Remediation Roundtable

June 18, 2019

Connecticut Department of Energy and Environmental Protection: Remediation Division

Remediation Roundtable Webcast

- Basic directions provided on listserv email
- Detailed directions on website
  - www.ct.gov/deep/remediationroundtable

Remediation Roundtable Agenda

- **Announcements**
- **Updates**
  - Wave 2 RSRs
  - Succession Planning and Division Goals
  - RSR Amendment Roll Out
  - Legislative Update Bill SB1030
- **Presentations**
  - PCB TSCA Workplans
  - Zone of Influence for In Situ Remediation Discharge Permits

Announcements – Web Updates

DEEP's New Document Online Search Portal

- The New Document Online Search Portal was created to provide public access to the Agency's electronic records
- Goal is transparency to public, reduced FOIA requests, and better access for staff
- Currently includes a limited collection of electronic documents
- DEEP continues efforts to digitize paper records to add to the list of those currently available

Announcements – Web Updates

- All Hazardous Waste Manifests are scheduled to be available by Fall 2019
- To open the portal use the link provided on the "DEEP Online Services" webpage or URL below
- Documents are searchable by a variety of fields
- Please refer to the "More Information and FAQ's" link in the portal for instructions and lists of what else is currently available https://filings.deep.ct.gov/DEEPDocumentSearchPortal/

(Note: For the best results use Chrome or Firefox browsers)

Questions or Comments?

Please Speak into Microphone
and State Your Name

www.ct.gov/deep/remediationroundtable

Update Wave 2
Remediation Standard Regulations

Betsey Wingfield
Deputy Commissioner
Environmental Quality

Air Management, Water Protection & Land Reuse and Materials Management & Compliance Assurance Bureaus

Questions or Comments?

Please Speak into Microphone
and State Your Name

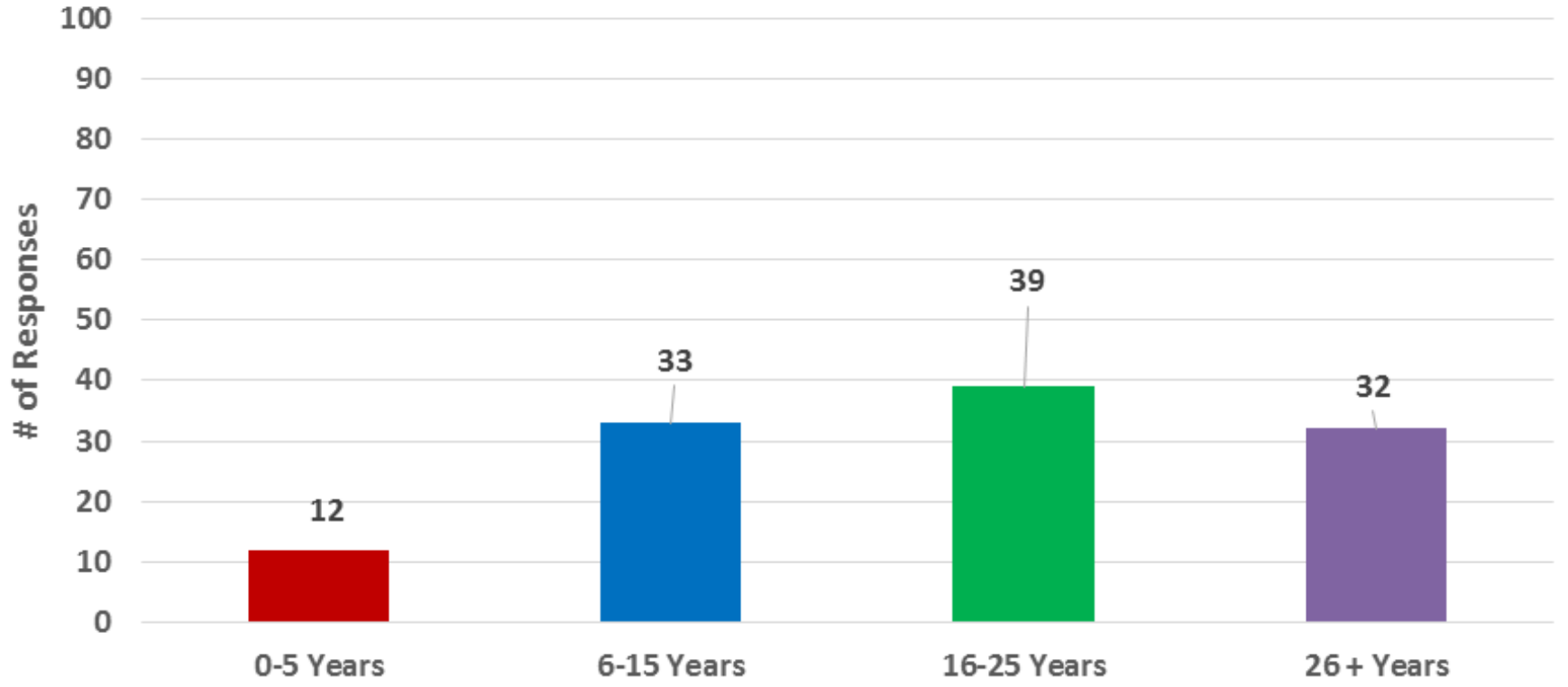
www.ct.gov/deep/remediationroundtable

Remediation Division
Succession Planning and Goals

Ray Frigon
Assistant Director
Remediation Division

Water Protection and Land Reuse

WPLR Staff Survey
Years employed at DEEP

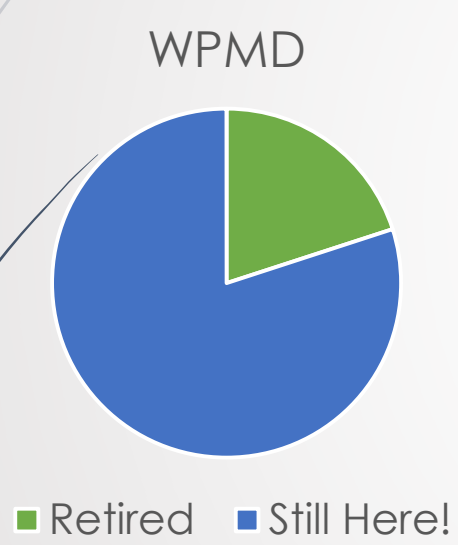


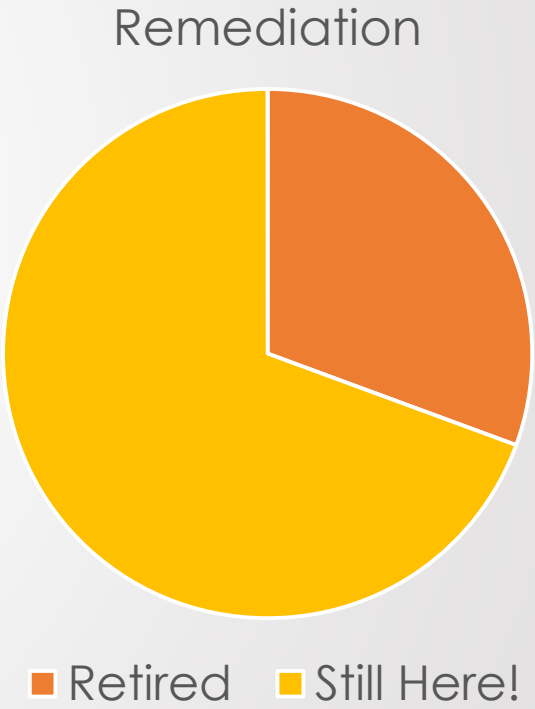
Ray Frigon

WPLR Staff Coming and Going

128 Staff Currently

2022 Projection is 86 Staff remain in Bureau

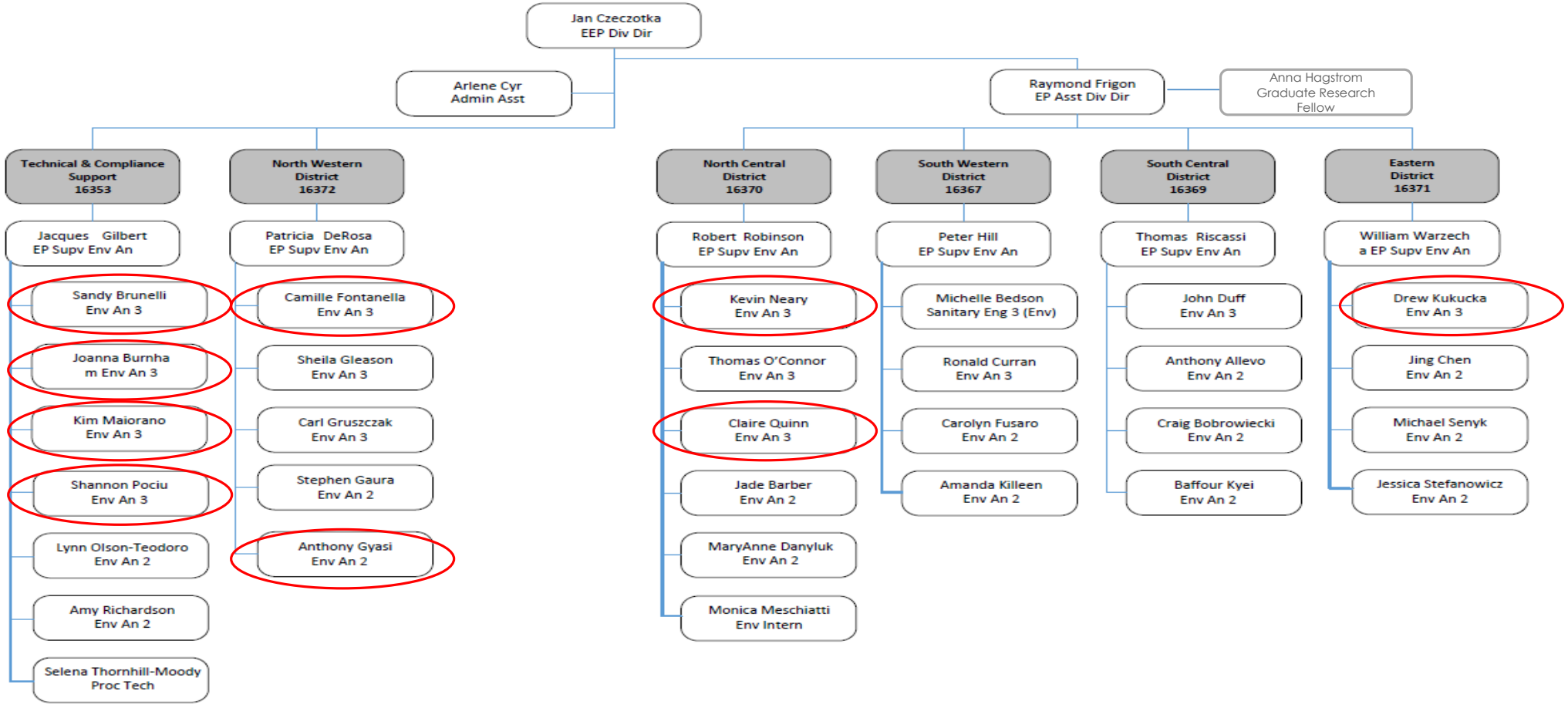




Organizational Chart

Bureau of Water Protection & Land Reuse
Remediation Division
DEP43700-16351

Rev 6/7/19



Coping with Staff Attrition

Goal – Position the Division to absorb upcoming staff attrition by:

