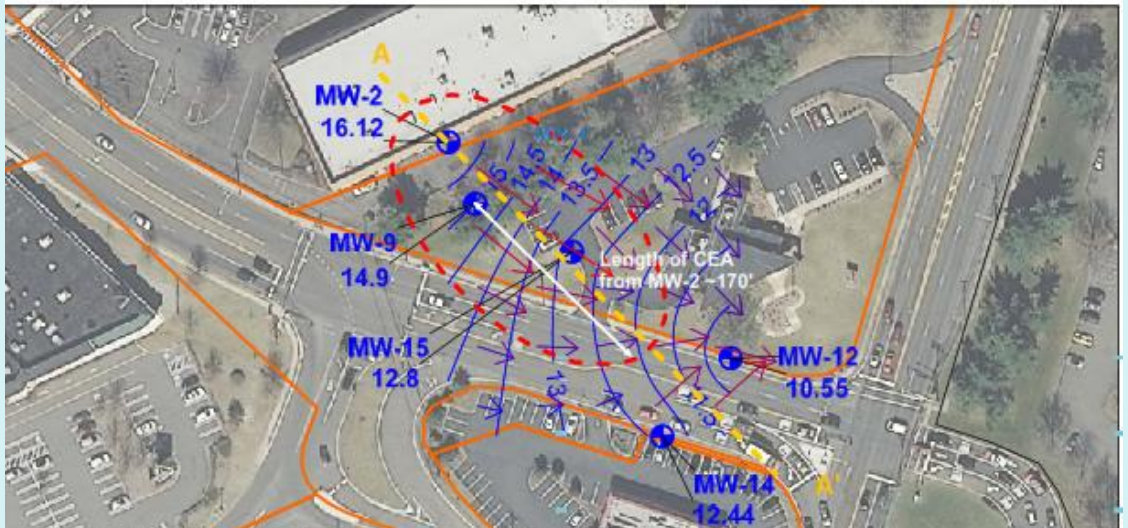
OLS Regression Slope	0.0424
OLS Regression Intercept	0.0711

Insufficient statistical evidence of a significant trend at the specified level of significance.

