

REMEDIATION ROUNDTABLE

October 25, 2016



Connecticut Department of Energy and Environmental Protection

www.ct.gov/deep/remediationroundtable

Roundtable Webinar

- Pilot test today with WebEx
- Basic directions provided on listserv email
- Detailed directions on website

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

CAMILLE FONTANELLA

Agenda



Updates:

- Reorganization of WPLR Bureau
- Roundtable Tips
 - Use of Reasonable Confidence Protocols
 - Verifications

Presentations:

- Wave 2 RSR and EUR Progress Update
- Brownfield Funding Sources and Process
- Emerging Contaminants: 1,4-Dioxane
- Emerging Contaminants Update, Part 2



Announcements

- Concurrence Memorandum for ITRC Guidance on ISCO
- EPOC Verifications and Audit Course for LEPs by DEEP staff (February 2017)
- NEWMOA Petroleum Vapor Intrusion – investigation and management (Nov 9 & 10, 2016)
- DECD accepting pre-applications to the dry cleaning fund (Oct 17, 2016 - Jan 31, 2017)
[Intake Form](#) / [Dry Cleaning Fund](#) / drycleaning@ct.gov



Schedule for 2017

March 14, 2017

June 20, 2017

October 17, 2017



Website Updates

Updated:

- [Municipal Brownfield Liability Relief Program Factsheet](#)
- [State](#) and [Federal](#) Superfund site summaries
- [Brownfields Grant info](#)
- [PREPARED Brownfields Municipal Workbook](#)

NEW:

- Emerging Contaminants (September 2016)
[Emerging Contaminants](#)
- ELUR map (October 2016)
[Environmental Land Use Restrictions](#)
DEEP.ELUR@ct.gov



Questions / Comments

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

Water Protection and Land Reuse (“WPLR”) Bureau Reorganization

October 25, 2016
Betsey Wingfield
Bureau Chief
Remediation Roundtable



Connecticut Department of Energy and Environmental Protection

WPLR Bureau Mission

Working together for the restoration, protection and conservation of Connecticut's water and land resources for current and future generations



Connecticut Department of Energy and Environmental Protection

BETSEY WINGFIELD

WPLR Former Divisions

- Office of Long Island Sound Programs
 - Managing and protecting coastal resources
- Remediation Division
 - Reducing risk from historical contamination
- Inland Water Resources
 - Managing and protecting inland waters
- Water Planning and Standards
 - Assessing and planning for integrated water quality and quantity management





Connecticut Department of Energy and Environmental Protection

BETSEY WINGFIELD

Challenges

- Budget is shrinking
- Staffing is being reduced through attrition
- Change will continue
- Our mission and responsibilities remain relevant and important
- We need to respond as an organization – now and in the future



2016 Reorganization Goals

- Reorganize WPLR Bureau into 3 divisions
- Resultant organization needs to:
 - Be adaptable to respond to changing conditions
 - Necessitate cross training
 - Build synergies where possible
 - Eliminate stovepipe model
 - Empower staff across program boundaries
 - Allow us to respond to gaps caused by attrition when necessary



What that Means to Organization

- Fundamental change in organizational identity at the division level
- Asking many staff to diversify
- Asking managers to increase span of control
- Changes will impact all – directly or indirectly
- Future change is inevitable



Reorganization Steps

- Kick-off in late June
- Meetings with each Division
- Series of meetings with supervisors and managers, individual programs and individuals
- Email exchanges
- Structure set early September
- Staff assignments late September
- Effective October 3, 2016



Effective 10/3/16



Connecticut Department of Energy and Environmental Protection

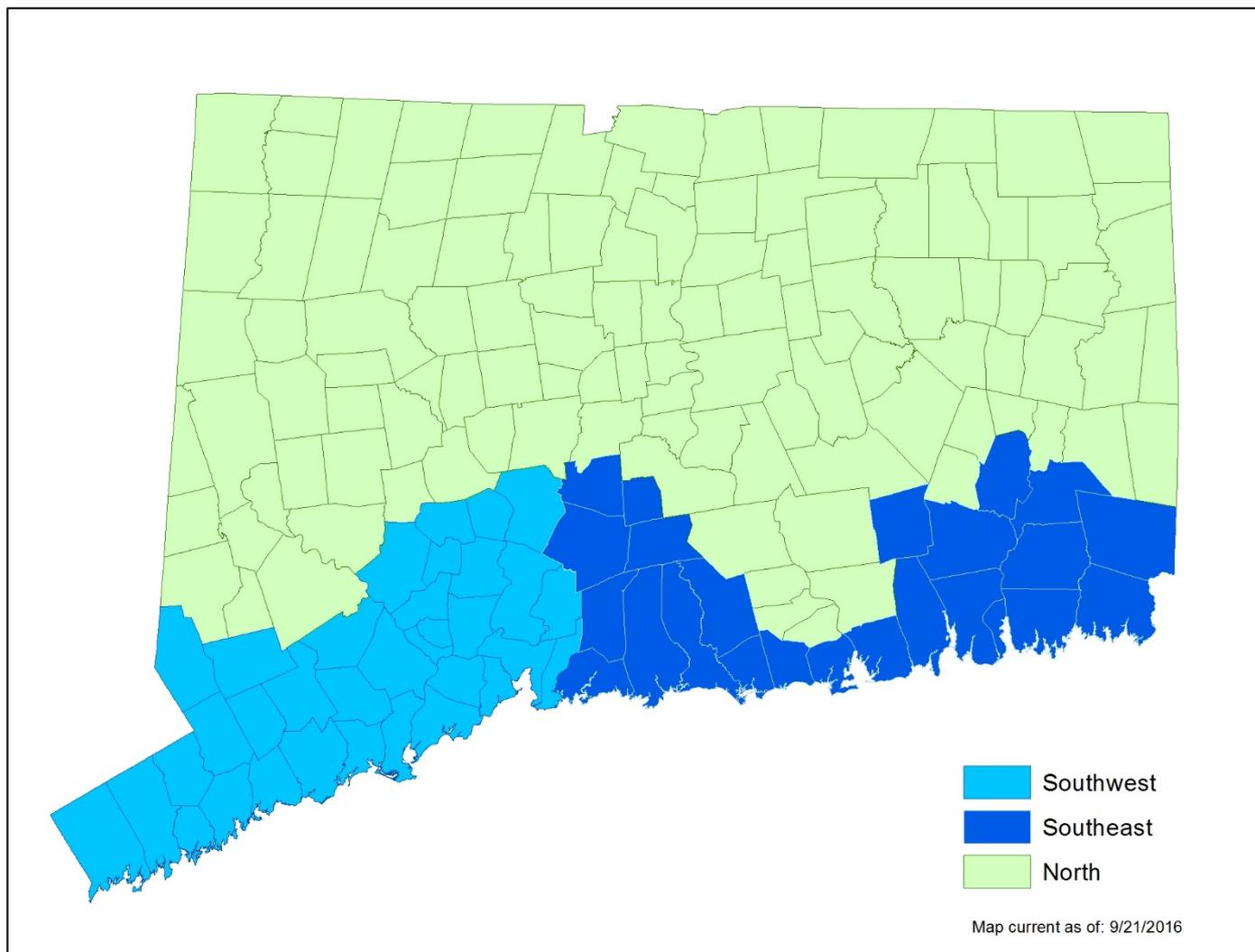
BETSEY WINGFIELD

Significant Changes LWRM

- New paradigm on how we approach individual site decisions/recommendations
- Opportunity for program cross training
- Consolidation of municipal planning assistance and outreach
- Consolidation of most of Long Island Sound Study participation



LWRM Geographic Regulatory Groups



Connecticut Department of Energy and Environmental Protection

BETSEY WINGFIELD

Significant Changes WPMD

- Establishment of Water Quantity Planning and Implementation Group
- Consolidation of programs responsible for infrastructure
 - Municipal Wastewater
 - State Dams
 - Dam Safety Regulatory
 - Facility Management and Operations
- Opportunity for infrastructure cross training
- Fill gaps resulting from attrition

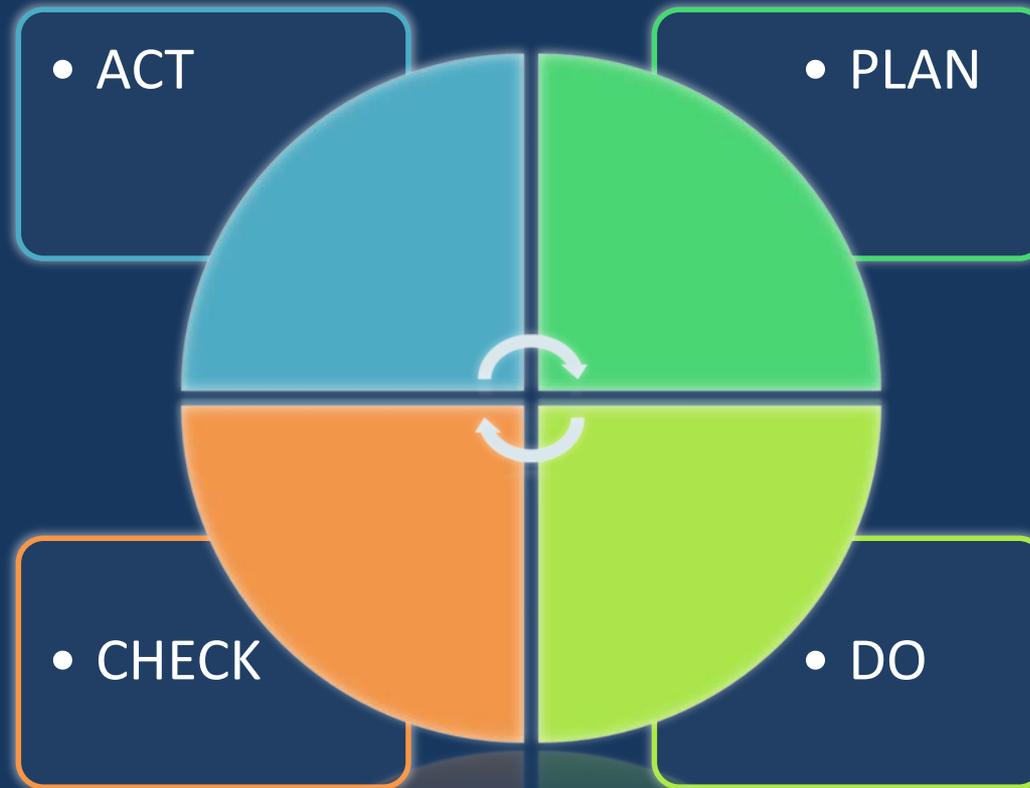


Significant Changes Remediation

- Realignment of reporting to function with one Assistant Director and transfer of Facility Management and Operations group



Continual Assessment



Questions / Comments

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

Roundtable Tips



Connecticut Department of Energy and Environmental Protection

Roundtable Tip #1

Use of Reasonable Confidence Protocols

Peter Hill
Remediation Division
Supervising Environmental Analyst



RCP Laboratory Certification Form

- The RCP Certification Form may not be altered
- Recently DEEP discovered that several laboratories modified the form following request from clients
- The laboratories have returned to using the original form



What Does This Mean?

- Reasonable Confidence is based on questions 1, 1A and 1B
- Modification of the responses to other questions on the form to include a “not applicable” option should not prevent the achievement of Reasonable Confidence
- A “not applicable” response without a narrative may not provide enough information for a data quality assessment and data usability evaluation



Next Steps

- Contact the laboratory or DEEP for assistance for questions regarding data assessment and usability when form has been altered.
- The Department is not requiring that laboratories issue new forms for data sets which were reported using a modified form
- DEEP will be contacting laboratories reminding them that the form may not be altered
- DEEP is seeking feedback on the form and may update the form



Questions / Comments

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

Roundtable Tip #2

Dates on Verification Forms

Rob Robinson
Remediation Division
Supervising Environmental Analyst



Verification Form: Inaccurate Date Statistics

Former Verification Forms:

2015 – 1st half 2016 → 45% incomplete or inaccurate

Current Form III Verification Forms (posted August 2016):

3 of the 1st 4 Verification Forms had inaccurate DATE issues

Currently, 60% of the Verification Forms have DATE issues

- Results in extended resources for DEEP
- Results in extended liability exposure to CP because Verification incomplete
- Results in Red Flag for selection of Audit

Indicator of potential inattention to detail in Verification Report



Connecticut Department of Energy and Environmental Protection

ROB ROBINSON

Form III Verification Form – Incorrect DATES

Part II: Verification Information

This verification Form III filed with the Department on **2/14/12** and assigned **Rem#** 99999.
 If this Form III filing used to also close any previous Form III filing(s), list the applicable Rem #s:
 DEEP **Note** → this verification will be rejected if erroneous entries are presented

The Date Filed is stated on DEEP's Acknowledgment Letter that the Form III filing was complete

may be applied to all releases existing at the parcel at the date the Form III the time of a Phase II Investigation (as defined in the Site Characterization verification may also be applied to the environmental conditions of the property and sealed.