- Making investments that advance our mission and improve customer service
- Identifying the key areas where staff resources are/will be needed most
- Evaluating the organizational structure of the Division to promote consistency and efficiency
- Hiring new staff

Remediation Division Goals

- **Adopt RSR and EUR Amendments**
  - New Guidance, Tools and Forms
- **Create/update standard operating procedures for all programs and tasks**
- **Update template formats for uniformity**
- **Continued commitment to compliance assistance**
- **Further our commitment to enforcement (Property Transfer Act Compliance Project)**

Remediation Division Goals

- **Define a plan of action to address pollution from the emerging contaminants, such as PFAS/PFOA**
- **LEAN the process of screening and auditing LEP Verifications**
- **Continue adding documents to electronic document repository for public access**
  DEEP Document Online Search Portal

Questions or Comments?

Please Speak into Microphone
and State Your Name

www.ct.gov/deep/remediationroundtable

Wave 2 RSRs Adoption Process

Ray Frigon
Assistant Director
Remediation Division

Wave 2 Proposed RSRs Amendment Rollout

- **July 8, 2019-** Official Roll Out of Proposed Amendments
  - Start of the 90 day comment period
- Kick-off meeting planned for **July 9, 2019 from 1:30 – 3:00 pm** at DEEP HQ, Gina McCarthy Auditorium
  - Introduce proposed amendments
- What will be released?
  - Summary Notes
  - Proposed RSR Amendments with Table of Contents
  - Red Line - Blue Line Version

- Keep an eye on our RSR web page for schedule and presentation updates
- **Notifications to interested parties through Remediation webpage E-alert system and Roundtable listserv (sign up)**

Wave 2 Proposed RSRs Amendment Rollout

- Planned Question and Answer Sessions
  - July 30th at DEEP HQ, 9:30-11:30am
  - August 6th at DEEP Kellogg Center, Derby, 1:30-3:30pm
  - TBA - End of August/Early September hosted by stakeholder
- Standing offer to meet with Stakeholders

Formal Regulation Adoption Process

1. Public Notice of Intent to Secretary of State
2. Public Hearing
3. Hearing Officer's Report
4. Final proposed regulations to the Commissioner
5. DEEP notification to all interested parties of availability of final wording

Formal Regulation Adoption Process

6. Final proposed regulations to Attorney General for Legal Sufficiency approval
7. Final proposed regulations to Office of Fiscal Analysis and Environment Committee
8. LRRC hold meeting on regulatory amendments per CGS section 4-170
9. Regulations filed with Secretary of State per CGS section 4-172 (Regulations final upon filing)
10. Publication of Regulations in the CT Law Journal

DEEP RSR Amendments Workgroup

Any informal questions or comments please contact:

- Jan Czeczotka- 860-424-3705; jan.czeczotka@ct.gov
- Ray Frigon- 860-424-3705; raymond.frigon@ct.gov
- Kevin Neary-860-424-3947; kevin.neary@ct.gov
- Camille Fontanella- 860-424-3074; camille.fontanella@ct.gov
- Carl Gruszczak- 860-424-3948; carl.gruszczak@ct.gov

- **Formal Responses to the RSRs package must be submitted to the Regulation Review Committee within 90 days of release**

Questions or Comments?

Please Speak into Microphone
and State Your Name

www.ct.gov/deep/remediationroundtable

Senate Bill 1030

"AN ACT CONCERNING THE AUDIT PERIOD FOR THE TRANSFER OF HAZARDOUS WASTE ESTABLISHMENTS"

Jan Czeczotka
Director
Remediation Division

Original Intent of Bill

- Shorten the audit period for verifications submitted pursuant to the Transfer Act
  - From 3 years to 60 days
- Testimony from Realtors
  - Concerned the Transfer Act was hurting property sales
  - Submitted testimony that included a significant proposed change to the Transfer Act

DEEP Response

- DEEP worked with key stakeholders and the chairs of the Commerce and Environment Committees
  - Developed and discussed alternative proposals to the original language in S.B. 1030
  - Five central themes emerged
    - Two are in the amended bill
    - Three will be considered along with other proposals for possible amendments during next year's legislative session

Central Themes

- Eliminate the "one-time" or "incidental" generation trigger
- Business transfers would investigate and remediate only areas where the establishment could impact the property
- Clarify and limit the application of the Transfer Act for transfers involving commercial and industrial common interest communities
- Clarify the definition of "transfer of establishment" so that only direct ownership change triggers the law
- Shorten the time-frame that the Commissioner has to decide to audit a final verification from 3 years to 1 year. Audits must be complete within 3 years unless certain conditions are met

2019 Amendments

- Audit time-frames for final verifications
  - Verifications received after October 1, 2007 and before October 1, 2019
    - Law requires the Commissioner to complete audit within 3 years after receiving a complete verification and notify Certifying Party and LEP of audit findings (no change from the current requirement)
  - Verifications received on or after October 1, 2019
    - Law requires that the Commissioner initiate audit within 1 year of receipt of a complete verification and complete the audit within 3 years of receipt of a complete verification and notify Certifying Party and LEP of audit findings

Added exclusions for one-time generation of hazardous waste

- The one-time generation of hazardous waste in any one month as a result of either:
  - The first time such waste was generated;
  - Such a one-time generation since the last time a Form I, Form II, Form III or Form IV was required to be submitted; or…

Added exclusions for one-time generation of hazardous waste

- **One or more of the following:**
  - (I)Remediation of polluted soil, groundwater or sediment;
  - (II)The removal or abatement of building materials or *removal of materials used for maintaining or operating a building;*
  - *(III)The removal of unused chemicals or materials as a result of the emptying or clearing out of a building, provided such removal is supported by facts reasonably established at the time of such removal;*
  - *(IV)The complete cessation of a business operation, provided the waste is removed not later than ninety days after such cessation and such cessation is supported by facts reasonably established at the time of such cessation*

Amendment Topics for 2020 Legislative Session

- Business transfers would investigate and remediate only areas where the establishment could impact the property
- Clarify and limit the application of the Transfer Act for transfers involving commercial and industrial common interest communities
- Clarify the definition of "transfer of establishment" so that only direct ownership change triggers the law
- Others?

DEEP's Added Goal

- DEEP will strive to reach the goal of issuing "no-audit" letters within 60 days of receiving a complete verification
  - Expect evaluation of current Division priorities
  - Will need help from the LEP community to reach goal
  - Will provide more transparency

Public Act Creates Workgroup

- Purpose of workgroup
  - Examine Transfer Act and develop recommendations for future legislation
- Workgroup will include
  - Chairs of Commerce and Environment or designees
  - DEEP Commissioner or designee
  - DECD Commissioner or designee
  - Environmental transaction attorneys
  - Commercial real estate brokers
  - Licensed Environmental Professionals
  - May include other members of the Commerce and Environment Committee

Workgroup Selection Process

- Chairs of Commerce and Environment will select the attorneys, real estate brokers, LEPs and other Committee members

- Chairs will also select a Chairperson for the Work Group

Workgroup Schedule

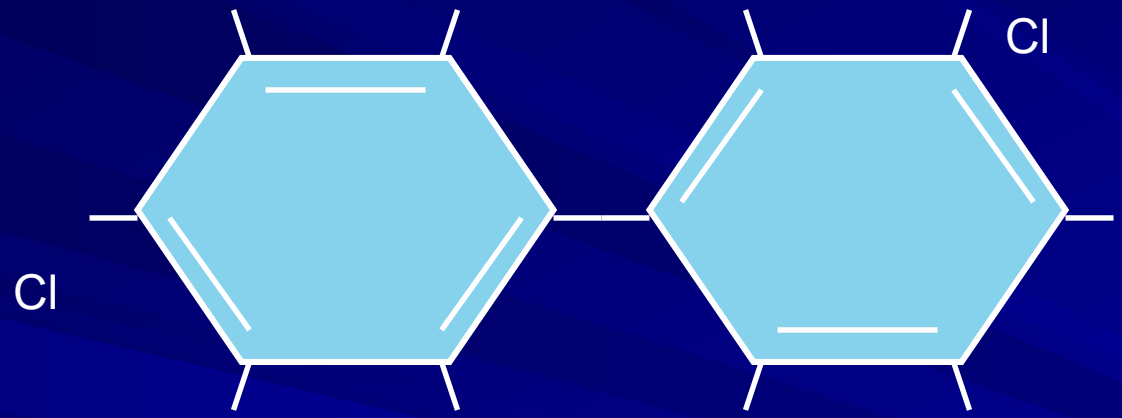
- Work Group Chair will schedule first meeting no later than 60 days after effective date of law
  - Meetings at least every month until a report is finished and presented to the Commerce and Environment Committees or no later than February 1, 2020
  - Work group shall terminate on the later of reporting to the Committees or February 1, 2020

Questions or Comments?