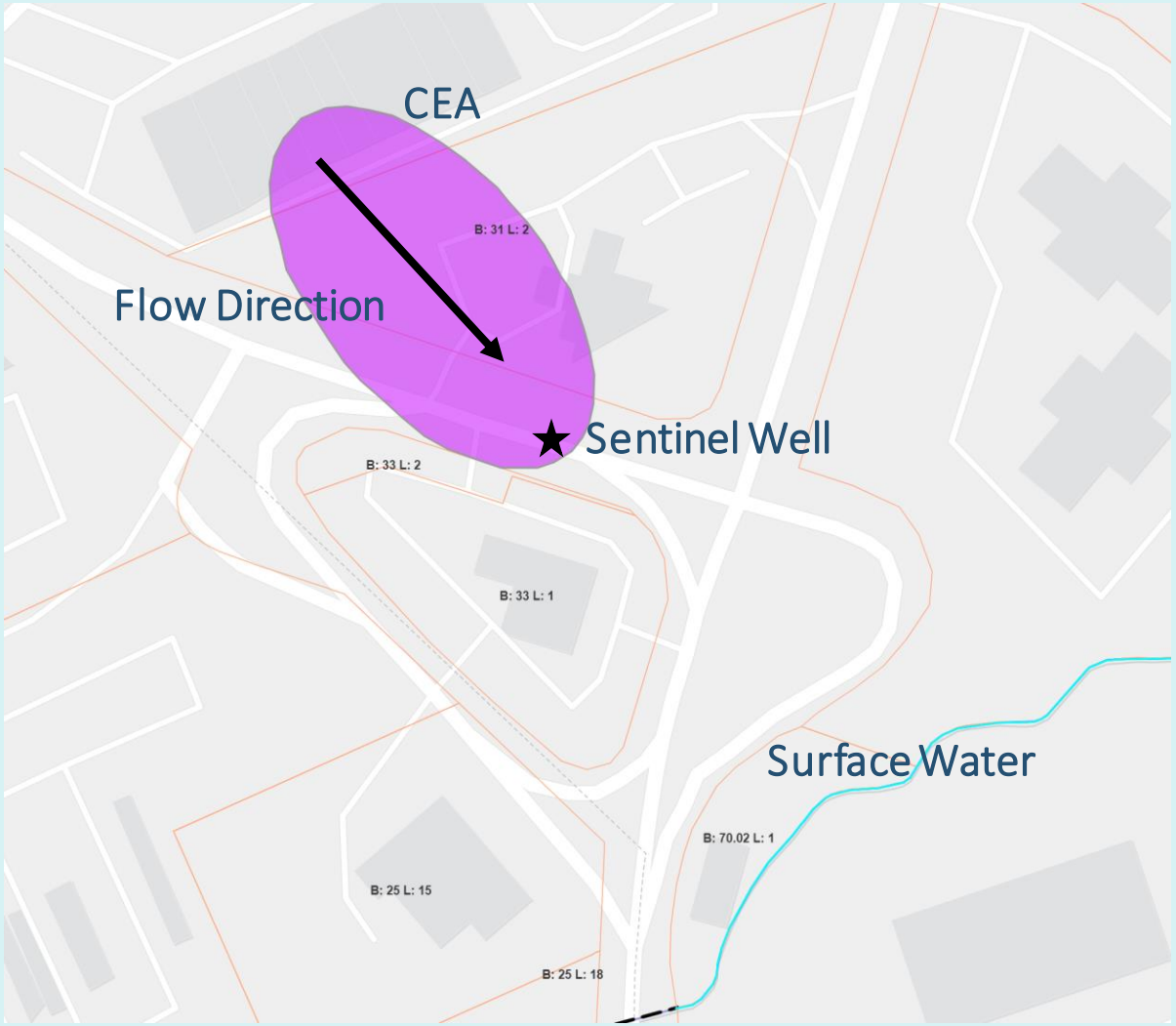
Case Study – Dry Cleaner CEA

Wells to Be Sampled	Type of Well	Easting	Northing	Sampling Schedule	Reporting Schedule	Parameters for Each Well	CASRN
MW-2	Plume sampling point	613333.2	539364.2	Other	Biennially	Chlorinated Organics	NA
MW-9	Plume sampling point	613380.3	539341.2	Other	Biennially	Chlorinated Organics	NA
MW-15	Plume fringe	613429.9	539277.5	Other	Biennially	Chlorinated Organics	NA
MW-12	Sentinel	613554.8	539193.9	Other	Biennially	Chlorinated Organics	NA
MW-14	Sentinel	613501	539132.9	Other	Biennially	Chlorinated Organics	NA