2 or 4 digit year is OK

Enter **all** of the following dates, then mark the one date to which this verification applies (check only one / Rem#).

	Date of Form III Filing:	Date of complete Phase II:	Date of this verification:
	2/10/2012	5/2013	10/27/16
This verification applies to this date: (check only one)	<input type="checkbox"/>	MM/DD/YR is required	<input type="checkbox"/>

"I verify in accordance with Section 22a-134(19) of the Connecticut General Statutes and Section 22a-133v-1(z) of the Regulations of Connecticut State Agencies (RCSA), that an investigation has been performed at the parcel in accordance with prevailing standards and guidelines, and that..."



Form III Verification Form – Incorrect application

Part II: Verification Information

This verification pertains to the Form III filed with the Department on 2/14/12 and assigned **Rem#** 99999.

If this Final Verification is being used to also close any previous Form III filing(s), list the applicable Rem #s:

■ ■ ■ ■

Note -this verification will be rejected if erroneous entries are presented

In accordance with §22a-134a(n), this verification may be applied to all releases existing at the parcel at the date the Form III was filed, or to all releases existing at the parcel at the time of a Phase II Investigation (as defined in the Site Characterization Guidance Document), whichever is later. This verification may also be applied to the environmental conditions of the property establishment as of the date this verification is signed and sealed.

Enter **all** of the following dates, then mark the one date to which this verification applies (Primary Rem#).

	Date of Form III Filing:	Date of complete Phase II:	Date of this verification:
	2/14/2012	5/30/2013	10/27/16
This verification applies to this date (check only one)			

DO NOT CHECK ALL THREE

"I verify in accordance with Section 22a-134(19) of the Connecticut General Statutes and Section 22a-133v-1(z) of the Regulations of Connecticut State Agencies (RCSA), that an investigation has been performed at the parcel in accordance with prevailing standards and guidelines, and that...



Form III Verification Form – Incorrect application

Part II: Verification Information

This verification pertains to the Form III filed with the Department on 2/14/12 and assigned **Rem#** 99999.

If this Final Verification is being used to also close any previous Form III filing(s), list the applicable Rem #s:

■ ■ ■ ■

Note → this verification will be rejected if erroneous entries are presented

In accordance with §22a-134a(n), this verification may be applied to all releases existing at the parcel at the date the Form III was filed, or to all releases existing at the parcel at the time of a Phase II Investigation (as defined in the Site Characterization Guidance Document). **Whichever is later** verification may also be applied to the environmental conditions of the property establishment as of the date this verification is signed and sealed.

Enter **all** of the following dates, then mark the one date to which this verification applies (Primary Rem#).

	Date of Form III Filing:	Date of complete Phase II:	Date of this verification:
	2/14/2012	5/30/2013	10/27/16
This verification applies to this date: (check only one)	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

"I verify in accordance with Section 22a-134(19) of the Connecticut General Statutes and Section 22a-133v-1(z) of the Regulations of Connecticut State Agencies (RCSA), that an investigation has been performed at the parcel in accordance with prevailing standards and guidelines, and that...



Verification Forms - DATES

DEEP is at a loss for reasons why it is difficult to accurately complete the first page of the Verification Form

We have *Italicized*, underlined, used **colored** and **Bold** font, and shaded boxes

and we are still at a 60% inaccurate rate

Please provide feedback on your take on this issue and solutions

Robert.robinson@ct.gov

Claire.quinn@ct.gov



Connecticut Department of Energy and Environmental Protection

ROB ROBINSON

Questions / Comments

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

Roundtable Tip #3

Phase I Expectations

Rob Robinson
Remediation Division
Supervising Environmental Analyst



Connecticut Department of Energy and Environmental Protection

Phase I ESA Expectations

Any Phase I ESA presented to DEEP as basis for support for a remedial program milestone is expected to be completed in FULL accordance with Connecticut's SCGD

The reason for this 'heads up' ...

DEEP has received Form II's that use an [exclusive] ASTM Standard Phase I to demonstrate no releases occurred subsequent to a previously filed verification

These Form II's have been and will continue to be rejected

This holds true when using the ASTM Standard Phase I as a basis to support a Form I



Connecticut Department of Energy and Environmental Protection

ROB ROBINSON

Phase I ESA Expectations

WHY?

The ASTM Standard Practice for Phase I ESA's is not all inclusive of the expectations for completing a Phase I in accordance with the SCGD

This position presented in the SCGD-Developed in cooperation with EPOC *and* public noticed

The SCGD states, in part, that while the ASTM Standard Practice for Phase I ESA's and EPA's "All Appropriate Inquiries" rule under CERCLIS provide some useful protocols to complete a Phase I, **they may not be all inclusive of the requirements for performing a Phase I ESA in accordance with the SCGD**



Connecticut Department of Energy and Environmental Protection

ROB ROBINSON

Phase I ESA Expectations

The focus of an ASTM based Phase I is to identify Recognized Environmental Conditions (RECs)

- means the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property
- Includes sub-categories of Historical REC and Controlled REC's

However, REC's are not all-inclusive of AOC's (as defined in SCGD)

Many conditions that are considered AOC's in the SCGD are considered as de minimus conditions in the ASTM standard practice

Conditions determined to be de minimus are not recognized environmental conditions, so therefore would not be evaluated as

an AOC



Connecticut Department of Energy and Environmental Protection

ROB ROBINSON

Phase I ESA Expectations

De minimus conditions:

“Conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.”

- **Yet, most conditions identified as de minimus are exactly what we expect to be identified as an AOC**



Connecticut Department of Energy and Environmental Protection

ROB ROBINSON

Phase I ESA Expectations

Most Phase I reports do include a statement that the Phase I 'generally conforms' to the SCGD

- yet there is rarely adequate discussion on what that means

➤ DEEP expects FULL conformance with the SCGD



Questions / Comments

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

Roundtable Tip #4

8-year Milestone - PTP

Rob Robinson
Remediation Division
Supervising Environmental Analyst



Connecticut Department of Energy and Environmental Protection

Heads Up → Compliance Project: 8 year Milestone

- As of 2009, all property transfers that file a Form III are required to complete remediation and submit a Final or Interim verification within 8 years of the date the filing was acknowledged as complete
- That means the first batch of milestone verifications will be due in 2017
 - As part of our Compliance Project, we will be mailing the 8-year Verification reminder letters to Certifying Parties approximately one year before their verifications are due
 - On 10/1/16, we mailed the first batch



Remediation RoundTable Tips: Recap

1. The RCP Certification Form may not be altered
2. Insert proper dates on Verification Form, and indicate proper application of the verification
3. When the ultimate goal is to demonstrate compliance with the RSRs, Phase I is to be in FULL conformance with the SCGD
4. Verifications are due within 8 years of filing



Questions / Comments

www.ct.gov/deep/remediationroundtable



Regulation Amendment Wave 2 Update: RSRs & Environmental Use Restrictions

Robert Bell
Remediation Division
Assistant Director



Connecticut Department of Energy and Environmental Protection

Environmental Use Restriction Regulations

- 2 types of EURs
 - Environmental Land Use Restriction (ELUR)
 - Notice of Activity & Use Limitation (NAUL)
- Amendment to ELUR provisions
- New: NAULs
- Amendments and new provisions for surveys
- New: allowable disturbances
- New: self-monitoring and fees



EUR - NAUL

- NAUL may be used for some remedies:
 - “No residential” (statute)
 - Inaccessible soil,
 - environmentally isolated soil
 - engineered controls

} ≤ 10x criteria (statute)

 - Or any concentration of environmentally isolated soil if total volume is ≤ 10 cubic yards
 - Vapor mitigation system (RSR Wave 2)
 - NAPL left in place (RSR Wave 2)
 - Technical impracticability (RSR Wave 2)



EURs – NAUL

- Preparing, recording and post-recording
- Many of same preparation steps as ELUR: survey, title search, decision document, public notice
- Temporary Release self-implementing with LEP approval and oversight



EURs – Allowable Disturbances



- Allow for limited disturbance/excavation
- Separate from emergencies
- LEP oversight
- 90 days, 250 cubic yards, 500 sq.ft.
- Post-work report



Connecticut Department of Energy and Environmental Protection

ROB BELL

EURs – survey highlights

- See Roundtable presentation 9/8/2015
- Allow more limited survey information when the EUR subject areas are < 50% of the property
 - saving time and money



EURs: self-monitoring and fees

- Self-monitoring
 - Annually
 - Keep records, submit upon request
- Fee for ELUR
 - No fee for municipality
 - No fee for govt/quasi-govt entity receiving brownfield funding
- No fee for NAUL



RSRs - Wave 2 Amendments

- Wave 2 Conceptual Language (posted April 5, 2016)
- 4 Question and Answer Sessions
 - E2 Monthly Meeting
 - DEEP Headquarters, Hartford
 - Kellogg Environmental Center, Derby
 - Connecticut Environmental Forum Monthly Meeting
- Informal public feedback ended May 6th
 - comments posted online (June)
- Revised RSR Wave 2 Conceptual Language (posted August 6, 2016)



A few highlights since April . . .

1) Background definition

- Dropped the draft terms “anthropogenic origin” and “naturally occurring condition”
- Amendments will clarify circumstances where:
 - Ok to not be solely from naturally-occurring sources
 - Some data can be from within other release areas

2) Roadways (not in August Conceptual Language document)

- Adding definition of Public Roadway
- Roadway Registration in lieu of ELUR
- DEEP will maintain the on-line registry



A few highlights since April . . .

- 3) Volatilization Criteria/Fate and Transport - Discussion Document proposal (May 6th)
 - modify Volatilization Criteria by either
 - 1) Use 1996 TAC with updated 2003 fate and transport, or
 - 2) Use 2003 TAC with updated 2003 fate and transport (proposed in 2003)
 - excludes petroleum substances (BTEX/MTBE)
 - Incorporate Option 2 into Wave 2
 - Similar to Wave 2 fate/transport proposals for self-implementing alternative GWPC, PMC and SWPC



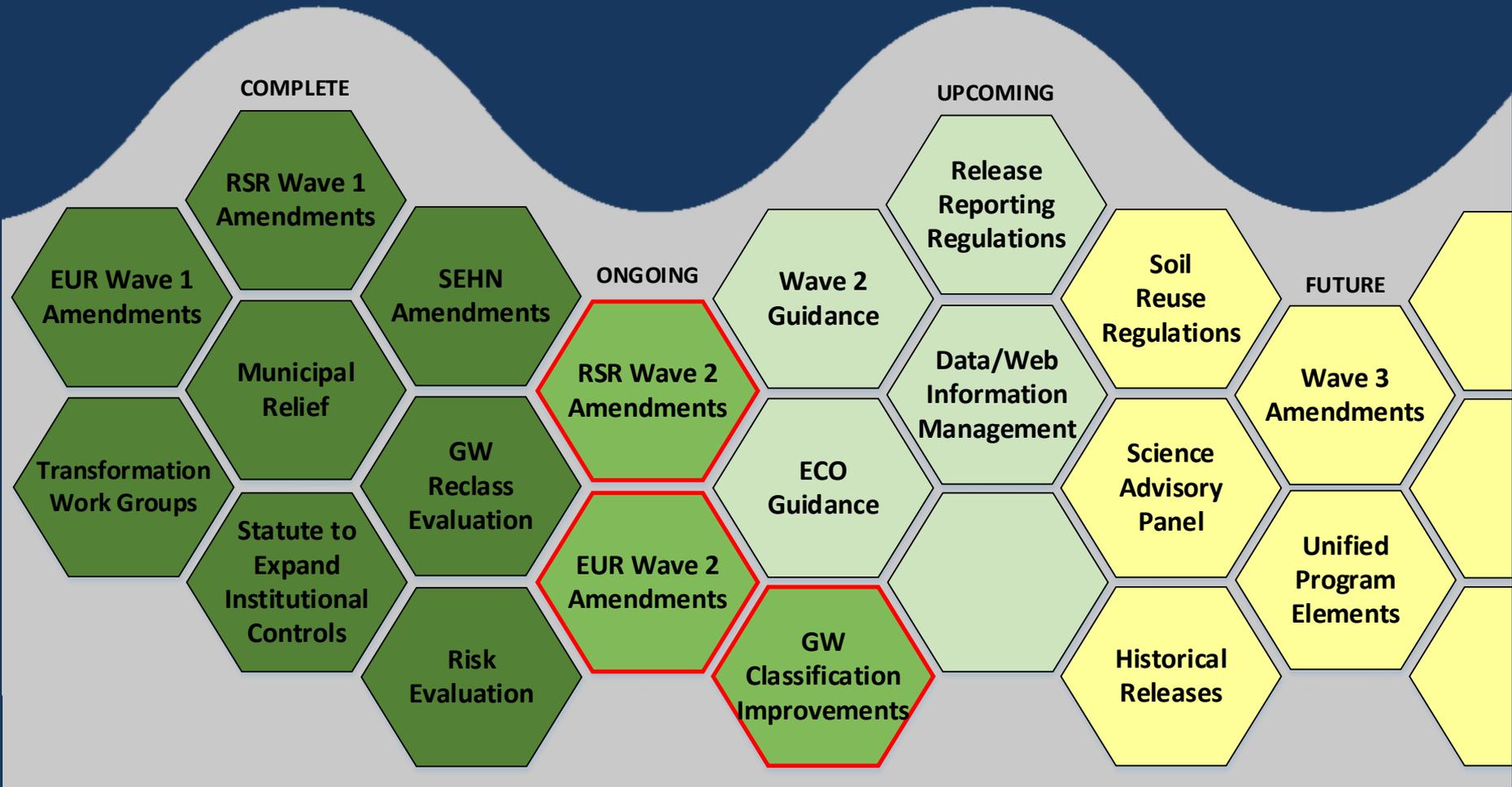
A few highlights since April . . .