Please Speak into Microphone
and State Your Name

www.ct.gov/deep/remediationroundtable

PCBs and TSCA



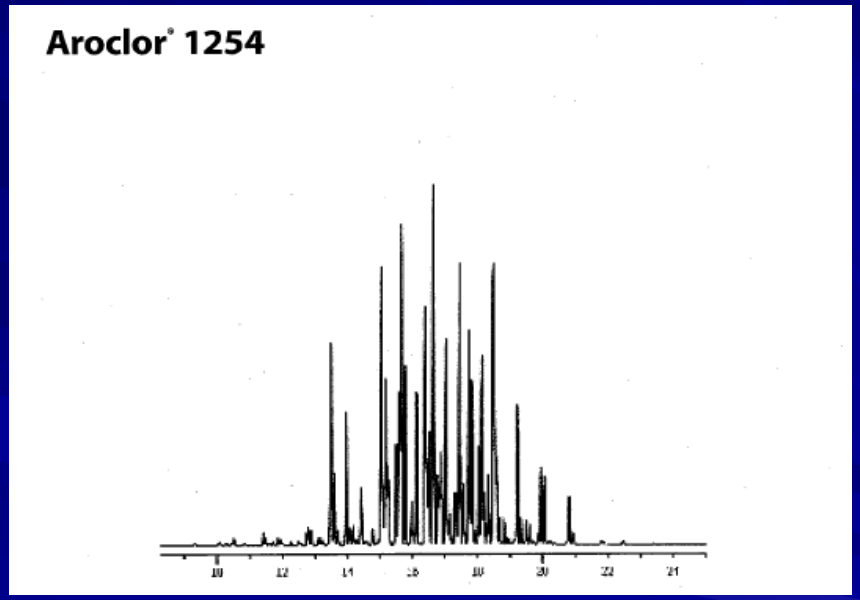
- Kim Tisa, PCB Coordinator
- US EPA Region 1
- CTDEEP Remediation Roundtable

  June 18, 2019

Formulating PCBs into Aroclors

(1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, 1268)

- Monsanto was only US producer - 1.4 billion lbs
- Only about 130 of the 209 congeners were used in commercial formulations
- >50 different congeners were used in an Aroclor mixture
- Range from oily liquids to waxy solids at room temperature
- Last two digit = % Chlorine by mass



PCBs in Industrial Applications

- Transformers
- Capacitors
- Hydraulic fluids
- Oil-based paints
- Fluorescent light ballasts
- Lubricating & cutting oils
- Floor finishes
- Fire retardants
- Thermal Insulation materials (foam, felt)
- Caulking & grout
- PVC coatings for electrical wire & components
- Carbonless copy paper
- Inks and dyes
- Adhesives/mastic

PCB USES – CAULKS & LIGHT BALLASTS

U.S. Production of Aroclors as a plasticizer ingredient (mostly Aroclor 1254)

- 1958 - 4 million pounds
- 1969 - 19 million pounds
- 1971 - 0 pounds produced in U.S. (imports?)

Fluorescent light ballast capacitors (mostly Aroclor 1242)

- Prior to 1977 - Many (most?) ballasts contain PCBs
- 1977 – 1978 - Some new ballasts contain PCBs
- After 1978 - No new ballasts manufactured w/ PCBs
- Some ballasts remain in place; some have leaked/failed

In fluorescent light ballasts

- PCB Small Capacitor of the type that can be found in clock systems. Trade Name is indicative of PCB content as well as the absence of the statement “No PCBs”

- Small Capacitor which does not contain PCBs of the type that can be found in clock systems. Marking “No PCBs” indicates that it was manufactured without PCBs.

Status of PCBs today?

- The TSCA PCB regulations (40 CFR Part 761) place prohibitions on the use (manufacture), processing, and distribution in commerce and specify storage and disposal requirements for PCBs and PCB items
- PCB regulations may govern owners, operators, and/or persons conducting cleanup of PCB-contaminated property where the PCB contamination exceeds allowable concentrations under the regulations
- TSCA authority is not delegated to the states; therefore both TSCA and state regulations will apply

PROJECT GENERAL STEPS
Site Characterization, Cleanup and Disposal

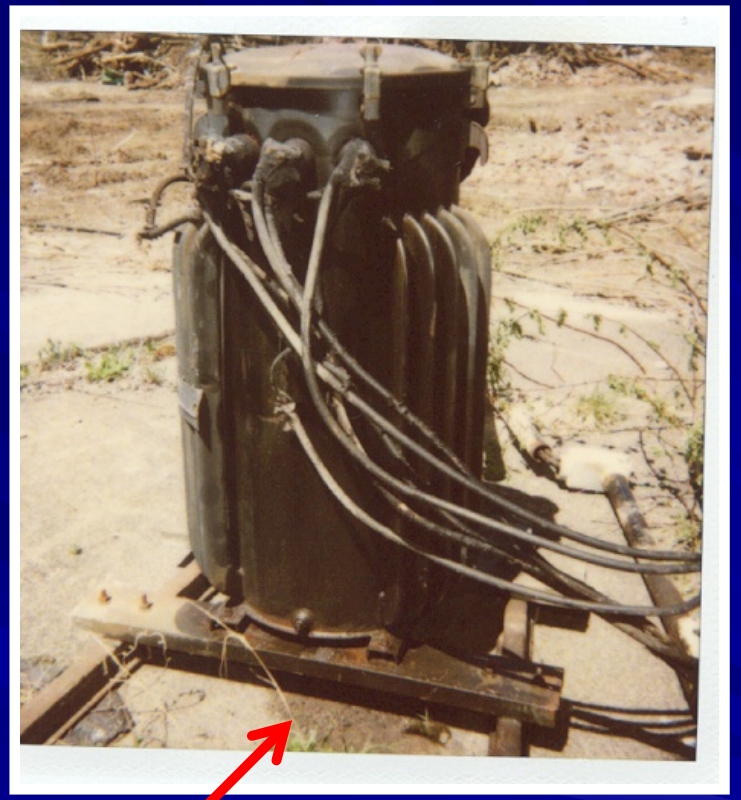
- Investigate
- Delineate
- Determine cleanup criteria and develop cleanup plan
- Perform cleanup and verify
- Dispose of waste according to regulations
- Document

PROJECT CONSIDERATIONS

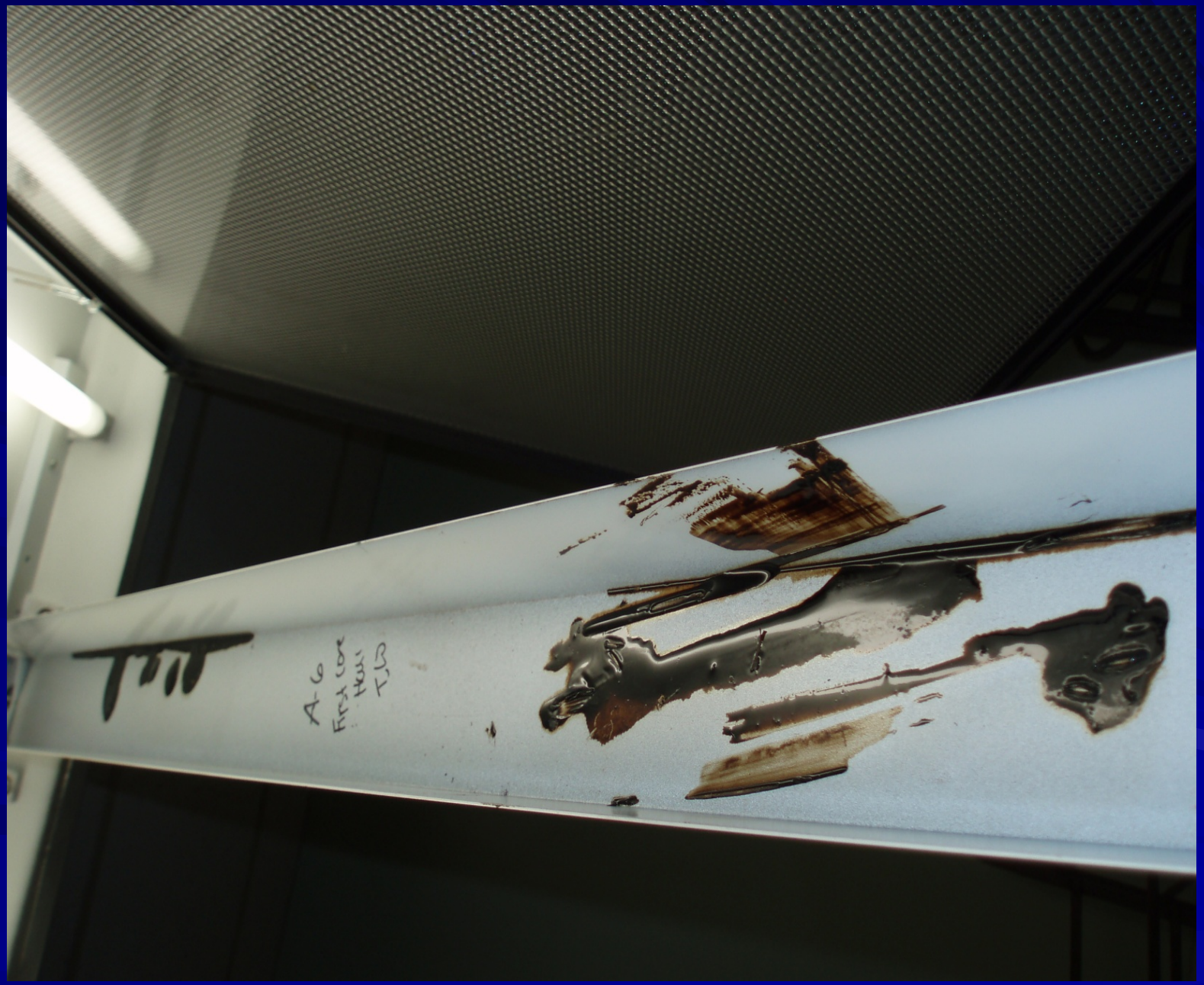
- **Do I need to look for PCBs**
- If I find PCBs, is my site regulated under TSCA
- What are my remedial options

PCBs Don’t Discriminate

- Universities, Schools and Daycare Centers
- Pools
- Federal Government Buildings
- State/Local Govt. Buildings
- Water Systems
- Commercial Buildings
- BFs
- Nuclear Power Plants