Case Study – Dry Cleaner Surface Water Check



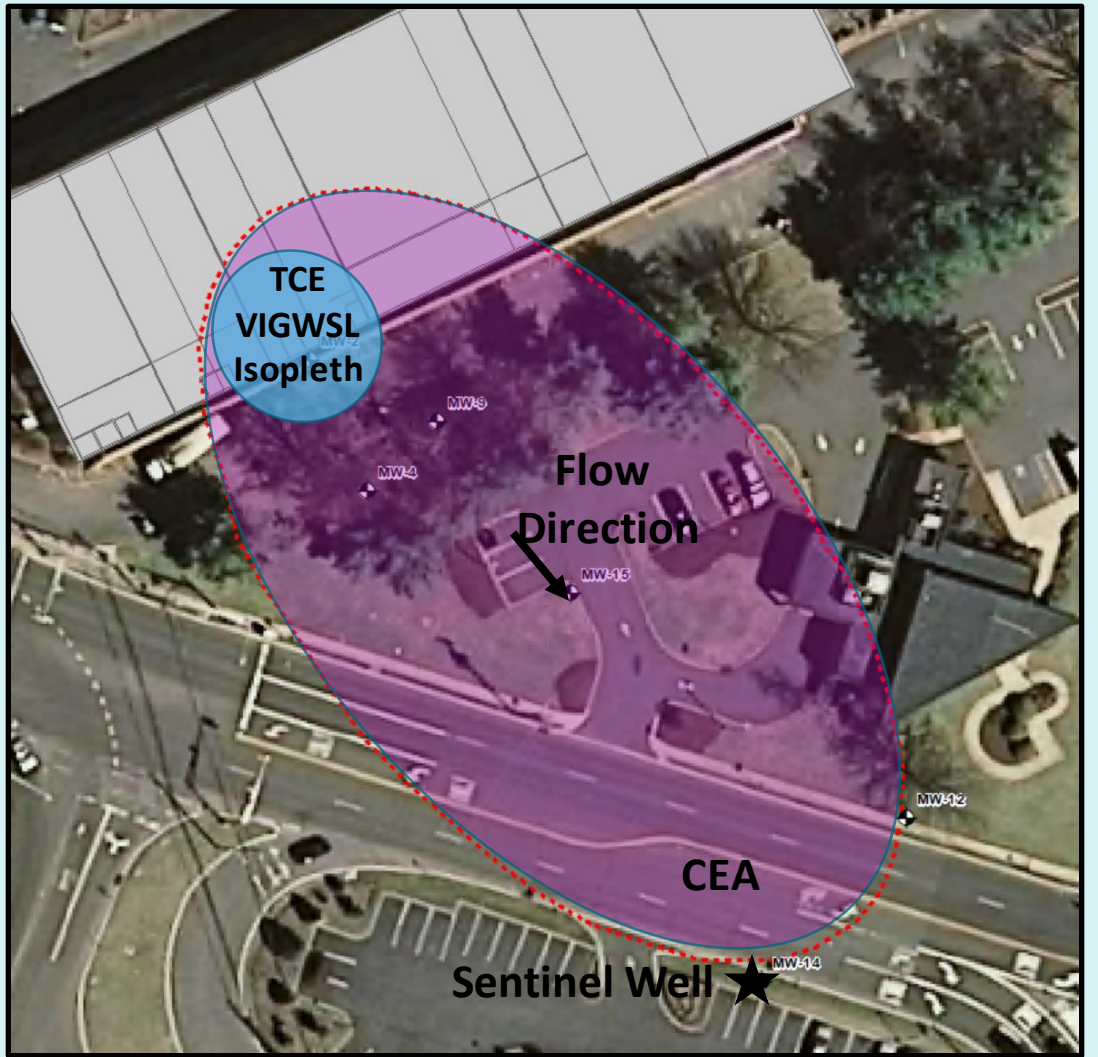
Case Study – Dry Cleaner Vapor Intrusion Check

Conducted a proper VI Investigation per the most recent version of the VITG

- Collected triggered sub-slab soil gas samples

  **Trigger distances are applied from the edge of the ground water contaminant plume based on linear interpolation of the ground water data as defined by exceedances of the VI Ground Water Screening Levels. It is not appropriate to apply the VI sampling trigger distance based solely on the location of a monitoring well itself when determining which buildings should be investigated.*

- Collected indoor air samples
- Installed sub-slab depressurization system as required



Case Study – Dry Cleaner Potable Well Check

- Prepared the Well Search to evaluate if there are any possible potable wells within 0.5 miles radius from the ground water CEA at the Site
- Conducted a door-to-door survey to identify unpermitted wells
- Sampled any potentially potable wells within appropriate trigger distances

Case Study – Dry Cleaner MNA Applicability

MNA may still represent an appropriate remedy for contaminants with concentration trends reflecting asymptotic decline if it can be demonstrated that:

- The plume is stable, and no receptors are impacted or threatened
- The sources of ground water contamination have been identified and remediated
- The sentinel wells were installed to delineate ground water contamination to the Groundwater Remediation Standards (GWRS)