- 4) Transition Period – option for 3 provisions:
– 2 years to remediate, 5 years to verify

Remedy/media	Existing RSRs	Wave 2 RSRs
Volatilization – depth from ground/bldg	15 feet	30 feet
Volatilization – criteria	Criteria for 30 substances	Criteria change for 19 substances (7 up, 12 down, 11 no change)
Inaccessible Soil	3” thick concrete	4” thick reinforced concrete



Transformation Process is Evolving...



eRegulations Website

DEEP notices of proposed regulations will be posted on the [Connecticut eRegulations website](#)

DEEP will no longer be posting these notices on the DEEP or PURA websites or providing notice of them through DEEP e-alerts

To receive email notification of proposed regulations, you must register on the eRegulations site



Questions / Comments

www.ct.gov/deep/remediationroundtable



Brownfields Funding

Mark Lewis, Brownfields Coordinator
DEEP- Office of Constituent Affairs & Land Management

Former US Baird
Machine Co., Stratford



Now
Two Roads Brewing Company



Connecticut Department of Energy and Environmental Protection

What's a Brownfield?

- Definition: Any abandoned or underutilized site where redevelopment, reuse or expansion has not occurred due to the presence or potential presence of pollution in the buildings, soil or groundwater that requires investigation or remediation before or in conjunction with the redevelopment, reuse or expansion of the property (CGS § 32-760)
- Not every contaminated site is a brownfield

Goodwin College, East Hartford



Connecticut Department of Energy and Environmental Protection

MARK LEWIS

State Brownfields Funding

Connecticut is a national leader in brownfield redevelopment

- Since FY2012, CT has invested \$173m in 100+ projects to remediate and redevelop contaminated sites
- Grants and loans
- For every \$1 invested by the State, \$5.45 has been or will be invested by non-State partners



Somersville Mill, Somers



Connecticut Department of Energy and Environmental Protection

Eligible Uses of DECD Funding

Costs associated with the investigation and re-development of a brownfield, including but not limited to:

- Soil, groundwater and infrastructure investigation
- Assessment
- Remediation
- Abatement
- Hazardous materials or waste disposal
- Long-term groundwater or natural attenuation
- Other institutional controls
- Attorneys fees
- Planning, engineering and environmental consulting
- Building and structural issues
- Environmental insurance

River Mill, Thompson



State Financial Assistance: Grants

DECD Municipal Brownfields Grants

- **Eligible Applicants:** Municipalities and economic development agencies
- **Funding Amounts:** Grants of up to \$4 million
 - Reimbursement-based
- **Application Process:** Competitive grants, periodic funding rounds
- **Next Round:** Applications due November 16 at 3 pm
- Info at www.ctbrownfields.gov

Montgomery Mill, Windsor Locks



Brownfield Areawide Revitalization Grant

- Comprehensive planning, moving from traditional site-by-site to area-wide approach
- Modeled after EPA Area-Wide Planning Grants
- First round awarded January 2016, next round will be announced March 2017
- Maximum \$200,000 (10% local match)
- Municipalities, Economic Development Agencies, and COGs eligible

Meriden Green- park on former brownfield



Connecticut Department of Energy and Environmental Protection

State Financial Assistance: Loans

OBRD administers a Targeted Brownfield Development Loan Program (TBDLP)

- Potential brownfield purchasers & current owners (including municipalities) eligible
- **Funding Amounts:** Up to \$4 million
- **Terms:** Low-interest, flexible/deferred interest; maximum 20-year term
- **Application Process:** Loans awarded on a rolling basis ~ 4x/ year
- DECD can consider applications for funding outside this schedule



EPA Brownfields Grants

- Assessment Grants
- Targeted Brownfields Assessments (TBA)
- Revolving Loan Fund Grants (RLF)
- Cleanup Grants
- Areawide Planning Grants (AWP)
- Job Training Grants



Chromium Process Company, Shelton



Site Specific EPA Assessment Grants

- Up to \$200k for specific site
- Up to \$350k with funding waiver
- Must meet threshold criteria
- May be good for large sites with lots of work
- Outreach session November 3, 2016- Goodwin College, East Hartford
- Applications due December 17, 2016

Info at <https://www.epa.gov/brownfields/apply-brownfields-grant-funding>



EPA Targeted Brownfields Assessment

- Grant of services instead of funding
- EPA contractor conducts site assessment
- Applications accepted year-round
- High priority sites with redevelopment plan

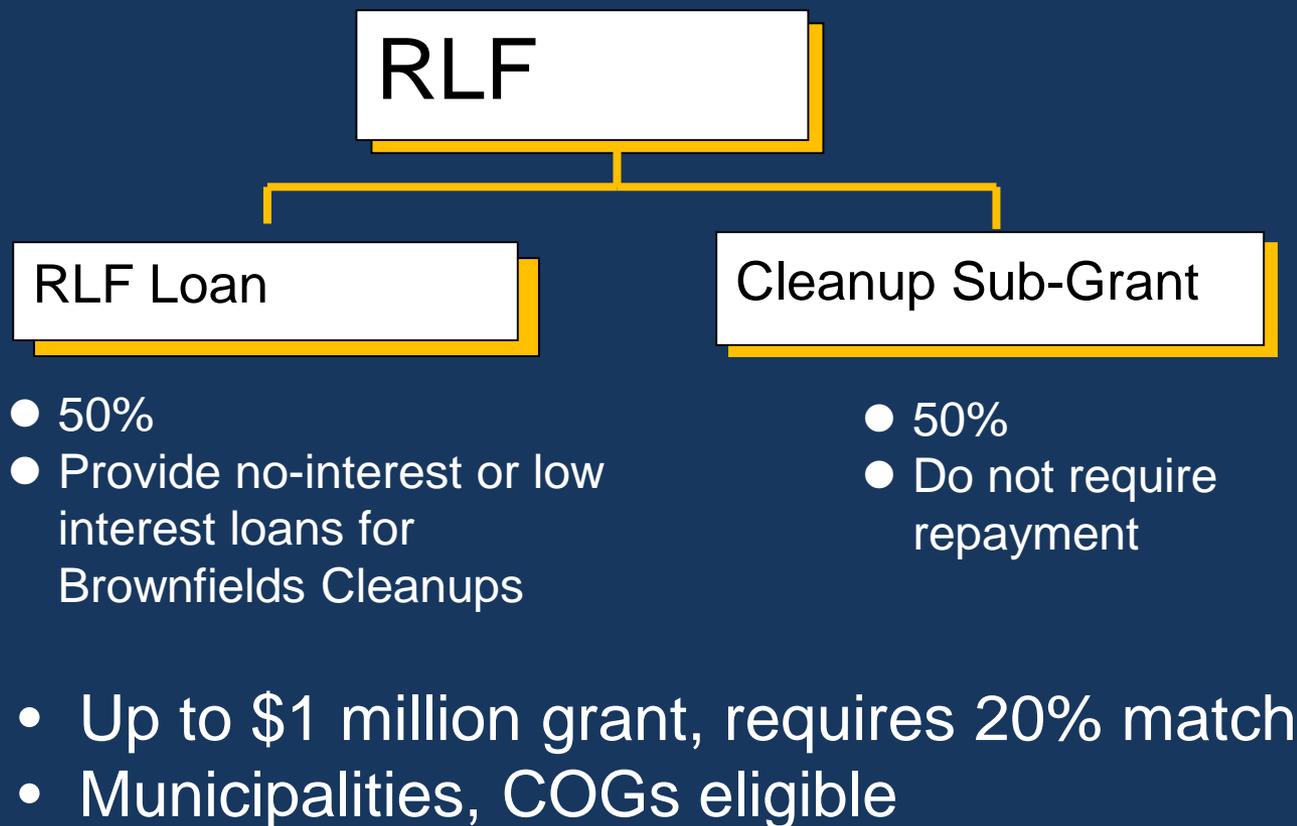
Habitat for Humanity, New London



Connecticut Department of Energy and Environmental Protection

MARK LEWIS

EPA Brownfields Revolving Loan Fund Grants



EPA Brownfields Cleanup Grants

- \$200k per site
- Applicant must own site at time of application
- Municipalities, non-profit organizations eligible
- Applicants can't be potentially liable under CERCLA
- 20% Cost Share
- Applicant may request hardship waiver of 20% cost share
- Applications due December 17, 2016

Info at <https://www.epa.gov/brownfields/apply-brownfields-grant-funding>



EPA Area-Wide Planning Grants

- Governmental & Nonprofits eligible
- Up to \$300k- split between hazardous and petroleum
- Inform cleanup & redevelopment of brownfields
- Focused on Brownfields- Impacted corridor or section of town
- Current conditions, infrastructure analysis, market study, community involvement
- Emphasis on implementation to assess, cleanup, and redevelop brownfields



Coordination with DEEP on EPA Grants

- DEEP approval needed for petroleum sites
- DEEP acknowledgement letter needed for applications
- Guidelines for requesting these letters on DEEP web site at http://www.ct.gov/deep/cwp/view.asp?a=2715&q=489004&deepNav_GID=1626#state
- Request your letters from DEEP early
- RSRs apply to cleanups using EPA grants and loans
- Must enroll in DEEP remediation program (voluntary, etc.)



Questions?

Mark Lewis

Brownfields Coordinator

Connecticut Department of Energy & Environmental Protection

(860) 424-3768

mark.lewis@ct.gov

www.ct.gov/deep/brownfields



Before



After

Knowlton Street Park Bridgeport



Connecticut Department of Energy and Environmental Protection

MARK LEWIS

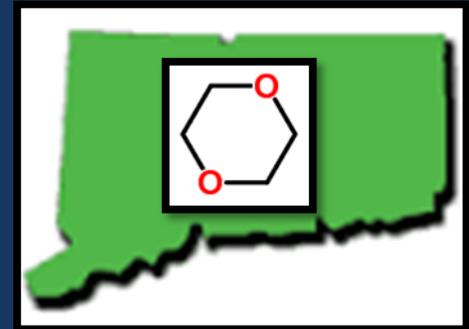
Emerging Contaminants: 1,4-Dioxane Update

Shannon Pociu
Remediation Division
Environmental Analyst 3



1,4-Dioxane Update

- Chemical Properties & Fate and Transport
- Uses and Where it can be found
- Analytical Methods
- Treatment Options
- UCMR3 Results
- Remedial Criteria and Site Investigation
- Other Considerations



What is 1,4-Dioxane?

- Used alone as a solvent from late 1920s
- Solvent stabilizer and acid corrosion inhibitor used with 1,1,1-trichloroethane, first patented use in 1954
- By-product of manufacturing
- Wide variety of applications



Chemical Properties of 1,4-Dioxane

- Colorless, flammable liquid, faint pleasant odor
- Cyclic ether ($C_4H_8O_2$)
- Specific gravity 1.033
- Vapor pressure 38.1 mm Hg (evaporates)
- Boiling Point $101^\circ C$
- Low K_{oc} 1.23, $\log K_{ow}$ -0.27 (mobile in soils)
- Completely soluble in water
- Very low Henry's Law Constant 4.88×10^{-6} atm-m³/mol (relatively non-volatile in water)



What Happens to 1,4-Dioxane when it's released to...