- Transformer Spill and Weepage




NO
KEEP

PROJECT CONSIDERATIONS

- Do I need to look for PCBs
- **If I find PCBs, is my site regulated under TSCA**
- What are my remedial options

DEFINITIONS: 40 CFR § 761.3

- PCB remediation waste
- PCB bulk product waste
- Excluded PCB products

Excluded PCB Products

- Must meet all criteria under § 761.3
  - ✓ concentration
  - ✓ sold/distributed in commerce prior to 1984
  - ✓ no dilution
- May be left in place without further restrictions/requirements
- State Requirements may require removal

PCB Remediation Waste § 761.3

- Material is considered a TSCA *PCB Remediation waste* if:
  - Disposed prior to April 18, 1978 and is currently at ≥ 50 ppm
  - Original PCB source ≥ 500 ppm beginning on April 18, 1978 and currently any concentration (≥ 1 ppm)
  - Original PCB source ≥ 50 ppm beginning on July 2, 1979 and currently any concentration (≥ 1 ppm)
  - Any concentration if from an unauthorized source

** Burden of Proof and Presumption of no unreasonable risk § 761.50(b)(3)

PCB Bulk Product Waste

Definition at § 761.3

> " Waste derived from manufactured products containing PCBs in a non-liquid state, at any concentration where the concentration at the time of designation for disposal was ≥ 50 ppm PCBs"

examples: caulk, applied dried paints, varnishes, other similar coatings or sealants, Galbestos


CAULK AROUND WINDOWS
16,000 - 40,000 PPM
CAULK BETWEEN
METAL LINTEL &
METAL WINDOW
FRAME
8.0 - 48 PPM
CAULK BETWEEN
METAL LINTEL &
WOOD SOFFIT
4.1 - 45 PPM
GLAZING
COMPOUND
1,700 PPM

PROJECT CONSIDERATIONS

- Do I need to look for PCBs
- If I find PCBs, is my site regulated under TSCA
- **What are my remedial options**

Cleanup/Disposal of *PCB Remediation Waste* – § 761.61

- Three options for PCB remediation
  - **Self-implementing Approach**
  - Performance-Based Approach
  - **Risk-Based Approach**

https://www.epa.gov/pcbs/pcb-facility-approval-streamlining-toolbox-fast-streamlining-cleanup-approval-process

PCB FACILITY APPROVAL STREAMLINING TOOLBOX

A Framework for Streamlining PCB Site Cleanup Approvals

Lean Transference Package

EPA530-F-17-002

May 2017

PCB FAST

TOOL 3: TSCA Self-Implementing PCB Cleanups Checklist – 61(a)

A. Introduction – General, Applicability, Notification, Disclaimers, and Clarifications

1. General

The Toxic Substances Control Act (TSCA) regulations for polychlorinated biphenyls (PCBs) in 40 CFR 761.61(a) require that responsible parties (RPs or cleanup parties) submit a Notification for self-implementing cleanups. The Notification must include a Cleanup Plan and Certification in addition to other information. Refer to 40 CFR 761.61(a)(3)(i) for details.

Section B below includes a checklist to be used as a guide when preparing the Notification. This checklist is to help assure completeness of the Notification and associated Cleanup Plan and Certification before that information is submitted to the U.S. Environmental Protection Agency (EPA). The Notification is submitted to the EPA Regional Administrator, Director of State or Tribal environmental protection agency, and the Director of the county or local environmental protection agency where the cleanup will be conducted. We strongly recommend the RP submit a copy of the Notification to the EPA Regional PCB Coordinator to expedite the review and approval process.

In situations when the RP is not sure about which PCB cleanup option (761.61(a) vs. 761.61(c)) to choose or if the site is larger than one acre, we recommend that an initial conference call and, if necessary, a Framework meeting be scheduled with EPA before drafting and submitting a Notification. This approach is strongly recommended to ensure the RP chooses the most applicable PCB cleanup option for the site. If the RP chooses the self-implementing cleanup option, the RP may consider scheduling a Framework meeting with EPA after making that decision, if desired.

2. Applicability of 40 CFR 761.61(a)

Self-implementing cleanup procedures in 40 CFR 761.61(a) **may not** be used to clean up PCBs in:

a. surface water
b. ground water
c. sediments in marine and fresh ecosystems
d. sewers or sewage treatment systems
e. any private or public drinking water sources or distribution systems
f. grazing lands
g. vegetable gardens

The cleanup plan and disposal of PCB remediation wastes from the site must be based on the as-found PCB concentration measured in media (e.g., soils, sediments in storm water drains) and/or materials (e.g., porous surfaces) of concern.

The Notification must consist of the cleanup plan and certification required in 40 CFR 761.61(a)(3)(i). The checklist below describes information required in that provision and additional information that EPA recommends be included in the Notification.

1. Part 1 Checklist: Information Required in 40 CFR 761.61(a)(3) to Include in Notification

Pre-Cleanup Site Characterization

- **The nature of the contamination, including kinds of materials contaminated. (40 CFR 761.61(a)(3)(i)(A)**
- **A summary of the procedures used to sample contaminated and adjacent areas and a table or cleanup site map showing PCB concentrations measured in all pre-cleanup characterization samples. The summary must include sample collection and analysis dates. The EPA Regional Administrator may require more detailed information including, but not limited to, additional characterization sampling or all sample identification numbers from all previous characterization activities at the cleanup site. (40 CFR 761.61(a)(3)(i)(B))**
- **The location and extent of the identified contaminated area, including topographic maps with sample collection sites cross referenced to the sample identification numbers in the data summary from paragraph (a)(3)(i)(B) of this section. (40 CFR 761.61(a)(3)(i)(C))**

PCB Cleanup Plan

- **A cleanup plan for the site, including schedule, disposal technology, and approach. This plan should contain options and contingencies to be used if unanticipated higher concentrations or wider distributions of PCB remediation waste are found or other obstacles force changes in the cleanup approach. (40 CFR 761.61(a)(3)(i)(D))**

Written Certification

- **A written certification signed by the owner of the property where the cleanup site is located and the party conducting the cleanup, that all sampling plans, sample collection procedures, sample preparation procedures, extraction procedures, and instrumental/chemical analysis procedures used to assess or characterize the PCB contamination at the cleanup site are on file at the location designated in the certificate, and are available for EPA inspection. Persons using alternate methods for chemical extraction and chemical analysis for site characterization must include in the certificate a statement that such a method will be used and that a comparison study which meets or exceeds the requirements of Subpart Q of this part, and for which records are on file, has been completed prior to verification sampling." (40 CFR 761.61(a)(3)(i)(E))**

2. Part 2 Checklist: EPA Recommended Additional Information to Include in Notification /Self-Implementing Cleanup Plan

Disclaimer: The RP must comply with all applicable requirements in 40 CFR Part 761. The checklist may not contain all the requirements that apply to PCB remediation waste under 40 CFR 761.61.

TOOL 4: TSCA Risk-Based PCB Cleanups Checklist – 61(c)

I. Introduction – General, Framework Meetings, Applicability, Disclaimers, and Clarifications

A. General

The Toxic Substances Control Act (TSCA) regulations for polychlorinated biphenyls (PCBs) in 40 CFR 761.61(c)(1) contain requirements for when a responsible party (RP) must submit a risk-based disposal approval application (Application) to EPA. Any person wishing to sample, cleanup, or dispose of PCB remediation waste in a manner other than prescribed in 40 CFR 761.61(a) or (b), must submit a risk-based disposal approval application in accordance with 40 CFR 761.61(c). Any person wishing to store PCB remediation waste in a manner other than prescribed in 40 CFR 761.65, must also submit a risk-based disposal approval application in accordance with 40 CFR 761.61(c).

The RP must apply in writing to the Regional Administrator in the EPA Region where the sampling, cleanup, disposal, or storage site is located, for sampling, cleanup, disposal, or storage occurring in a single EPA Region; or to the Director, Office of Resource Conservation and Recovery, for sampling, cleanup, disposal, or storage occurring in more than one EPA Region. EPA recommends the RP also send a copy of the Application to the EPA Regional PCB Coordinator to expedite its review and approval process. No person may conduct cleanup and/or related activities under 40 CFR 761.61(c) prior to obtaining written approval from EPA.[1]

The checklist in Section III below is intended to ensure that a responsible party (RP) prepares an Application that contains complete and technically sound information. The content of such an Application is described in the checklist in Section III.A and III.B and includes:

- The information required in 40 CFR 761.61(a)(3)(i) consistent with 40 CFR 761.61(c)(1), including a cleanup plan and a written certification (Section III.A), and
- EPA-recommended additional site-specific information to facilitate EPA's full understanding of environmental issues and human health and ecological risks at the site (Section III.B).

The RP should include sufficient information in the Application for EPA to make the no unreasonable risk determination required in 40 CFR 761.61(c)(2).

III. Checklist for Risk-Based Approval Application Content

A. Part 1 Checklist: Required Information in 40 CFR 761.61(a)(3) for Risk-Based Application in Accordance with 40 CFR 761.61(c)(1)

Pre-Cleanup Site Characterization

- The nature of the contamination, including kinds of materials contaminated. (40 CFR 761.61(a)(3)(i)(A))
- A summary of the procedures used to sample contaminated and adjacent areas and a table or cleanup site map showing PCB concentrations measured in all pre-cleanup characterization samples. The summary must include sample collection and analysis dates. The EPA Regional Administrator may require more detailed information including, but not limited to, additional characterization sampling or all sample identification numbers from all previous characterization activities at the cleanup site. (40 CFR 761.61(a)(3)(i)(B))
- The location and extent of the identified contaminated area, including topographic maps with sample collection sites cross referenced to the sample identification numbers in the data summary from paragraph (a)(3)(i)(B) of this section. (40 CFR 761.61(a)(3)(i)(C))

PCB Cleanup Plan

- A cleanup plan for the site, including schedule, disposal technology, and approach. This plan should contain options and contingencies to be used if unanticipated higher concentrations or wider distributions of PCB remediation waste are found or other obstacles force changes in the cleanup approach. (40 CFR 761.61(a)(3)(i)(D))

Written Certification

- A written certification signed by the owner of the property where the cleanup site is located and the party conducting the cleanup that all sampling plans, sample collection procedures, sample preparation procedures, extraction procedures, and instrumental/chemical analysis procedures used to assess or characterize the PCB contamination at the cleanup site are on file at the location designated in the certificate and are available for EPA inspection. Persons using alternate methods for chemical extraction and chemical analysis for site characterization must include in the certificate a statement that such a method will be used and that a comparison study which meets or exceeds the requirements of Subpart Q of this part, and for which records are on file, has been completed prior to verification sampling. (40 CFR 761.61(a)(3)(i)(E))

B. Part 2 Checklist: EPA Recommended Additional Information to Include in Application

Disclaimer: The RP must comply with all applicable requirements in 40 CFR Part 761. The checklist may not contain all the requirements that apply to PCB remediation waste under 40 CFR 761.61.