Case Study – Dry Cleaner MNA Applicability

- The ground water contaminant levels do not follow the ground water elevation fluctuations
- There are a minimum of eight (8) rounds of groundwater data from key monitoring wells, following source removal for which it has been attempted to demonstrate a decreasing trend
- The asymptotic ground water contaminant levels are less than 10x the respective NJDEP GWQS

Case Study – Dry Cleaner MNA Applicability

- Sites with low ground water contaminant levels that have documented asymptotic concentration trends will have minimal changes in contaminant concentration levels over time

- At sites with CEAs established for low, asymptotic contaminant levels:
  - Fate and transport modeling should support long CEA duration at the time when the GW RAP was initially developed
  - Monitor contaminant trends to evaluate possible CEA duration changes

From Active Remedy through MNA to GW RAP Termination

January 31, 2023

Neil Rivers, LSRP

Langan Engineering & Environmental Services, Inc.

Background – Hypothetical Site

- Active remedy implemented
- Per monitoring: treatment may no longer be needed
  - Lower source area concentrations
  - Plume is stable or shrinking
  - Plume geochemistry consistent with contaminant degradation

So, What's Next?

- Consider potential receptors
  - Revisit the Conceptual Site Model
- Assess potential for success of natural attenuation
  - Evaluate the potential for rebound (e.g., pulsed pumping)
  - Consider MNA and Ground Water SI/RI/RA Guidance
- Is there evidence that the active remedy is ongoing?
  - Amendment residuals, geochemistry
  - May need to wait to begin MNA evaluation

Reminders!

- Continue with permit-specified monitoring
  - Many older GW RAPs do not have a monitoring plan designed for MNA evaluation or long-term MNA monitoring
  - Supplement for MNA evaluation, but an updated plan will eventually be needed
- Consider remediation life cycle in future GW RAP applications

Consider Potential Receptors

- Revisit the Conceptual Site Model
  - Will discontinuing active remediation alter the plume dynamics?
  - Changes in property or ground water use?
    - VI assessments
    - Sentinel well locations
    - Potable supply wells
    - Need to change monitoring program?

Assess Potential for MNA

- Consider lines of evidence in MNA Guidance
- 8 rounds of post-treatment data typically needed
  - With at least 4 consecutive quarterly events
- Sample from throughout the plume
  - Evaluate “rebound” in treatment zone
  - Vertical and horizontal (lateral and downgradient) conditions
  - Account for seasonal variability/measure GW elevations

Success! Submit Permit Modification

- Remedial Action Permit Modification Application form
- Cover letter/report explaining reason for modification
- Provide MNA monitoring results and modeling
  - Include depth to ground water and concentration data
  - Ground water elevation contours
  - Include secondary and tertiary lines of evidence, if applicable
- CEA/WRA Fact Sheet form

Success! Submit Permit Modification

- Updated Long Term Monitoring Plan
  - Refer to MNA Technical Guidance
  - May not need some of the wells from the treatment zone
  - Adjust sampling frequency and analytical suite as needed
    - Protection of receptors
    - Decision-relevant data (selection of analytical parameters)
  - VI monitoring plan, if applicable
- OM&M plans for VI mitigation and POETs, as needed

Transition from MNA to Closure (Finally!)

Background

- Ground water monitoring indicates compliance with GWQS

or

- The modeled CEA duration is approaching

Verify Compliance with GWQS

- Minimum of two successive rounds of concentration data
  - N.J.A.C. 7:26C-7.9(f)
  - Minimum 90 days between events
  - At least one round biased to expected higher concentrations
    - Consider seasonal variability

Verify Compliance with GWQS

- Demonstrate compliance throughout the entire plume
  - Vertically and horizontally
- Per Field Sampling Procedures Manual, sample last two rounds using volume averaged purge
  - Or provide technical basis for deviation from guidance

Success! Terminate CEA and RAP

- Remedial Action Permit Termination Application form
- Cover letter/report justifying termination
- Provide ground water monitoring results

Success! RAO Update NOT Required

Limited Restricted Use RAO + GW RAP Termination =

Unrestricted GW RAO

MNA/GW RAP Guidance Document Training

January 31, 2023

Questions?