Air

- Readily evaporates, moderate vapor pressure of 38.0 mm Hg at 25°C
- As a vapor, breaks down readily to form aldehydes and ketones



Soil

- Will tend to migrate through soil rather than adsorb to particles (except for moist clay/silt)



What Happens to 1,4-Dioxane when it's released to...

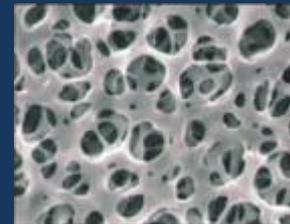
Water

- Completely soluble in water = travels ahead of other solvents in plume (similar to MTBE)
- Tends to stay dissolved, therefore low volatilization risk from groundwater
- Chemically stable, not expected to degrade once in groundwater or surface water



Uses of 1,4-Dioxane

- As the Main Ingredient
 - Cellulose Acetate Membrane Production
 - Scintillation Counting Cocktails/Bray's Solution
- Synthesis of other products
 - Pharmaceutical industry
 - Brominated flame retardants
 - Paper industry (coated paper)



Source: T. Mohr, Midwest GeoSciences Webinar, March 19 & 21, 2013.



Uses of 1,4-Dioxane (cont.)

- As a Minor Ingredient
 - Magnetic Tape Production
 - Tissue Preservative in Histology
 - Inks and printing operations
 - Painting, coating and stripping
 - Polyurethane medical devices
 - Brake cleaning sprays and fluids
 - Wood glue and contact cement
 - Loosening agent for hardware



Source: T. Mohr, Midwest GeoSciences
Webinar, March 19 & 21, 2013.



Connecticut Department of Energy and Environmental Protection

SHANNON POCIU

Uses of 1,4-Dioxane (cont.)

- Produced as By-Product
 - Photographic film recycling (dimethyl terephthalate, DMT)
 - Aircraft deicing fluid
 - Antifreeze production
 - Ethoxylated surfactant production
 - Resin production
 - PET plastic production
 - Pesticides and fumigants



Source: T. Mohr, Midwest GeoSciences Webinar, March 19 & 21, 2013.



Connecticut Department of Energy and Environmental Protection

SHANNON POCIU

Facilities and Operations

Where 1,4-Dioxane Could Be Found

Degreasing operations	Electroplating/polishing
Paints, varnishes, lacquers, strippers	Inks, dyes, coatings, and adhesives
Pharmaceutical mfg. plants & laboratories	Polymers, plastics, and rubber
Petrochemical processing	Explosives mfg.
Semiconductors, electronic components	Commercial printing and photographic equipment



Facilities and Operations

Where 1,4-Dioxane Could Be Found (cont.)

Military Installations/DoD sites

NPL sites

RCRA CA sites

University and other landfills

Airports with de-icing fluids

Agricultural & veterinary products

Cotton, textiles

Pulp, paper, fiber manufacture

Personal care products
(cosmetics, detergents,
shampoos)

Car washes

Many places!



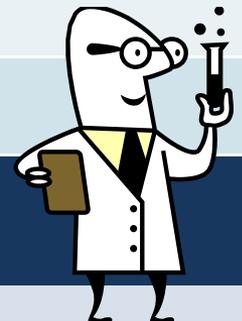
Why do we care?

- EPA - Probable Human Carcinogen
 - Kidney and liver effects
 - Updated IRIS tox. data 9/2013
- Widespread use
- Persistence - not expected to biodegrade under natural conditions
- Found in drinking water supply wells



Analytical Methods

Matrix	Method	Detection Limits
Soil/ Water	EPA Method 8260 Mod. – GC/MS-SIM	0.5 – 10 µg/L
	EPA Method 8270 Mod. – GC/MS-SIM	0.15 – 1 µg/L
	EPA Method 8261A – VD/GC/MS	1.1 µg/L
Drinking Water	EPA Method 522 – SPE, GC/MS-SIM	0.020 – 0.036 µg/L
	EPA Method 524.2 Mod.	1 – 20 µg/L
	CT DPH Method (similar to EPA 524.3)	0.5 µg/L
Air	EPA Method TO-15	



Treatment Options



Not Effective

- Air stripping (unless soil is dry)
- Ion exchange
- MNA

Limited Effectiveness

- GAC filters - Depends on influent water quality
- Reverse osmosis
- Biorem. – CB1190



EFFECTIVE

- Adv. Ox.
- Ozone
- Peroxide/UV
- In-situ Thermal
- Synthetic Resin
- ISCO



Public Water Systems in CT

- 1,4-Dioxane included in Unregulated Contaminant Monitoring Rule 3 (UCMR3) list
 - Required sampling of PWSs from 2013-2015 per 1996 Safe Drinking Water Act Amendments
- 38 PWSs required to monitor, EPA 522
 - 116 Sources tested, 309 samples, includes both surface water and groundwater
 - 16 sources > MRL of 0.07 $\mu\text{g}/\text{L}$
 - 5 sources > EPA ref. conc. of 0.35 $\mu\text{g}/\text{L}$
 - 1 source > 3 $\mu\text{g}/\text{L}$ (3.6 $\mu\text{g}/\text{L}$)



1,4-Dioxane Drinking Water Criteria

State	Drinking Water Standards
CT	3 $\mu\text{g/L}$ – DPH Drinking Water Action Level (private wells) 50 $\mu\text{g/L}$ – DPH Bathing/Showering Action Level
MA	0.3 $\mu\text{g/L}$
VT	3 $\mu\text{g/L}$
NH	3 $\mu\text{g/L}$
ME	4 $\mu\text{g/L}$
NJ	0.4 $\mu\text{g/L}$
CO	0.35 $\mu\text{g/L}$
CA	1 $\mu\text{g/L}$
EPA	NO MCL, 0.46 $\mu\text{g/L}$ Regional Screening Level, tap water



1,4-Dioxane APS Criteria

Fast Track Additional Polluting Substance Criteria
available for use upon request

Criterion Type	APS Criteria
Groundwater Protection	3 µg/L
Surface Water Protection	960 µg/L
Residential Direct Exposure	6.1 mg/kg
Industrial/Commercial Direct Exposure	57 mg/kg
GA Pollutant Mobility	0.1 mg/kg
GB Pollutant Mobility	0.6 mg/kg



1,4-Dioxane APS Criteria

Fast Track Additional Polluting Substance Criteria
available for use upon request

Criterion Type	APS Criteria	
Residential Soil Vapor Volatilization	0.050 ppmv	0.18 mg/m ³
Industrial/Commercial Soil Vapor Volatilization	0.61 ppmv	2.2 mg/m ³

****Note that there are no Groundwater Volatilization Criteria listed on the Fast Track APS Form because of low Henry's Law Constant.**



Investigation Recommendations

- Under what circumstances should 1,4-dioxane be included as a COC?
 - ✓ Direct knowledge of its use
 - ✓ Releases of TCA and/or TCE
 - ✓ Generated as a manufacturing by-product
 - ✓ Solid Waste or Industrial Landfills
- Included on Completion of Investigation Form
- May be present even if TCA has biodegraded



Other Considerations

- Why co-occurrence with TCE?
 - US Air Force Study (Anderson et al., 2012)
 - OR – release chronology
- Extent of plume
 - Can be at leading edge of chlorinated solvent plume
 - BUT – may not be leading edge based on release chronology
- Not treated by POTWs



Other Considerations

- Can penetrate mineral structure of clay LF liners (T. Mohr)
- Retained in unsaturated silts/clays at 10-100x concentration as in adjacent sands (T. Mohr)
- Don't use polyethylene Passive Diffusion Bag samplers
- Liquinox – present in trace amounts



Resources

- *Environmental Investigation and Remediation: 1,4-Dioxane and other Solvent Stabilizers*, Thomas Mohr, 2010
- MA DEP Fact Sheet “Guidance on Sampling and Analysis for 1,4-Dioxane at Disposal Sites Regulated under the MCP”, June 22, 2015
<http://www.mass.gov/eea/docs/dep/cleanup/laws/guidance-on-sampling-for-1-4-dioxane.pdf>
- CLU-IN
<https://clu-in.org/contaminantfocus/default.focus/sec/1,4-Dioxane/cat/Overview/>
- EPA Fact Sheet
https://www.epa.gov/sites/production/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf



Connecticut Department of Energy and Environmental Protection

SHANNON POCIU

Emerging Contaminants Webpage

http://www.ct.gov/deep/cwp/view.asp?a=2715&q=581988&deepNav_GID=1626

The screenshot shows the website header for the Connecticut Department of Energy & Environmental Protection. The main navigation bar includes links for Home, About Us, Programs & Services, Publications, Forms, and Contact Us. Below this is a secondary navigation bar with categories: ENERGY, ENVIRONMENTAL QUALITY, NATURAL RESOURCES, OUTDOOR RECREATION, and PURA. The left sidebar contains a menu with items like Remediation / Sites Clean-Up, FAQs, Information for General Public/Home Owners, Information for Business & Industry, Towns and Environmental Professionals, Guidance, Policies, Forms, Permits, Remediation / Sites Clean-Up Main Page, and Main Menu. There is also a button for 'Report on ENVIRONMENTAL Concern/Problem' and a 'Calendar of Events' link.

Emerging Contaminants

According to EPA, an emerging contaminant is a chemical or material characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards. A contaminant also may be "emerging" because of the discovery of a new source or a new pathway to humans.

The Remediation Standard Regulations do not contain numeric cleanup standards for emerging contaminants, but do require remediation using the procedures for [Additional Polluting Substances \(APS\)](#). Regulated parties and their environmental professionals should consider whether emerging contaminants are constituents of concern when evaluating Phase I information and test for those emerging contaminants where warranted. Doing so will help avoid uncertainty, audits, and further work in the future. If emerging contaminants are detected, please contact the Department in advance of submitting APS criteria approval to clarify any issues.

[General Information on Chemicals of Emerging Concern](#) [1,4-Dioxane](#)
[Per- and Polyfluorinated Alkyl Substances \(PFASs\)](#) [Perchlorate](#)
[Pharmaceuticals and Personal Care Products](#) [Nanomaterials](#)

Contaminant	Where are they found?	Analytic Method/Media/Notes
1,4-Dioxane	<ul style="list-style-type: none">Associated with chlorinated solvent contaminationStabilizer for TCA, possibly other	<ul style="list-style-type: none">EPA Method 522 – drinking waterModified EPA Method 8260 or 8270 with SIM