The Current Conditions Report mentioned in Section II (Before Submitting a PCB Risk-Based Approval Application) above should include the information described in Sections III.B.1 through III.B.5 below. The Current Conditions Report does not need to include any of the certifications described in Section III.B.1.

PCB Remediation Plan Pitfalls

- Source Identification
- PCB delineation incomplete
  - Sampling Intervals
  - Laboratory Data / Methods
- Waste management / disposal
- Other federal/state/local permits/certs
- Regulatory Jurisdiction and TSCA requirements
- Inconsistency
- Missing Information

LAB COMMUNICATION ISSUES

- Discuss Project Requirements

  - Methods
    - Allowable extraction methods – Soxhlet extraction (3540) preferred
    - Extraction by sonication not preferred
      - Inefficient
      - Not applicable to all matrices
      - Not allowed under many state QA programs

    - Alternative techniques require correlation study
      - Subpart Q

  - Reporting limits

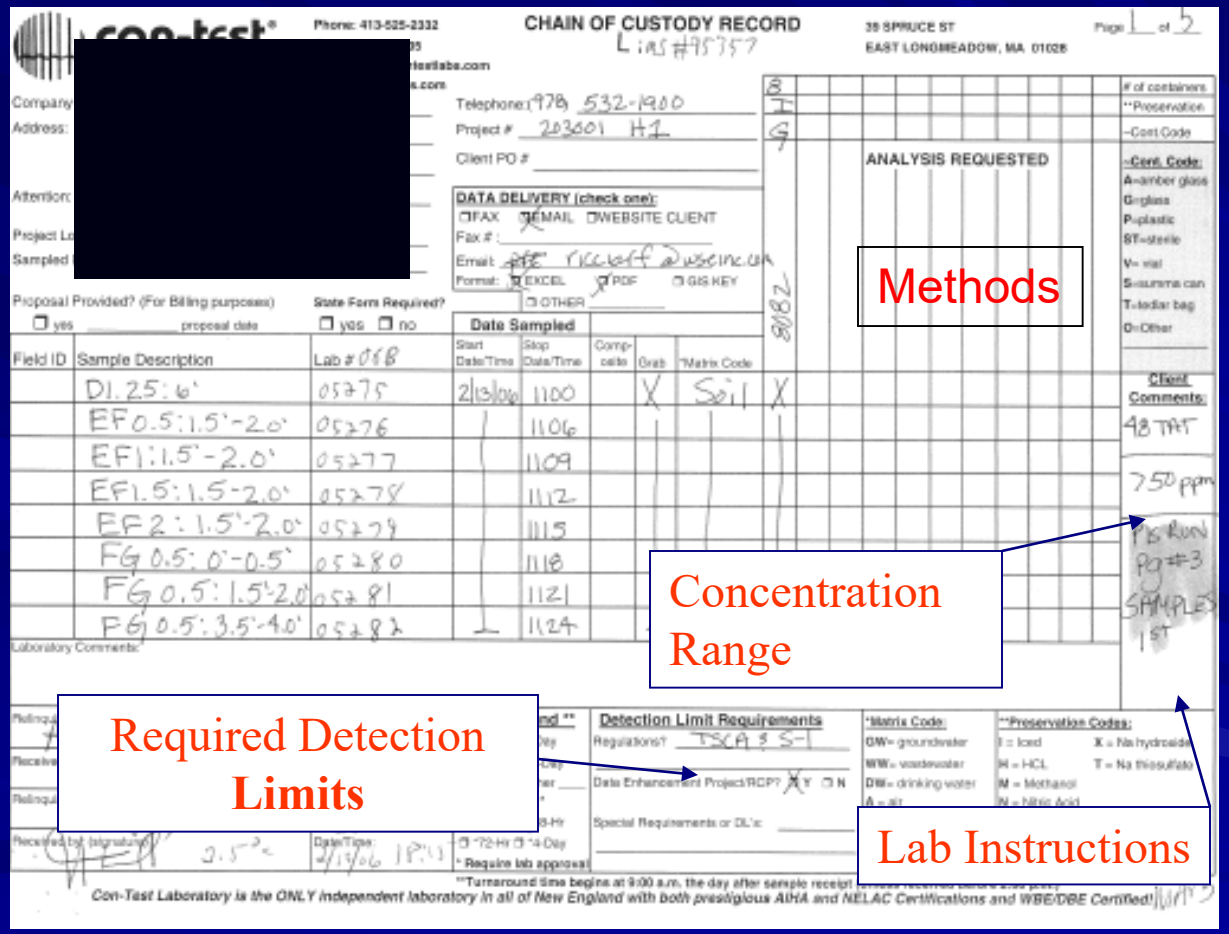
Incorrect / Incomplete COC Info.

1) Analytical and extraction requirements

2) Expected concentration range

3) Required reporting limits

4) Special Instructions



PCB Project Dos and Don'ts

- DO:
  - Use checklists for plans
  - Know your Site
  - Delineate nature/extent
  - Appropriate and Representative Sampling
  - Appropriate analytical data
  - Contractor Plans consistent with remediation
  - Consider waste management/storage
  - Count on the unexpected

PCB Project Dos and Don'ts

- DON'T:
  - Forget your Lab
  - Mishandle Waste
  - Re-contaminate cleaned areas
  - Improperly Decontaminate
  - Collect Samples while still conducting cleaning

  - Time delays
  - *$$$*

Contacts and PCB Info

Kimberly Tisa – USEPA Region 1 PCB Coordinator

617-918-1527 (direct)
tisa.kimberly@epa.gov

Katherine Woodward, Project Manager
617-918-1353
woodward.katherine@epa.gov

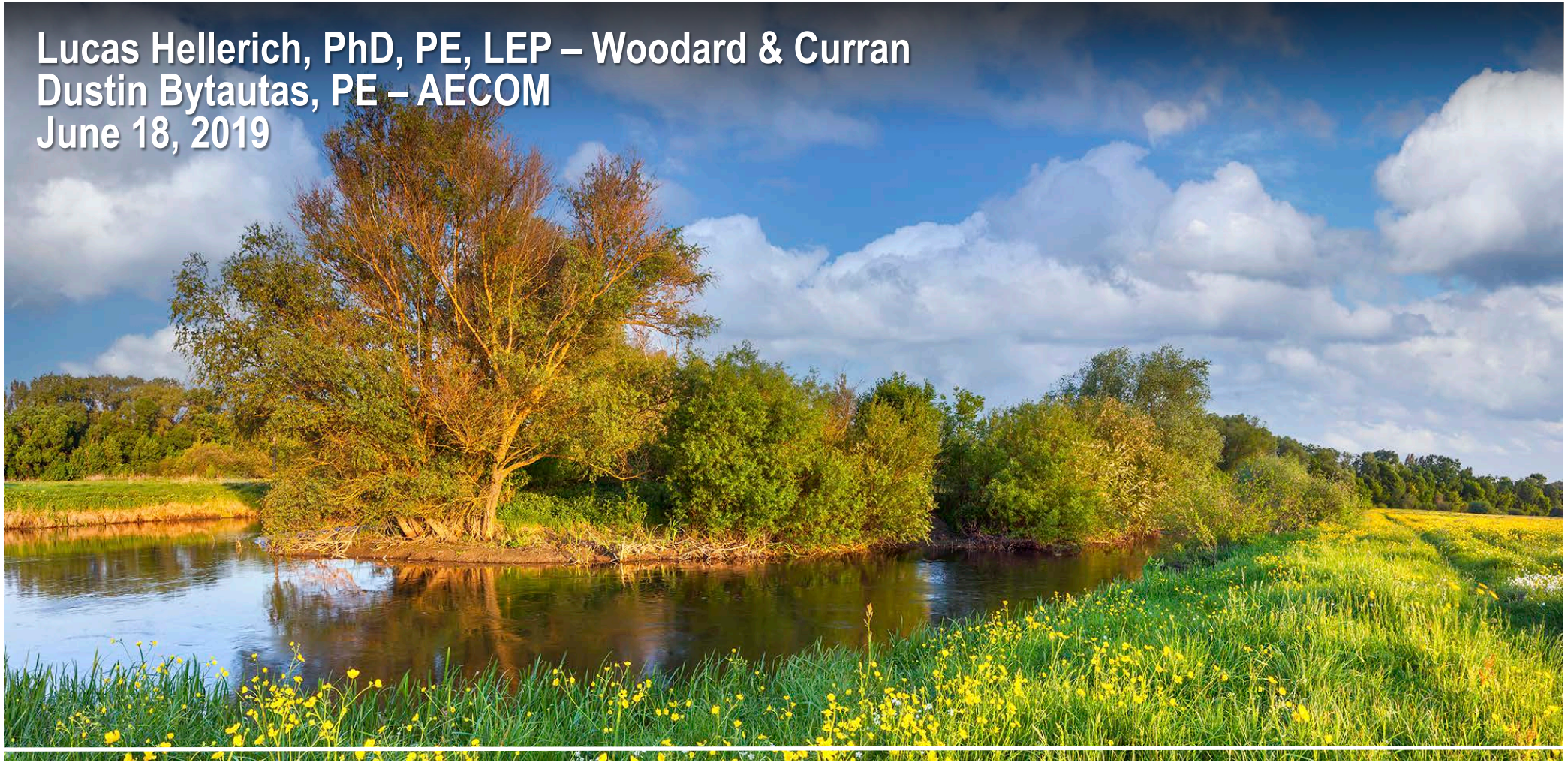
https://www.epa.gov/pcbs/pcb-facility-approval-streamlining-toolbox-fast-streamlining-cleanup-approval-process

https://www.epa.gov/pcbs

Questions and Discussion

CT DEEP Remediation Roundtable
Zone of Influence for In Situ Remediation

Lucas Hellerich, PhD, PE, LEP – Woodard & Curran
Dustin Bytautas, PE – AECOM
June 18, 2019