MNA Technical Guidance Q&A

January 31, 2023

Dominik Hudyka, Environmental Specialist
Bureau of Inspection and Review
Contaminated Site Remediation & Redevelopment Program

Rich Lake, LSRP
Geo-Technology Associates, Inc

Beginning the Eight Rounds of Sampling

Q: Can I begin sampling for my eight rounds immediately after active ground water remediation has ended?

A: Sufficient sampling should occur following an active ground water remedy phase to demonstrate that the active remedy is no longer enhancing natural attenuation.

Aquifer in Equilibrium after Active Remediation

Q: When does the Department consider an aquifer as being in equilibrium after active ground water remediation?

A: This determination can be made by evaluating the presence of reagents or amendments injected or otherwise discharged, and changes in geochemical parameters between baseline, treatment, and post treatment time intervals. Reagents or byproducts remaining in ground water that are not anticipated to be influencing attenuation are not relevant to this determination (e.g., sodium).

Use of Historic Groundwater Data

Q: Can I use ground water data collected from my SI/RI phase as part of my eight rounds of sampling?

A: Yes, if the samples were collected after any active soil or ground water remediation.

Historic Quarterly Monitoring Data

Q: I have a historic site where the four quarterly ground water samples were conducted more than 10 years ago. Do I need to conduct an additional four rounds of quarterly samples?

A: The LSRP should use their independent professional judgment when deciding on using historic data when evaluating MNA. The four quarterly samples should provide an understanding of seasonal variability on the ground water plume and the LSRP should evaluate whether any potential changes in hydrogeologic conditions affect present-day seasonal variability.

Requirement of Eight Rounds of Sampling

Q: I did not conduct active ground water remediation; do I still require eight rounds of sampling to demonstrate that MNA is an applicable remedy?

A: Yes. Many sites will not require an active ground water remedy.

Remedial Action Timeframe

Q: What if I cannot obtain eight rounds of samples before my remedial action regulatory timeframe?

A: We recommend that you apply for an extension of the regulatory timeframe (if you qualify). You may also consider whether less than eight rounds of sampling is sufficient to evaluate the MNA remedy for your site. Please note that this is a deviation from the MNA Guidance and lines of evidence supporting the deviation should be provided in the RAR and RAP application.

Monitoring Well Sampling Frequency for Non-Decreasing Trends

Q: Should I use the recommended monitoring well sampling frequency for MNA when I have a non-decreasing trend situation?

A: In general, the frequency suggested in the guidance is for sites with a decreasing trend. We recommend that you evaluate historical ground water data to develop an appropriate monitoring frequency for source area wells. The sentinel monitoring well sampling frequency should be based on the methods described in the guidance.

Ground Water Monitoring Program Wells

Q: Do all wells installed at the SI/RI phase need to be sampled as part of the performance monitoring program and included in the long-term monitoring program?

A: In many cases, the number and location of SI/RI monitoring wells used to support the MNA determination will be more robust than what is needed under the ground water monitoring plan (GWMP). The wells selected for the GWMP should be based on the distribution of the ground water contaminants and the site hydrogeology and include all impacted hydrogeologic units. The well array should be sufficient to evaluate if contaminant trends are continuing to decrease, and support that receptors remain protected. Justification should be provided to support the GWMP

GW RAP Guidance Document Q&A

January 31, 2023

Robert Hawke, Environmental Specialist
Bureau of Remedial Action Permitting
Contaminated Site Remediation & Redevelopment Program

Mark D. Fisher, LSRP
The ELM Group

Variances from Rule / Deviations from Guidance

Q: Can I vary from the Technical Requirements for Site Remediation (N.J.A.C. 7:26E) or guidance if it seems appropriate to do so, and if so, how do I document it?