Connecticut Department of Energy and Environmental Protection

SHANNON POCIU

Questions/Comments

Shannon Pociu

Environmental Analyst 3

Remediation Division

Shannon.Pociu@ct.gov

860-424-3546



Connecticut Department of Energy and Environmental Protection

SHANNON POCIU

Tracking and Evaluating Emerging Contaminants

Gary Ginsberg

Connecticut Department of Public Health

Roundtable Presentation, June 21/Oct 25th, 2016



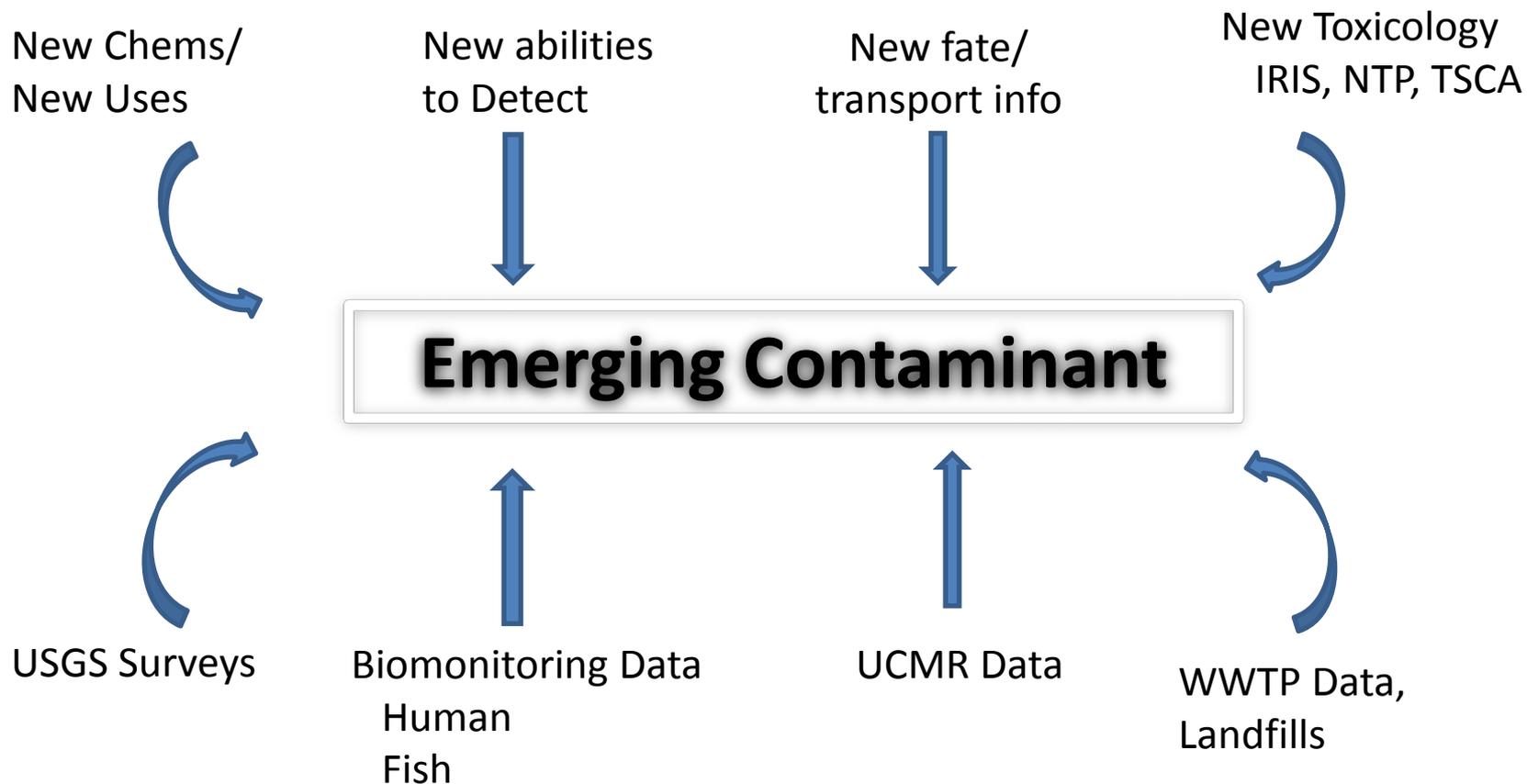
Emerging Contaminants Over Time

- Ethylene Dibromide (EDB) – 1970s
 - Surprise – it gets to GW
- Methyl t-Butyl Ether (MtBE) – 1990s
 - Surprise – it travels so far in GW
- 1,4-Dioxane – 2000s
 - Surprise – may remain at sites already cleaned up
 - hard to remove from GW
- Perchlorate – 2000s
 - Surprise – high levels near military bases, blasting

More Recent Emerging Contaminants

- Perfluorinated Alkyl Subs (PFOS, PFOA)- 2013
 - Surprise – GW contam from FFFs and coatings
- Hexavalent Chromium (CrVI) – 2008-2016
 - Surprise – carcinogenic by drinking
 - Surprise – much of total Cr in GW can be CrVI
- Sodium and Chloride - 2015
 - Surprise – ↑ing road salt → ↑ing Na/Cl in DW
- Pharma and Personal Care Prods – 2010
 - Surprise – WWTPs don't remove hormones, drugs

Reasons Chemicals Emerge



Technical Support Document:

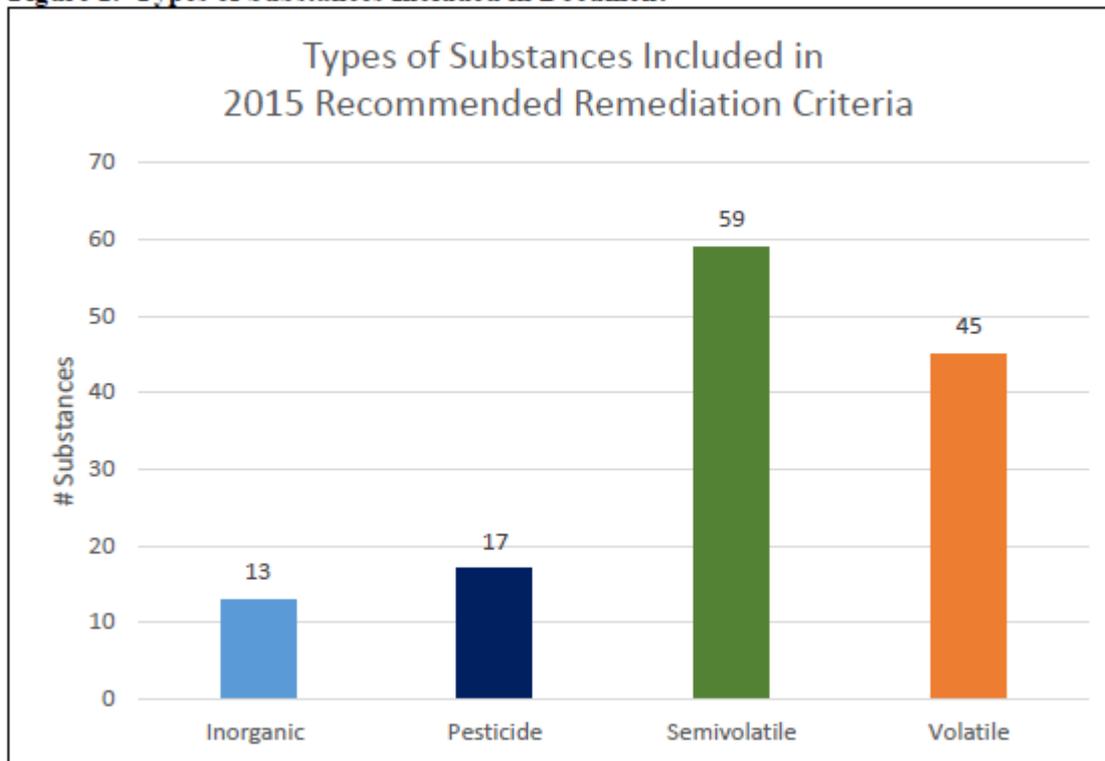
Recommended Numeric Criteria for Common Additional Polluting Substances and Certain Alternative Criteria

December 10, 2015
(Rev. 3/8/16)



N= 134 APS Determinations

Figure 2. Types of Substances Included in Document*



Reasons Chemicals “Emerge”

- New chemicals or uses
 - E.g. – PFAS, MtBE
- New ability to detect
 - E.g. – 1,4-dioxane, perchlorate
- New understanding of fate/transport/sources
 - E.g. – PCBs at schools, EDB in groundwater
 - Chlordane??
- New toxicology/epidemiology
 - E.g. – TCE acute intervention; CrVI
- Testing programs - UCMR

How Chemicals “Emerge”

LOCAL

- Waste site monitoring
 - 1,4-Dioxane associated with TCA spills
 - PFOS/PFOA – Minnesota, 3M – biomonitoring, fish
 - Parkersburg WV – 2004 biomon 70x > US pop
 - MtBE – obvious that it would be in gw from LUST
 - Not obvious that it would be so ubiquitous
 - Perchlorate – Colorado River spill; western waste sites – 1990s
- USGS monitoring
- UCMR monitoring → Federal or State MCL?
- EPA *modeling* of sources and at risk public wells

NATIONAL

Unregulated Contaminant Monitoring Rule

- US EPA-initiated survey of PWS for ECs in DW
- Candidate Contam List (CCL) → UCMR → MCL
- UCMR 3, 2013 to 2015
- List 1 (21 chems) tested for at all PWSs serving > 10,000 customers + 800 smaller supplies
 - CrVI,
 - 1,4-dioxane,
 - 6 PFAS chemicals
 - 1,2,3-trichloropropane
 - Chlorate
- List 2: 7 estrogens and testosterone

Many CCL Chemicals Become Monitored Under UCMR

32 of the 116 CCL3 Highlighted in AWWA 2014

- Nitrosamines
- *N-nitrosodimethylamine (NDMA)*
- *N-nitrosodiethylamine (NDEA)*
- *N-nitrosodi-n-propylamine (NDPA)*
- *N-nitrosopyrrolidine (NPYR)*
- *N-nitrosodiphenylamine (NDPhA)*
- Chlorate
- Molybdenum, Strontium, & Vanadium
- 1,1,2-Tetrachloroethane
- 1,2,3-Trichloropropane (TCP)
- 1,3-Dinitrobenzene
- 1,4-Dioxane
- Methyl *tert* butyl ether (MTBE)
- Nitrobenzene
- PFOS/PFOA
- RDX (cyclotrimethylenetrinitramine)
- Dimethoate
- Disulfoton
- Diuron
- Molinate
- Terbufos
- Terbufos sulfone
- Acetochlor
- Actochlor ethanesulfonic acid
- Acetochlor oxanilic acid
- Alachlor ethanesulfonic acid
- Alachlor oxanilic acid
- Metolachlor
- Metolachlor ethanesulfonic acid
- Metolachlor oxanilic ac

Sources

- New detections from historic ind/comm releases
 - Even residential uses (e.g., chlordane)
- Current industrial uses and releases
 - E.g. – PFAS as fume suppressant chrome plating baths
 - Need knowledge of industrial processes, wastestreams and how changed over time
 - Brainerd MN WWTP Case Study
 - High PFOS in WW samples – traced to an upstream chrome plater
 - Recycling – do we create new pathways for chem contamination

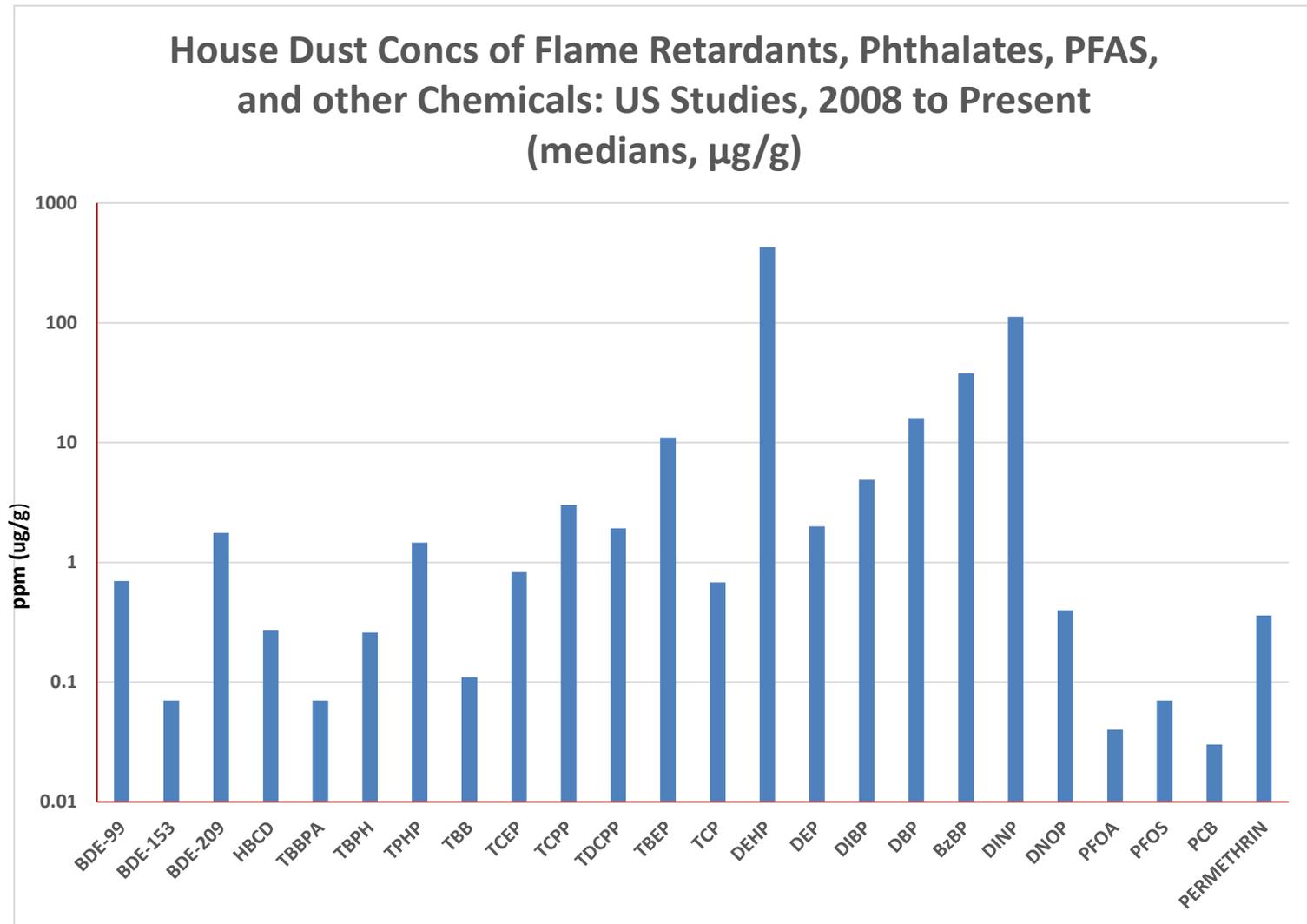
Sources (cont)