In situ remediation requires a robust understanding of technologies and monitoring program to confirm the zone of influence

- Regulatory permits for in situ remediation and ZOI
- Objectives and design of ZOI monitoring programs
- Operational and performance monitoring for in situ remediation
- Technical considerations during in situ remediation
- In situ remediation case study
- Summary

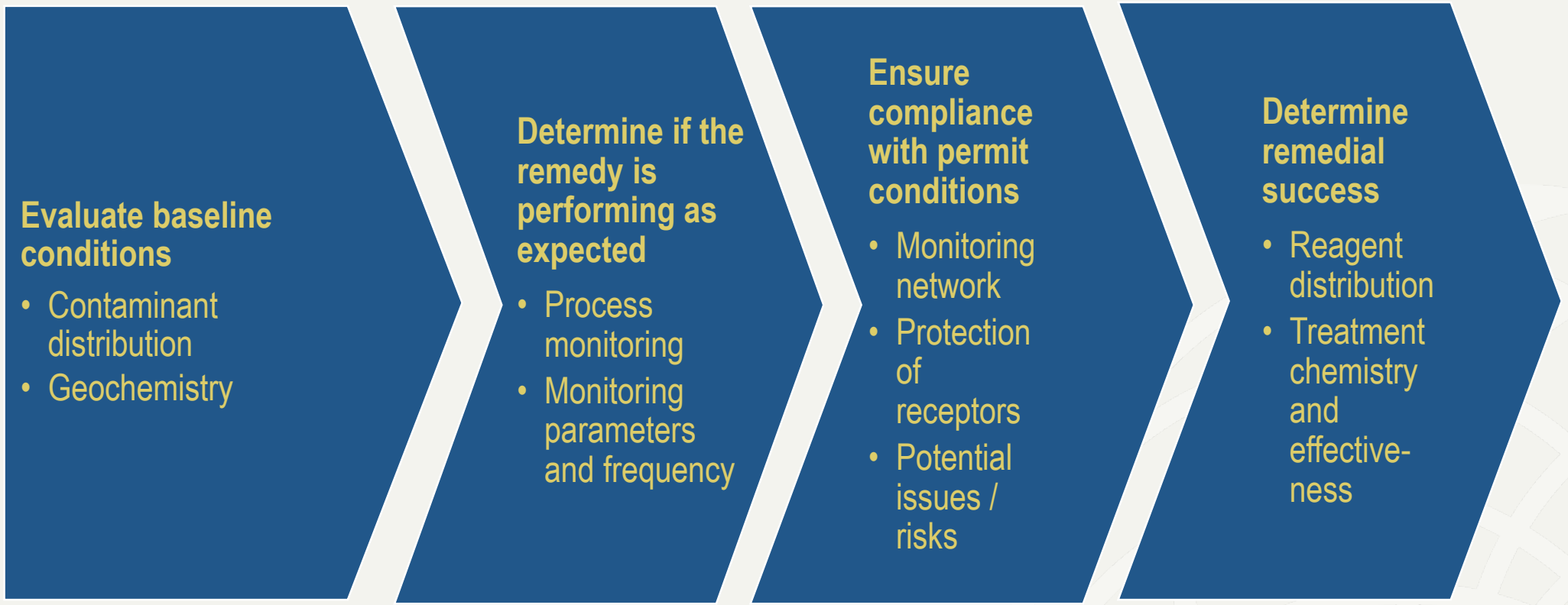
Zone of Influence is defined by changes in water quality and effects on the aquifer

"Zone of Influence" means the spatial area or volume of receiving water flow within which some degradation of water quality or use impairment is anticipated to occur as a result of a discharge (RSCA 22a-430-3(a)), and in this specific usage it is the volume of groundwater with a change in water quality resulting from the permitted discharge or its effects on the aquifer system. (CTDEEP, Instructions for Completing the Application for Emergency or Temporary Authorization to Discharge to Groundwater to Remediate Pollution, July 2012)

Permits related to performing in situ remediation in Connecticut provide considerations for ZOI

Permit / Authorization	Considerations	
Emergency or Temporary Authorization to Discharge to Groundwater to Remediate Pollution (July 2012)	• Proximity of nearby parcels • Natural Diversity Data Base review • Wetlands/watercourses • Water supply wells • Sensitive site receptors	• **Hydrogeology** • **Hydrochemical properties** • **Basis for expected ZOI (horizontal/vertical)** • Monitoring program details
Individual Permit for Wastewater Discharges from Manufacturing, Commercial, or Other Activities (Rev. December 2016)	• NDDB review • Aquifer Protection Areas • Coastal areas • **Wetlands/watercourses** • **Water supplies/wells**	• Groundwater and surface water classifications • **Operational and monitoring plan** • **Discharge flowrates, volumes, and frequencies**
General Permit for In Situ Groundwater Remediation: Enhanced Aerobic Biodegradation (August 2009; expires in 2020)	• *Similar considerations as listed in Temporary Authorization (TA)*	• **Generation of treatment byproducts**
General Permit for In Situ Remediation: Chemical Oxidation (June 2014)	• *Similar considerations as listed in TA* • Generation of treatment byproducts • Ancillary substances	• Size of ZOI • Complexity issues • Effects on infrastructure

Monitoring objectives are driven by multiple requirements during the remediation lifecycle



Objectives and Design of ZOI Monitoring Programs

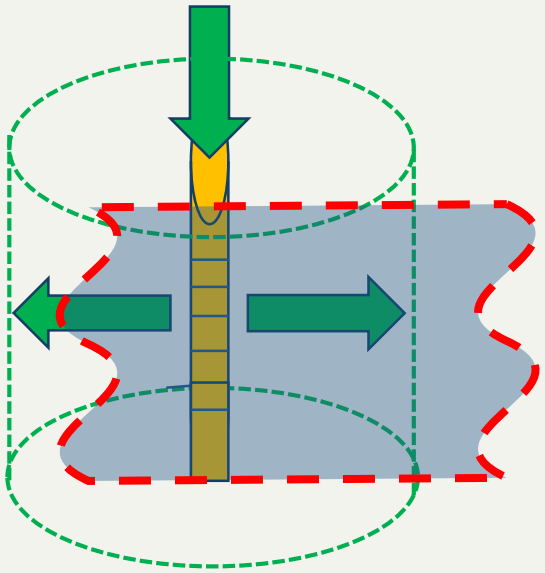
Zone of influence is driven by the remediation technology, injected/emplaced quantities, hydrogeology, geochemistry, and duration of the process

Remediation Technology

Remediation Technology Examples	Considerations for Zone of Influence
Aerobic bioremediation / air sparging	Hydrogeology Soil and groundwater geochemistry (e.g., redox, pH, terminal electron acceptors, soil oxidant demand) Preferential pathways Low permeability zones Longevity of remediation process (substrate, oxidant, reductant, elevated temperature) Under anaerobic conditions, potential for mobilization of metals (e.g., As, Fe, Mn) Under oxidizing conditions, potential for mobilization of metals (e.g., Cr(VI)) Geochemical and thermal "halos"
Anaerobic bioremediation	
In situ chemical reduction	
In situ chemical oxidation	
In situ thermal remediation	
Distribution - direct-push, injection wells, recirculation, permeability enhancement (e.g. hydraulic fracturing)	Configuration is selected based on the conceptual site model and treatment objectives: hydrogeology; source areas; heterogeneity of soils (high versus low permeability); need for multiple injection events; presence of preferential pathways

Zone of influence is driven by the remediation technology, injected/emplaced quantities, hydrogeology, geochemistry, and duration of the process

Injected / Emplaced Quantities



$$\theta_m = \frac{V_{inj}}{\pi \times r_{inj}{}^2 \times h}$$

Mobile porosity

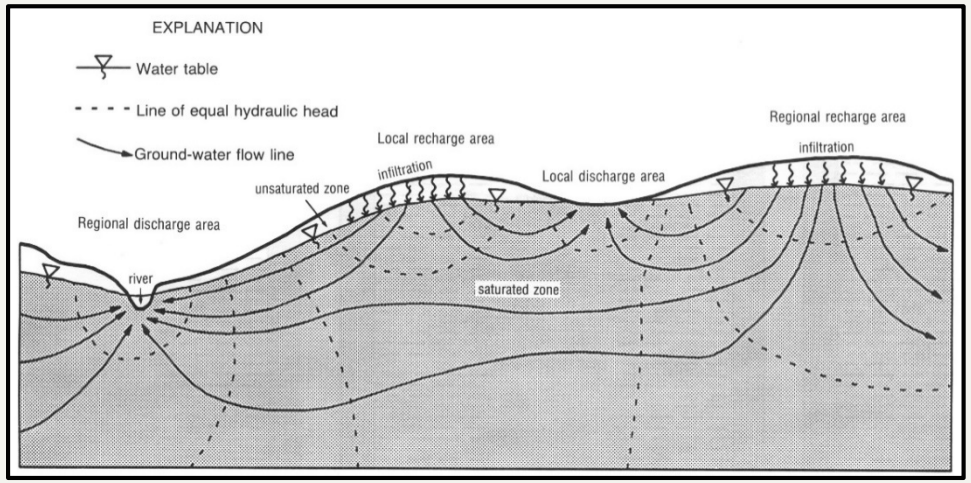
Distribution Factors	Considerations
Groundwater flux	Higher groundwater flux both enhances distribution of reagents and potentially decreases the lifespan of the reagent
Injected volumes	Greater volumes affect a greater portion of the mobile pore volume
Reagent quantities	Higher quantities yield longer reactions and/or induce greater geochemical effects
Reagent longevity	Longer-lived reagents sustain reactions and facilitate treatment of low permeability soils
Heterogeneity	Highly heterogeneous soils require closely spaced injection and monitoring intervals / locations
Combined effects	Actual distribution varies from predicted distribution

Objectives and Design of ZOI Monitoring Programs

Zone of influence is driven by the remediation technology, injected/emplaced quantities, hydrogeology, geochemistry, and duration of the process