A: Yes, and any variance/deviation must be documented, and independent professional judgment provided in the Remedial Action Report (RAR) per N.J.A.C. 7:26E-1.6(b)4 and 1.7, as well as in "Other Information Provided" on the Remedial Action Permit (RAP) Application. "Other Information Provided" should reference the section of the RAR where the variance/deviation was discussed and justified

Free and Residual Product

Q: When is it appropriate to apply for a Ground Water Monitored Natural Attenuation (MNA) RAP for a site with a history of free/residual product?

A: After post-remedial sampling data shows that all free/residual product has been treated or removed from:

- **The entire historically mapped extent of free/residual product**
- **The vicinity of impacted monitoring wells**
- **The area within the radius of influence of any prior active remediation**

Technical Impracticability (TI)

Q: A TI determination was made for my site; what type of RAP should I apply for?

A: For cases with a TI determination, an Active Remediation Ground Water RAP should be applied for. Please also note that:

- **Product that can be removed, should be removed**
- **Product that can't be removed should be contained**
- **It is strongly recommended that a joint technical consultation occur with both the Bureau of Ground Water Pollution Abatement (BGWPA) and the Bureau of Remedial Action Permitting (BRAP) prior to application submission (https://www.nj.gov/dep/srp/srra/technical_consultation/)**

Subdivisions

Q: My site has been subdivided; which portion requires a RAP and what is now considered the site?

A: If a property is subdivided, the portion containing the source area is to be considered on-site and only that parcel would require a RAP. Former on-site parcels that do not contain the source area should now be considered off-site

It is recommended that source areas not be split via subdivision as this would require more than one Ground Water RAP Application and create more than one site

Multiple Classification Exception Areas / Remedial Action Permits

Q: If I have multiple releases at my site, do they require separate RAPs and Classification Exception Areas (CEAs)?

A: A separate Initial Ground Water RAP Application, Classification Exception Area/Well Restriction Area (CEA/WRA) Fact Sheet Form, and Ground Water Monitoring Plan (GWMP) are recommended, but not required, for each source area/contaminant plume based on several reasons, including but not limited to:

- **CEA durations may vary by contaminant of concern**
- **Smaller GWMPs**
- **Fewer modifications**
- **Streamlined review of Ground Water RAP Applications**

Please contact BRAP at (609) 984-2990 for any questions on this recommendation

Test Your Knowledge #4

For cases with an approved TI determination, a _____ GW RAP application should be submitted:

A. Monitored Natural Attenuation
B. Active Remediation
C. Technical Impracticability
D. None of the Above

Test Your Knowledge

For cases with an approved TI determination, a(n) _____ GW RAP application should be submitted:

A. Monitored Natural Attenuation

B. **Active Remediation**

C. Technical Impracticability

D. None of the Above

Tentatively Identified Compounds (TICs)

Q: How do I calculate and list total and individual TICs for my permit application?

A: "Total TICs" should be a Contaminant of Concern (COC) if they exceed the 500 µg/L Ground Water Remediation Standard (GWRS). When both scans are required, Total TICS = Volatile Organic (VO) + Semi-Volatile Organic (SVO) TICs. When applicable, there should be 15 VO and 15 SVO TICs

"Individual TICs", should be a COC if any exceed the 100 µg/L GWRS. The concentration should be the highest individual VO or SVO TIC concentration used in "Total TICs"

TICs (cont'd)

Q: A contaminant that is typically a targeted compound showed up in the lab results on my TIC scan, what should I do?

A: Contaminants with GWRS should not be considered TICs. They should be removed from the VO or SVO TIC scan results

When removing a contaminant from the VO or SVO TIC lists, the TIC with the next highest concentration should be added in its place to keep a total of 15 VO TICs and 15 SVO TICs

There are other rare situations where contaminants may need to be removed from TIC results. If you have questions about your TIC results or TIC sampling in general, please contact Greg Toffoli with the Office of Data Quality at (609) 633-2356

Ground Water Remedial Action Permit Terminations

Q: When should I terminate my permit?