- **Landfills:** phthalates, PFAS
- **Agriculture/Extermination**
 - Legacy pesticides with increased testing in gw
 - Chlordane – many detects in Stamford wells
 - Chlordane/dieldrin/arsenic in soil
 - Modern pesticides – atrazine, glyphosate
 - Biosolid soil amendments – fertilizer
- **Sewage treatment plants**
 - PPCPs, PFOS, “Phenols”
- **“Process wastewater”** if not handled properly
 - E.g., released to septic system
- **Air releases** from combustion
 - E.g., if plans had proceeded to put Mn in gasoline
 - Outdoor wood boilers

Media of Concern for Emerging Contaminants

- **Ground Water / Drinking water**
 - If no MCL, no one is testing tap water
 - E.g., perchlorate, PFAS
 - EPA's UCMR important role
 - Importance of Phase I and II investigations
 - Limitations in typical lab scans
 - Peak chasing can help identify emerging contams
 - Importance of site history, inventoried chemicals
- **Surface Water**
 - Persistent chemicals → potential for fish accumulation
- **Soil:** most air deposition and disposal sources known
 - Biosolid fertilizer for agriculture and home gardens
- **Food:** diet typically the major source for persistent chems

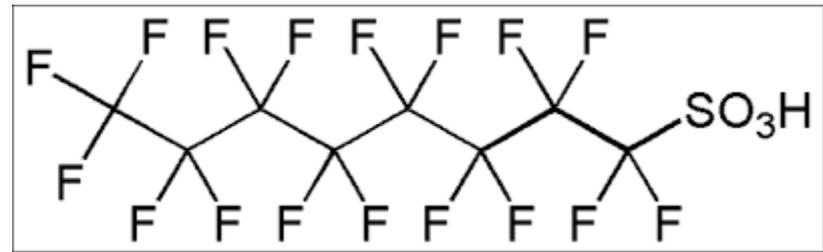
Chemicals “Emerge” into the Home from Products and Built Environment



Media of Concern for Emerging Contaminants

- House Dust
 - Exposure source for young children and pets
 - Indicative of novel chemicals in consumer market and built environment
 - Likely to also be in various environmental media
 - Industrial discharges
 - Sewage discharges
 - Landfills

PFAS:

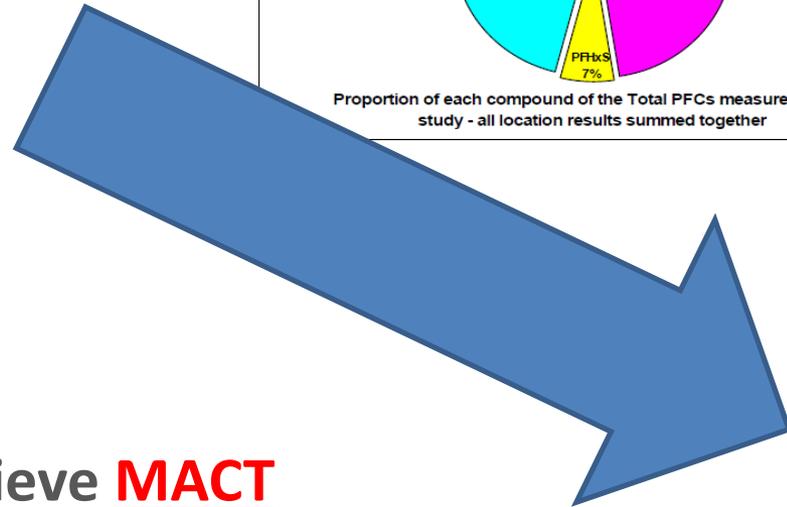
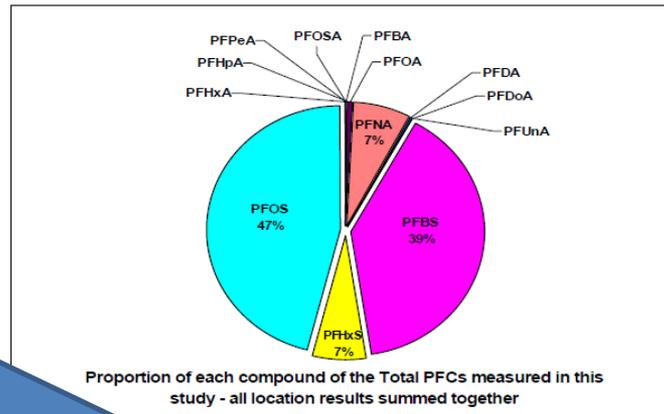


- Many industrial, commercial, consumer uses
- 8 carbons – PFOS/PFOA phased down
- 6 carbons – use increasing (e.g., PFHxS)
- Toxicology concerns
 - Metabolic disorders – liver enlarged
 - Thyroid dysfunction
 - Fetal and early life development
 - Cancer
 - Half-life of years in humans
 - Persistence and accumulation in fish/environment

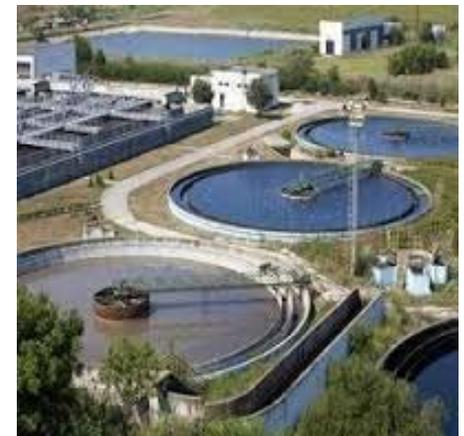
PFAS Detections

- Pease NH AFB, 1956-1991
 - 1970 aqueous film-forming foam (AFFF)
 - plane crashes and firefighting training
 - Affected Portsmouth NH drinking water wells
 - Concs > 200 ppt PFOS
- Hoosick Falls NY public well > 600 ppt PFOA
 - Saint-Gobain Performance Plastics well: up to 18000 ppt
 - Resident died of kidney cancer, son tested tap water
- Other plastics manufacturing and chemical plants prompt testing and detects
 - Petersburgh NY
 - Merrimack NH

~ 40 Tons/Yr PFOS in Chrome Baths Worldwide



Means to Achieve MACT



PFAS: Interim/Emerging DW Targets

- USEPA Health Advisory, May 2016: 70 ppt
 - PFOS + PFOA
- VT target: 20 ppt
- NH target: 40 ppt
- NY target: 100 ppt (at Hoosick Falls)
- NJ target: 14 ppt
- No standards yet for other PFAS
 - is C6 the next to “emerge”??

Biomonitoring of PFAS in Portsmouth Area, NH

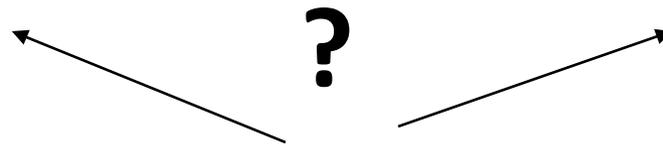
Table: Summary of 108 Child Results (aged 11 years and younger) From the First Round of Testing.

PFC Tested	PEASE TRADEPORT (Level in µg/L)				TEXAS STUDY* (Level in µg/L)		
	Geometric Mean	Median	Min	Max	Median	Min	Max
PFOA	4.0	4.5	<0.1	12.0	2.9	<0.1	13.5
PFOS	8.9	8.9	0.5	30.8	4.1	<0.2	93.3
PFHxS	6.1	7.4	0.2	26.2	1.2	<0.1	31.2
PFUA	<0.1	<0.1	<0.1	0.5	N/A	N/A	N/A
PFOSA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6
PFNA	1.1	1.0	<0.1	5.2	1.2	<0.1	55.8
PFDeA	0.2	0.2	<0.1	0.7	<0.2	<0.2	2.1
Me-PFOSA-AcOH	0.1	<0.1	<0.1	1.3	<0.2	<0.2	28.9
Et-PFOSA-AcOH	<0.1	<0.1	<0.1	0.2	<0.2	<0.2	0.7

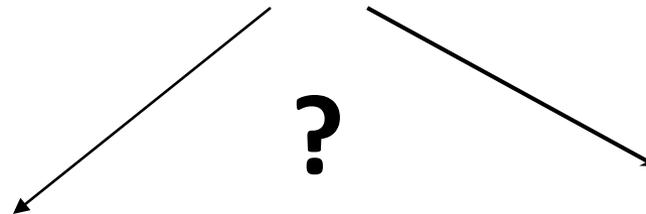
*Comparison numbers are from: Schecter et al. Polyfluoroalkyl Compounds in Texas Children from Birth through 12 Years of Age. *Enviro Health Perspect* 2012;120(4):590-594.

**Contaminated drinking water may have increased median but not max exposure
What does it mean?**

Where Does Your Water Come From?



PPCPs



The Arguments For/Against PPCPs

Public Health Concern

YES, A Concern

- WWTPs can't remove
- Chem interactions?
- Fish affected
- Supplies not sampling
- No one knows what it means!!

NO, Not a Concern

- Only trace levels – chemist's fault
- Pharmas taken >> levels
- Many systems not affected
- Not really a new issue
- No documented effects

What PPCPs are being found

- Ibuprofen – British rivers – 3 ppm
- Tylenol
- Various EDCs, mostly estrogenic (BPA)
- Caffeine
- Carbamazepine
- DEET
- Erythromycin

Connecticut – No Recycling of Water for Potable Use

- According to State Statute (22a-417)
 1. No industrial or public wastewater discharges into public drinking water supply drainage areas;
 2. No degradation of land owned within public water supply watershed areas.
 3. Oversight of $\approx 100,000$ acres of watershed land owned by public water systems
 4. New groundwater wells for public water must be separated away from potential sources of pollution
- Could still have private wells affected by septic

Myth:

Rx Drugs Should Be Flushed Down Toilet

Reality: Needs proper disposal –

- Efforts being focused on health care facilities
- Consumers – some pharmacies offer “take back” days



Releases from Pharmaceutical Manufacturing,

Larsson et al. 2014

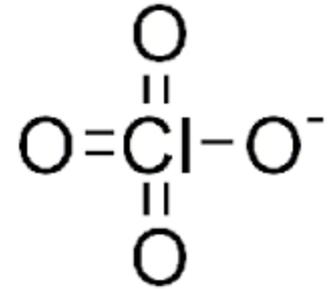
Chemical Analysis

Switzerland	oseltamivir—antiviral	surface water: ciprofloxacin 0.5 mg l	surface water: 160 ng l ⁻¹	2010	[18]
USA	narcotic opioids		effluent: metaxalone 3.8 mg l ⁻¹	2010	[19]
India	fluoroquinolone antibiotics		river sediment: ciprofloxacin 914 mg kg ⁻¹	2011	[20]
		organic material			
Korea	lincomycin—antibiotic		effluent: 43.9 mg l ⁻¹	2011	[21]
Israel	venlafaxine and metabolites		effluent: venlafaxine 11.2 µg l ⁻¹	2012	[22]
Israel	carbamazepine and venlafaxine		effluent: venlafaxine 11.7 mg l ^{-1b}	2013	[23]
Pakistan	several antibiotics		surface water: sulfamethoxazole 49 µg l ⁻¹	2013	[24]
India	fluoroquinolone antibiotics		groundwater: ciprofloxacin 770 ng l ⁻¹	2014	[25]
		soil: ciprofloxacin 7.2 µg g ⁻¹ organic matter			
Spain	venlafaxine		effluent: 2.6 µg l ⁻¹	2014	[26]

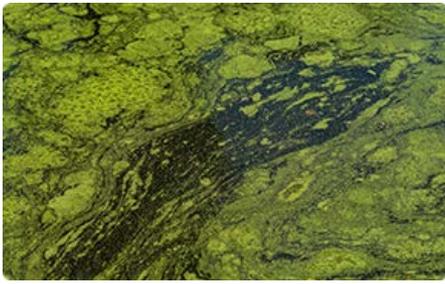
Bioassays

France	fish	plasma vitellogenin and intersex	field	no	2010	[46]
China	bacteria	antibiotic resistance and taxonomy	field	yes	2011	[47]
India	microbial communities	antibiotic resistance gene abundance and taxonomy	field	yes	2011	[20]
India	fish	protein expression and enzyme activities	laboratory	yes	2013	[48]
India	bacteria	antibiotic resistance and bacterial genetics	field	(yes)	2013	[49]
India	rats	gene expression, blood chemistry and weight gain	laboratory	yes	2013	[35]
India	bacteria	antibiotic resistance and bacterial genetics	field	(yes)	2013	[50]
Pakistan	bacteria	antibiotic resistance gene abundance	field	yes	2013	[24]
India	bacteria	antibiotic resistance gene abundance	field	yes	2014	[25]

Perchlorate



- Rocket fuel, munitions, blasting
 - Military bases
 - Production facilities out west
- Potentially used in road and housing construction
- Fireworks displays - surface and groundwater
- UCMR-2: sufficient PWS detects for federal MCL
 - EPA still sorting through effects on thyroid and brain development in low iodide early life scenario
 - State MCLs: MA 2 ppb; CA 6 ppb
- No detections found in CT UCMR-2 results



Cyanobacteria



- “Blue-green algae” blooms associated with
 - Microcystin and other harmful toxins
 - Liver toxicity, cancer
 - USEPA 2015 Health Advisory: 0.3 ug/L
- Toledo OH drinking water – Lake Erie
 - Summer 2014, Spikes in microcystin-LR
 - Water shut off to 500,000 residents
 - Treatment and daily monitoring since then
- Several CT waterbodies and supplies affected
 - Visible evidence, testing, alt water on temp basis
- Potential exposure from fish and swimming
- Source of problem: nutrient loading, warmer summers
- Recent shellfish bed closings due to Shellfish toxins (domoic acid)
 - Sporadic, possibly increasing/emerging trend?