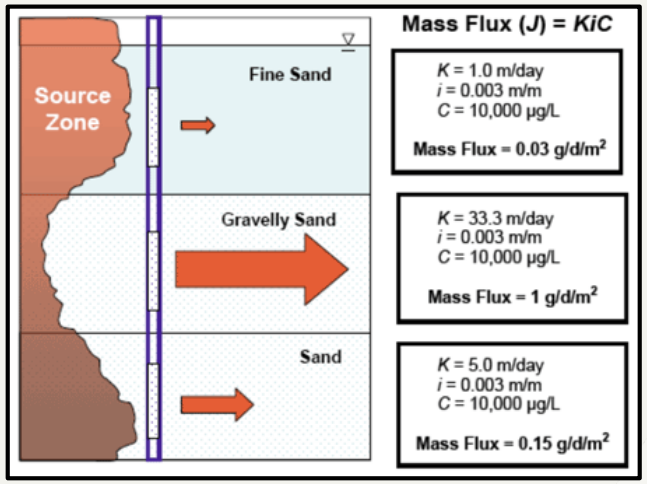
Hydrogeology

Variable horizontal and vertical hydraulic gradients and discharge pathways affect groundwater flows



Source: Figure 4 located at https://igws.indiana.edu/MarionCounty/Hydrogeologic

Heterogeneous soils can lead to preferential flow paths



Source: Figure 2 located at https://clu-in.org/characterization/technologies/default.focus/sec/Mass_Flux/cat/Overview/

Disturbed soils and subsurface utilities can lead to short-circuiting

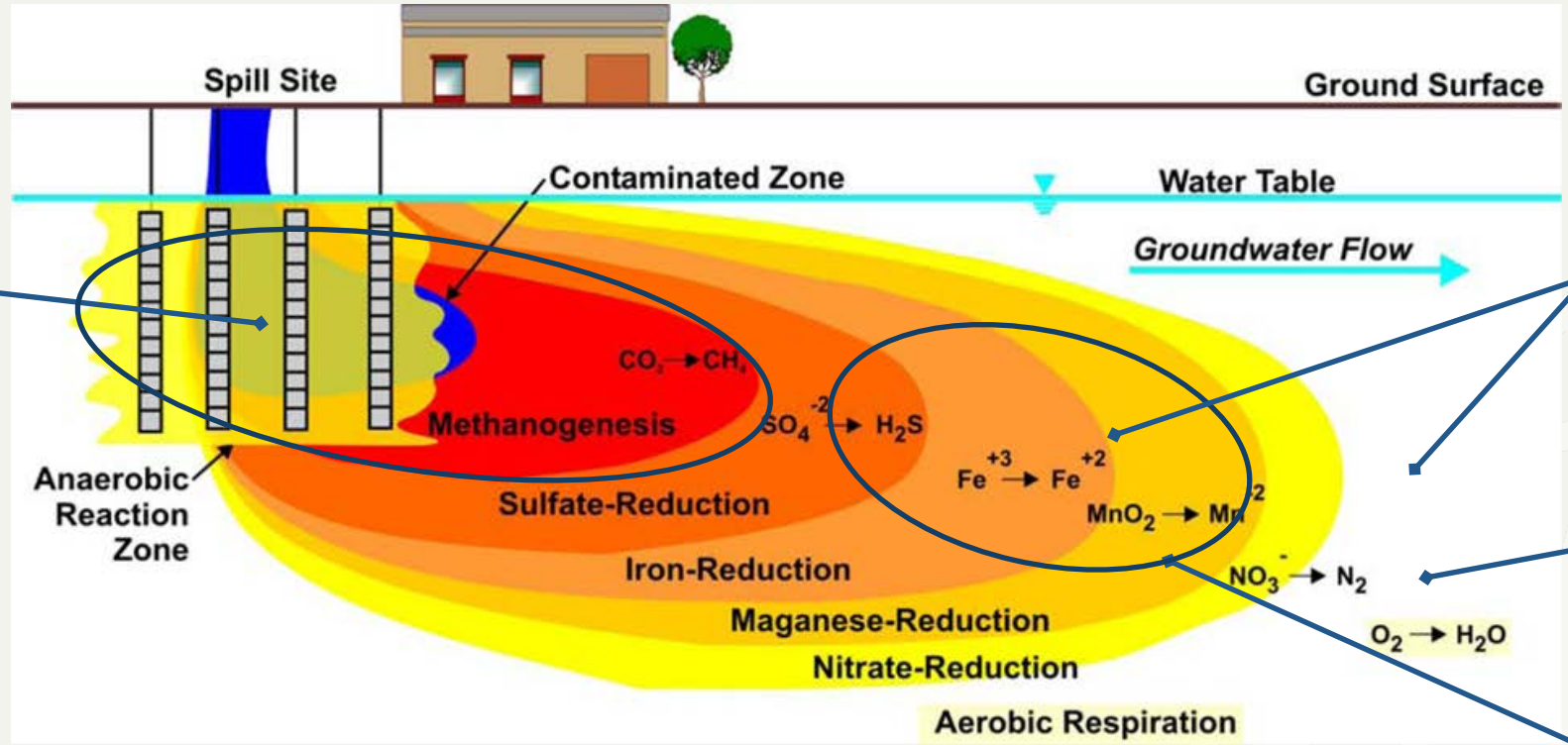
Source: Pac, *et al.* Remediation. 2019; 29:75-91.

Variable horizontal and vertical hydraulic gradients, discharge pathways, heterogeneity (low vs high permeability zones), seasonal variations, and preferential flow paths/ short-circuiting affect subsurface distribution and ZOI

Zone of influence is driven by the remediation technology, injected/emplaced quantities, hydrogeology, geochemistry, and duration of the process

Geochemistry

Anaerobic conditions



Include monitoring locations outside of the immediate treatment area

Aerobic conditions

Geochemical halo / anaerobic fringe

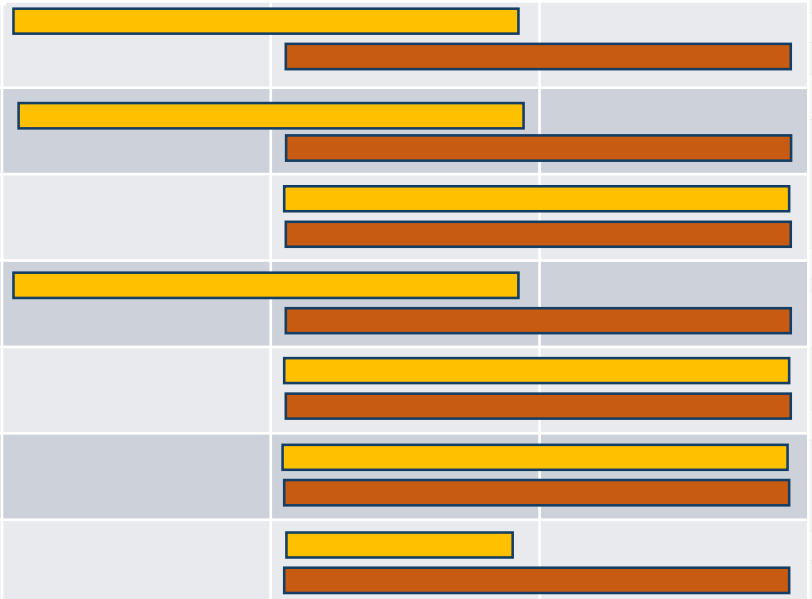
(Source: Figure 2 located at https://clu-in.org/techfocus/default.focus/sec/Bioremediation/cat/Anaerobic_Bioremediation_(Direct)/

Objectives and Design of ZOI Monitoring Programs

Zone of influence is driven by the remediation technology, injected/emplaced quantities, hydrogeology, geochemistry, and duration of the process/effects

Duration of the process

Technology Examples	Duration of Process ( ) and Resulting Effects ( )
	Weeks / Months / Years
Air sparging	
Short-lived chemical oxidants (e.g. ozone, Fenton's Reagent)	
Long-lived chemical oxidants (e.g. persulfate, permanganate)	
Short-lived biological substrates (e.g. lactate, molasses)	
Long-lived biological substrates (e.g. ORC, HRC, EVO, EHC™)	
ISCR (e.g. calcium polysulfide, zero-valent iron	
Thermal	



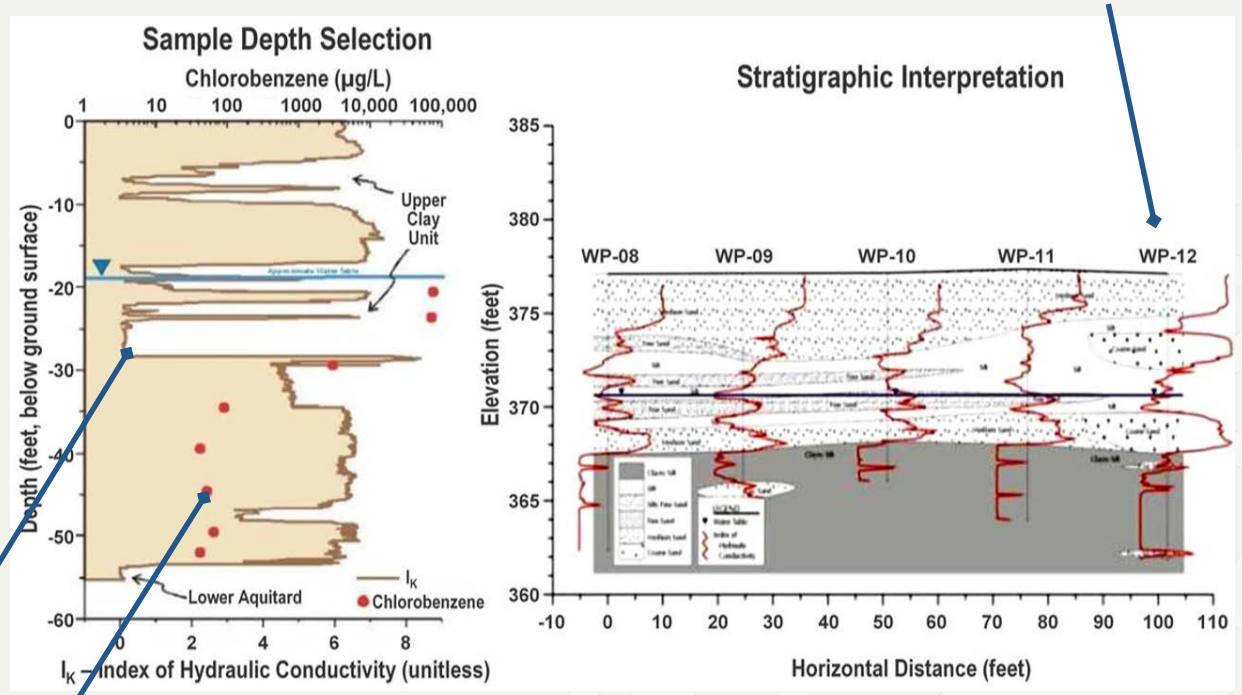
Longer reactivity will enhance areas of treatment, provide longer-term geochemical effects, and help to mitigate concentration rebound by treating contaminant mass contained in low permeability soils