A: A Ground Water RAP Termination Application can be submitted if:

- **A minimum two rounds below GWRS that account for seasonal fluctuation (at least 90-days apart) have been collected from all wells on the GWMP, at least one being the month/season with historic high concentrations**
- **The number of ground water samples collected is representative of the entire horizontal and vertical extent of the ground water CEA (N.J.A.C. 7:26C- 7.9(f))**
- **All required VI termination sampling has completed in accordance with the Vapor Intrusion Technical (VIT) Guidance Document, if applicable**

Increasing Trend Under An Existing MNA RAP

Q: Contaminant concentrations increased during the last sampling event, should I transition my Ground Water MNA RAP to an Active RAP?

A: Not necessarily. If a new release is not suspected, the increase should be confirmed over additional sampling events

- **If an increasing trend is not present, the current MNA RAP may still be appropriate**
- **If an increasing trend is present and you plan on treatment via a continuously operating/long-term system, transition to an Active RAP is required**
- **If an increasing trend is noted and you do not plan on treatment via a continuously operating/long-term system (e.g., a one-time injection), a Permit-By-Rule (PBR) for an in-situ treatment under the current Ground Water MNA RAP can be obtained through BGWPA**

Adverse Effects From Injection Under An Existing MNA RAP

Q: If I obtain a PBR for an injection while I have a Ground Water MNA RAP, what should I do if there are adverse effects from the injection?

A: If the treatment has adverse effects (e.g., significant plume displacement or introducing additional contaminants above GWRS) that are still present when the next biennial evaluation is completed, a Ground Water RAP Modification Application is required per N.J.A.C. 7:26C-7.12(b)

Previously Approved CEAs

Q: My CEA was approved with modelling during the Remedial Investigation (RI) stage, should I revise the CEA for my permit?

A: If the CEA was based on modelling, then yes. Modelling is only acceptable during the RI stage. When applying for a permit during the Remedial Action (RA) stage, the boundaries of the CEA shape should be drawn to the required clean (at or below the applicable GWRS) ground water sampling points in all directions unless sufficient information exists that supports a smaller CEA footprint

Primary Contact for Permit Compliance (PCPC)

Q: What is the PCPC?

A: The PCPC (formerly Primary Responsibility for Permit Compliance), is whichever co-permittee agrees to be the Department's primary co-permittee contact for compliance issues. It is an internal designation and is not listed on the RAP. Even though one entity is called the PCPC, all current permittees are jointly and severally liable for permit compliance

Remedial Action Protectiveness/ Biennial Certification Forms

Q: Some monitoring wells on my permit could not be sampled during the last sampling event and my next Remedial Action Protectiveness/Biennial Certification Form is due; should I wait to send the form after I sample all wells on my GWMP?

A: If the monitoring wells in the Ground Water RAP/GWMP are inaccessible, then the Department recommends sampling the wells as soon as possible, but maintaining the Ground Water RAP schedule and noting the issue in the Ground Water Remedial Action Protectiveness/Biennial Certification Form due for the site. The next Ground Water Protectiveness/Biennial Certification Form due should include the missing and regularly scheduled ground water sampling data

Technical Consultation Contact Information

- **Ground Water Issues**
  - Mary Anne Kuserk – Maryanne.Kuserk@dep.nj.gov
- **Migration to Ground Water Exposure Pathway Fate & Transport Models**
  - William Carp – William.Carp@dep.nj.gov
- **Laboratory Analysis and QA/QC Issues**
  - Greg Toffoli – Greg.Toffoli@dep.nj.gov
- **Remedial Action Permits**
  - Alexander Shelkonovzeff – Alexander.Shelkonovzeff@dep.nj.gov
- **Soil Contamination and Other Technical Issues**
  - Allan Motter – Allan.Motter@dep.nj.gov

Reminders!

- Please fill out the Course Evaluation here: https://www.surveymonkey.com/r/2XF667R
- Look out for an email from the LSRPA for CEC certificate access
- Questions not answered today will be answered via email in the coming weeks
- Slides and presentation will be posted on the CSRRP Training page

Thank you!