Chlorate in Water Supplies

- Disinfection processes, bkdwn of hypochlorite
- Bleaching in pulp, paper mills
- Agriculture
- Detects common in the UCMR-3
 - Guidance level of 210 ug/L
 - Cousin of perchlorate, also affects thyroid

Hex Chrome (CrVI)

- Tested in UCMR
- PHG in Calif = 0.06 ug/L, MCL = 10 ug/L
- Much of Total Cr can be CrVI in GW
- Carcinogenic but how potent?
 - EWG 2016: *'Erin Brockovich' Carcinogen in Tap Water of More than 200 Million Americans*

USEPA OPPT - TSCA Reviews

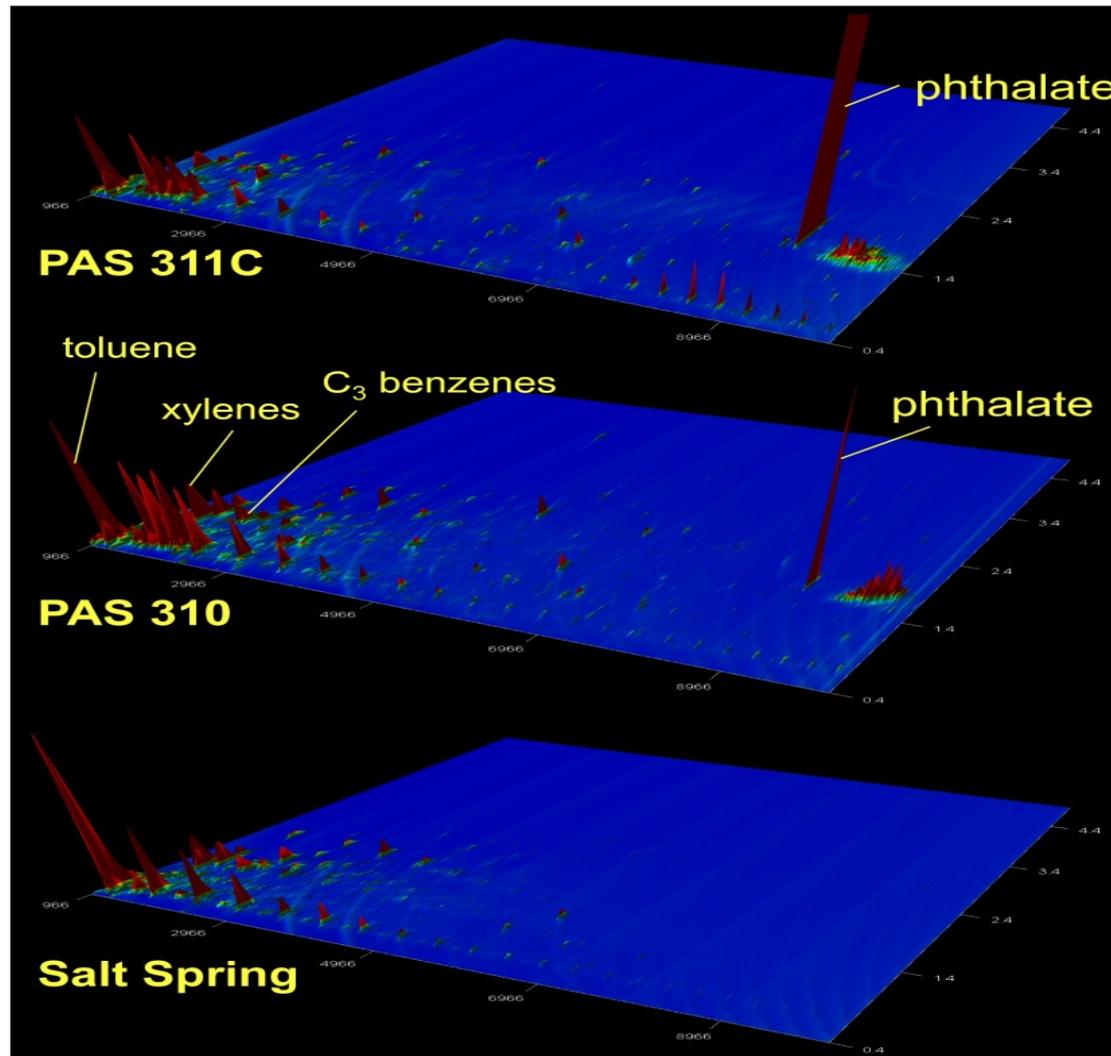
5 Fast Track Chems, Oct 2016

- Decabromodiphenyl ethers (DecaBDE), flame ret
- textiles, plastics and polyurethane foam;
- Hexachlorobutadiene (HCBD),
- manufacture of rubber compounds and lubricants and as a solvent;
- Pentachlorothio-phenol (PCTP),
- makes rubber more pliable in industrial uses;
- Tris (4-isopropylphenyl) phosphate, flame ret
- consumer products and other industrial uses;
- 2,4,6-Tris(tert-butyl)phenol,
- ingredient in fuel, oil, gasoline or lubricants

Phthalates

- Plasticizers common in PVC, cosmetics, flooring, consumer products, medical tubing
- Anti-male endocrine disruptive effects
 - Period of in utero development most sensitive
 - Tox values still being developed
- DEHP, high concern phthalate
 - Phased out of toys, medical tubing
- Levels in environment can be substantial
- Not commonly sampled – lab blank issue

DEHP – fingerprint of GW contamination from hydraulic fluid from
Marcellus Shale fracking operations, PA



Drollette et al. PNAS 2015

Barnes et al. 2004: Leachate Plume from Norman OK Landfill, USGS

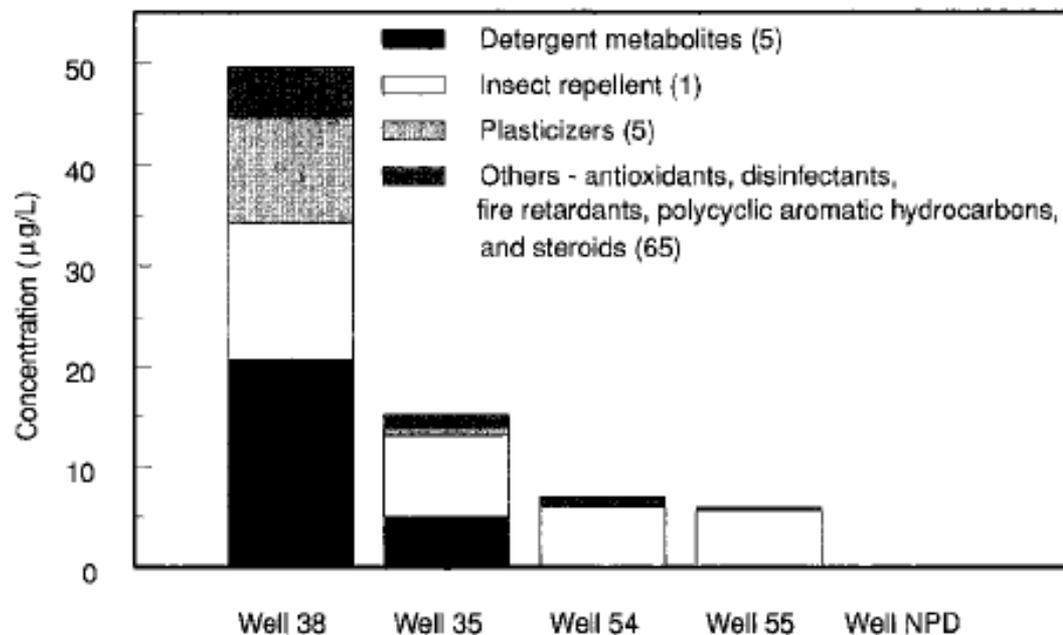


Figure 3. Total measured concentrations of organic waste water contaminant general use groups, by site. Number of compounds in each group shown in legend.

Table 3
Analytical Results of Ground Water Sites Sampled for 76 Organic Waste Water Contaminants
 (concentrations in µg/L) OK Landfill, Barnes et al.

Compound Name	Well 35	Well 38	Well 54	Well 55	Well NPD
cholesterol	0.042	0.044	0.022	0.039	0.022
coprostanol	0.074	0.057	< 0.005	< 0.005	< 0.005
cotinine	0.13	< 0.05	0.12	0.10	< 0.05
2,6-di-tert-butylphenol	< 0.15	0.23	< 0.08	< 0.08	< 0.15
2,6-di-tert-butyl-1,4-benzoquinone	0.4 ^a	0.9	< 0.5	< 0.5	< 0.6
anthracene	< 0.06	< 0.06	0.02 ^d	< 0.05	< 0.05
3-tert-butyl-4-hydroxy anisole	0.2 ^a	< 0.12	< 0.12	< 0.12	< 0.12
bis(2-ethylhexyl) phthalate	< 2.5	250 ^b	< 2.5	< 2.5	< 2.5
bisphenol A	0.84	0.50	< 0.09	< 0.09	< 0.09
fluoranthene	< 0.03	< 0.03	0.01 ^d	< 0.03	< 0.03
lincomycin	0.10	< 0.05	< 0.05	< 0.05	< 0.05
4-methyl phenol	0.19	0.49	< 0.04	< 0.04	< 0.06
naphthalene	0.063	0.09	< 0.02	< 0.02	< 0.025
<i>N,N</i> -diethyltoluamide	8.1	13	6.1	5.5	< 0.08
4-nonylphenol	1 ^c	3 ^c	< 0.5	< 0.5	< 0.70
4-nonylphenol monoethoxylate	3 ^c	7 ^c	< 1.00	< 1.00	< 1.00
4-nonylphenol diethoxylate	< 1.10	10 ^c	< 1.10	< 1.10	< 1.10
4-octylphenol monoethoxylate	0.4 ^c	1 ^c	< 0.10	< 0.10	< 0.12
4-octylphenol diethoxylate	0.2 ^c	0.3 ^c	< 0.20	< 0.20	< 0.20
stigmastanol	< 2.0	2 ^a	< 2.0	< 2.0	< 2.0
triclosan	< 0.05	0.21	< 0.04	< 0.04	< 0.05
tri(2-chloroethyl) phosphate	0.36	0.74	0.25	0.22	< 0.04

^aConcentration estimated—average recovery < 60%

^bConcentration estimated and changed to 10 µg/L (five times the reporting level) for summary statistics; value greater than highest point on calibration curve

^cConcentration estimated—reference standard prepared from a technical mixture

^dConcentration estimated—value less than reporting level

Compounds suspected of being hormonally active are in bold (National Research Council 1999; Foran et al. 2000).