Pre-design strategies are useful to enhance the understanding of the conceptual site model and anticipated behavior during implementation of the in situ remediation

- Pre-design strategies
  - Subsurface utility location
  - Soil characterization
  - High resolution site characterization
  - Hydrogeologic testing
  - Bench- and pilot-scale testing

High resolution site characterization example

Soil coring



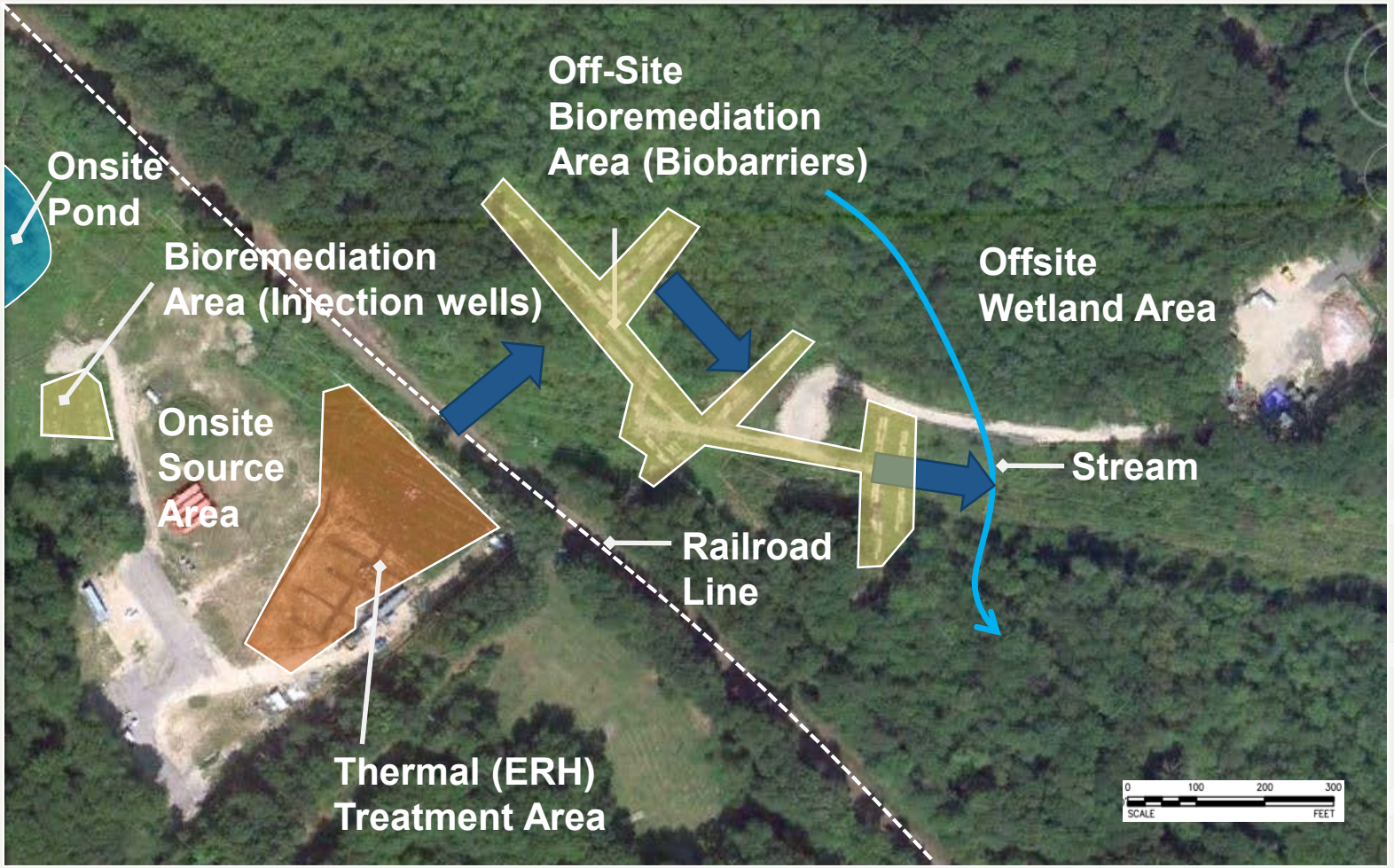
Hydraulic profiling tool

Vertical aquifer profiling

(Source: 2014 High Resolution Site Characterization located at https://www.navfac.navy.mil/navfac_worldwide/specialty_centers/exwc/products_and_services/ev/erb/rits/pastrits.html

In situ remediation case study

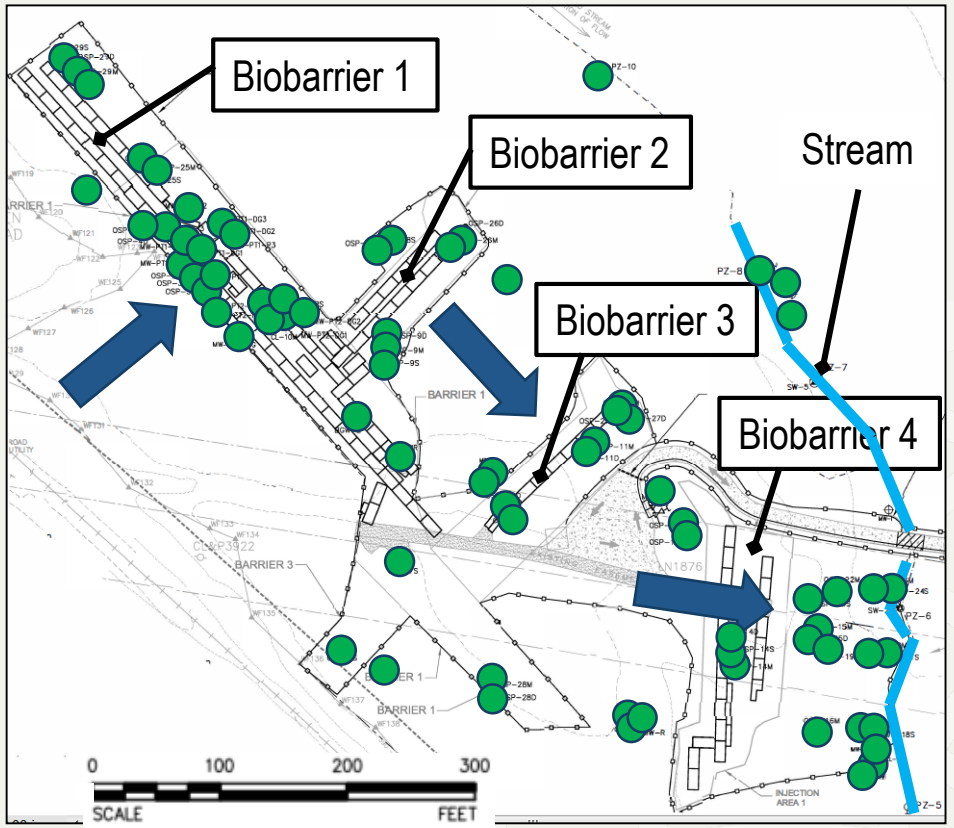
A combined thermal and bio remediation approach had multiple objectives and varying monitoring networks



In situ remediation case study

In situ remediation requires a robust monitoring program to confirm the zone of influence

- Biobarriers in wetland and near stream
- Objectives and design
  - Distribution of injected substrates
  - Multi-depth measurements
  - Geochemistry
  - Potential metals mobilization
- Monitoring network
  - Wells within treatment area: 16 shallow, 13 mid-depth, 11 deep/weathered bedrock
  - Downgradient wells: 10 shallow, 11 mid-depth, 8 deep/weathered bedrock
  - Stream shoreline and bottom



Summary

Determining the zone of influence is critical to meeting remediation objectives and achieving compliance with permitting requirements

- A complete understanding of the Conceptual Site Model is needed
- Remediation technologies will result in near-term and long-term hydrogeochemical changes
- An in situ remediation design should provide an expected assessment of the zone of influence based on the application and site conditions
- The zone of influence determination program needs to incorporate baseline, process, permit compliance, and performance monitoring considerations
- Planning for uncertainties and contingency actions is recommended
- A monitoring well network that encompasses a larger area helps to address uncertainties

Additional Resources

Numerous guidance documents are available for the design of ZOI monitoring programs

- ITRCweb.org/Guidance
  - Bioremediation
  - Direct-Push Wells
  - Enhanced Attenuation of Chlorinated Organics
  - Geospatial Analysis for Optimization
  - In Situ Chemical Oxidation
  - Mass Flux and Mass Discharge
  - Remediation Management of Complex Sites
  - Remediation Process Optimization
  - Site Characterization and Monitoring
- Clu-In.org
  - Technologies – Remediation (Activated Carbon-Based Technology for In Situ Remediation, Air Sparging, Bioremediation, Combining Remedies, Environmental Fracturing, In Situ Chemical Reduction, In Situ Flushing, In Situ Oxidation, Nanotechnology, Thermal Treatment: In Situ)
  - Strategies and Initiatives (High-Resolution Site Characterization (HRSC) Focus Area, Optimizing Site Cleanups)

Contact Information

LHellerich@woodardcurran.com

(203) 699-6081

Remediation Roundtable

E-mail: DEEP.remediationroundtable@ct.gov

Web: www.ct.gov/deep/remediationroundtable

Remediation Roundtable

Next meeting: October 22, 2019