Sodium and Chloride Contamination of Groundwater

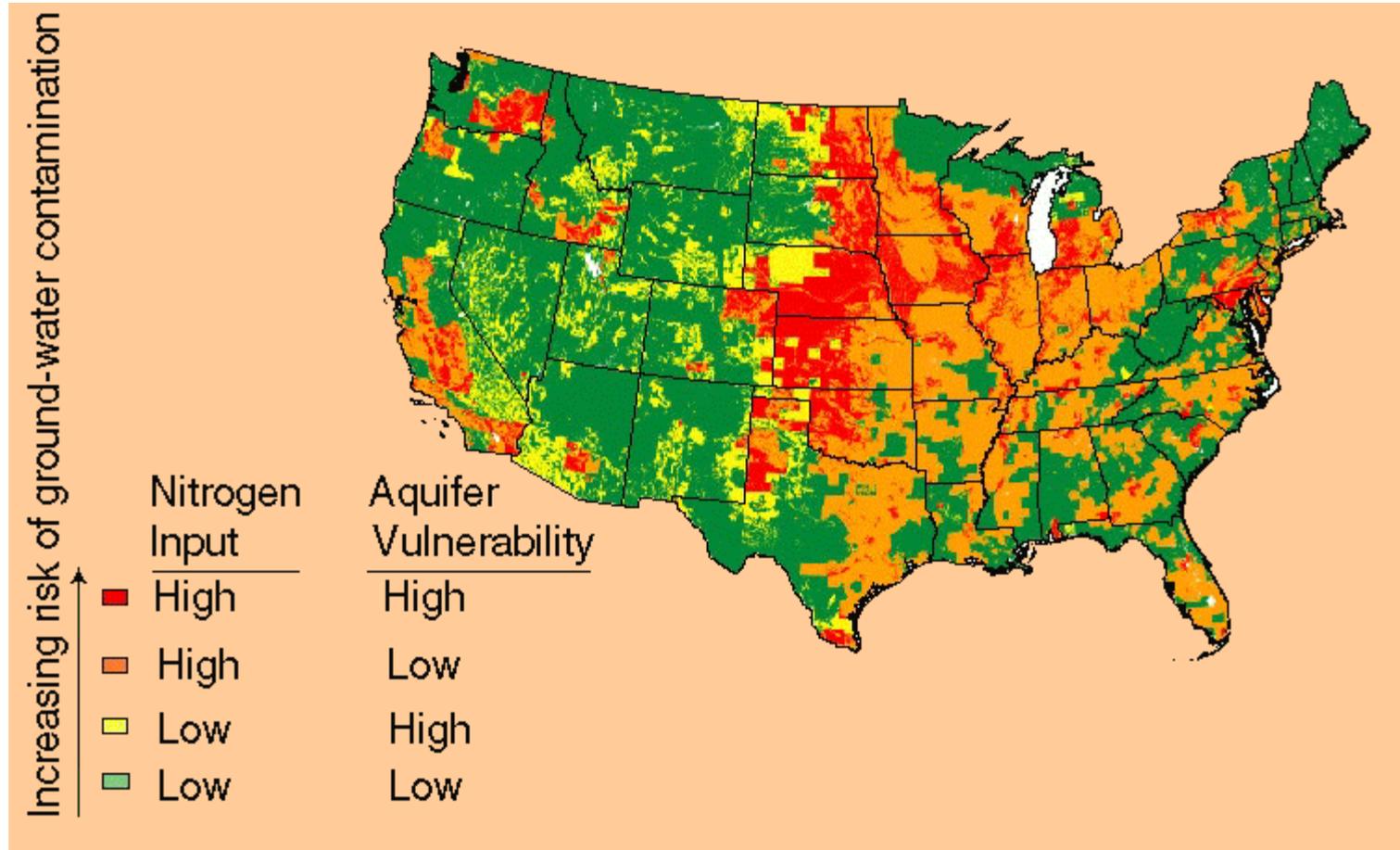


- High Na^+ in DW a possible blood pressure risk
 - Notification level of 100 mg/L
- High Cl^- in DW can be corrosive
 - CT state MCL of 250 mg/L
- Cases of high salt in DW appears to be on rise

USEPA Nitrate GW Estimates

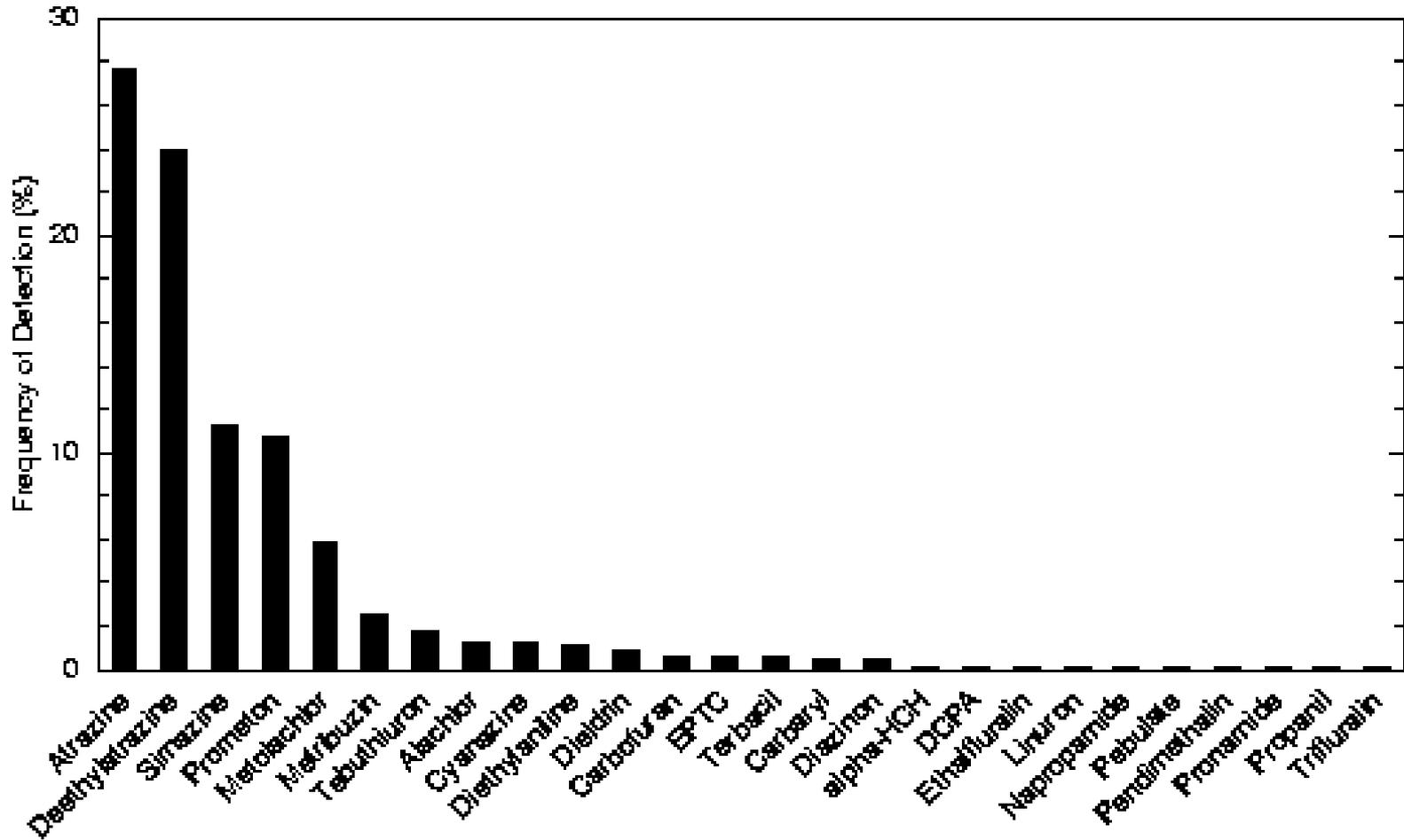
State	Estimated area (mi²) of state with groundwater nitrate concentrations > 5 mg/L	Estimated % of state area with groundwater nitrate concentrations > 5 mg/L	Estimated % of population with self-supplied drinking water
Alabama	646	1%	11%
Alaska	No data	No data	35%
Arizona	12,763	12%	4%
Arkansas	1,606	3%	7%
California	15,004	10%	7%
Colorado	4,628	4%	6%
Connecticut	276	6%	24%

USGS Nitrate Prediction Map of US

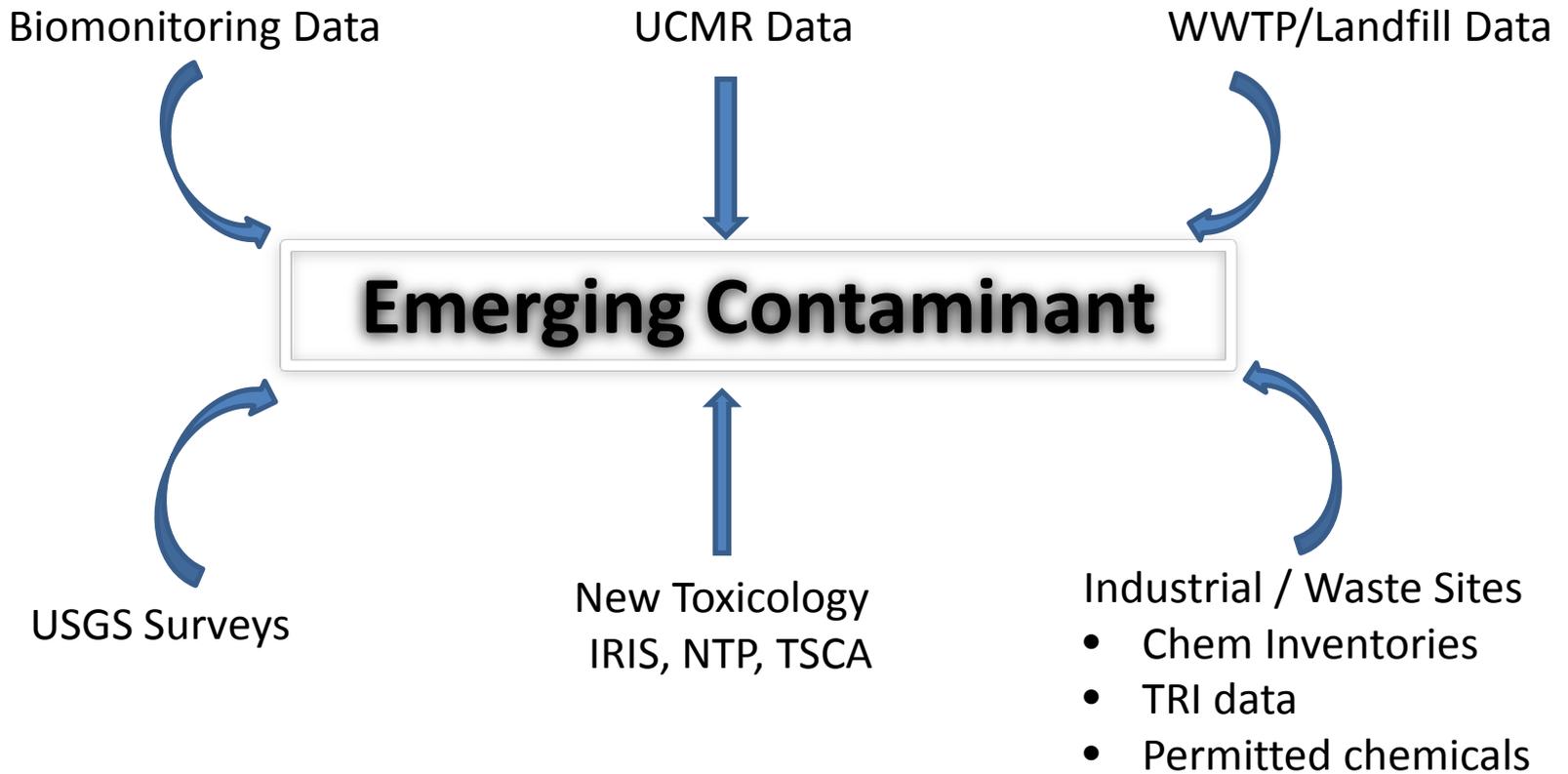


Research Links Nitrate In Drinking Water To Birth Defects (May 2016)

Pesticides in GW Across US (USGS, 1998)



Staying Ahead of the Curve



Questions / Comments

www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection

Remediation Roundtable



E-mail: DEEP.remediationroundtable@ct.gov

Web: www.ct.gov/deep/remediationroundtable



Connecticut Department of Energy and Environmental Protection



REMEDIATION ROUNDTABLE

Next meeting: March 14, 2017



Connecticut Department of Energy and Environmental Protection

www.ct.gov/deep/remediationroundtable