

PFAS

A Regulator's View

NEWMOA Event
May 8, 2017
Danielson, CT

Vermont's Experience

Outline

What are Perfluoroalkyl Substances (PFASs)
(PFOA) & (PFOS)

What are the Sources

What are their Health Effects

Review of Standards

Public Outreach

Geology/3D CSM

Review Statewide Plan

Questions

Perfluoro alkyl substances (PFASs)

PerfluoroOctanic Acid (PFOA)

Perfluorooctanoic acid
Chemical Compound



Perfluorooctanoic acid, also known as C8, is a synthetic perfluorinated carboxylic acid and fluorosurfactant. One industrial application is as a surfactant in the emulsion polymerization of fluoropolymers. [Wikipedia](#)

Formula: $C_8HF_{15}O_2$

Molar mass: 414.07 g/mol

Boiling point: 372.2°F (189°C)

Density: 1.8 g/cm³

Perfluorobutanesulfonate (PFOS)

Perfluorooctanesulfonic acid



Perfluorooctanesulfonic acid is an anthropogenic fluorosurfactant and global pollutant. PFOS was the key ingredient in Scotchgard, a fabric protector made by 3M, and numerous stain repellents. [Wikipedia](#)

Molar mass: 500.13 g/mol

Formula: $C_8HF_{17}O_3S$

Boiling point: 271.4°F (133°C)

Classification: Sulfonic acid

Properties of PFASs

- ▶ There are hundreds of PFASs, from C4 to C14 and maybe higher
- ▶ They are extremely resistant to degradation due to C–F bond
- ▶ They are highly soluble
- ▶ They have little retardation in soils and groundwater in the environment

- ITRC is working on white papers that will summaries these properties

What are PFASs In?

What are PFASs in?

- Teflon production (Parkersburg, WV)
- Electronics coatings (Hoosick Falls, NY & Pownal, VT)
- Scotchguard/Gortex (background household levels)
- Fire fighting foam (AFFF) (PFOS, others) (Loring AFB, ME, Pease AFB, NH, & VTANG, VT)
- Textile coating (Chemfab) (PFOA) (Bennington, VT)

Textile Coating Made at Chemfab



PFASs Health Effects

PFASs Health Effects

- Concentrates in Blood Serum
- May cause hypertension, low birth weight, some immune systems effects, thyroid disease, kidney cancer, and testicular cancer
- Current EPA Health Advisory is **70 ng/l** PFOA/PFOS combined
- Vermont Health Advisory at **20 ng/l (ppt)** for PFOA/PFOS combined

Standards (Drinking Water)

- ▶ USEPA 2009 Provisional DW Health Advisory for PFOA was 400 ng/l
- ▶ USEPA Interim Lifetime DW Health Advisory for PFOA of 100 ng/l; NY adopted at Hoosick Falls
- ▶ VT set DW Health Advisory of 20 ng/l PFOA/PFOS combined in May of 2016
- ▶ USEPA adopted Health Advisory of 70 ng/l PFOA in May of 2016; many states have adopted this standard
- ▶ NJ has proposed DW Standard for PFOA of 14 ng/l

Standards (Other Media)

- ▶ No Standards set for most Media – Big Problem
- ▶ MN, ME had some health advisories in 2016
- ▶ VT set soil standard for direct contact at 300 ug/Kg in March of 2016
- ▶ Still working on sediment, surface water, and fish advisory levels
- ▶ ME has set Screening Levels for soils, sediment, GW, surface water and fish

Analytical Methods

- ▶ For Water, EPA Method 537 (Liquid Chromatography/Tandem Mass Spectrometry) (LC/MS/MS)
 - Tests for PFOA, PFOS, PFNA, PFHxS, PFHpA, PFBS
 - (UCMR) 3 for PFAS in 2013 in VT of 13 Public Systems; No PFAS found in any system

No EPA Method for soils, sediment, fish

So labs use modified methods, each being a little different from the other –SO BE CAREFUL

Site Discovery – Public Outreach

- ▶ Jan. 16 – DEC alerted by citizen of potential PFOA issue in N Bennington, VT – Chemfab
- ▶ Early Feb., 16 – Sampling Plan, DQOs
- ▶ Feb 16, 2016 – 5 Wells sampled



She says there wasn't much to it. Griffith and her co-workers would drop a chalk line on a big roll of fabric and cut it with a pair of scissors. Then they'd run the fabric through a chemical cocktail, bake it at temperatures that exceeded 650 degrees and watch the smoke rise up through the stacks.

Public Outreach (Cont.)



Sampling results received on 2/25/16.

1 well had 2880 ppt PFOA, all 5 had elevated PFOA levels

Gov. Shumlin immediately announced results of testing in press conference

Public Outreach (Cont.)



Next Day – Public Meeting to discuss results of sampling and next steps

Alyssa Schuren, DEC Commish, commits to sample all wells within 1.5 mile radius and provide bottled water until results are received

Immediate Challenge



Getting Homes Clean Water

- Bottled water delivered immediately to all residents
- 11 homes/business connected to municipal system where water line nearby
- 280 systems Point of Entry Treatment (POET) systems installed
 - Connecting to municipal system is preferred long term solution

POET Picture



Public Outreach (cont.)



Citizens concerned with health of family, property values, businesses, gardens, animals, agriculture, maple syrup, milk, fish...



Mar. 14 –
Information Center
opened in Benn;
staffed by DEC &
VDH, 8–6 M–F

Public Outreach (Cont.)

RESPOND BE TRANSPARENT BE TRUSTWORTHY

Immediate Response – mobilize staff to:

- Make sure residents have safe drinking water

- Plan to identify full extent of drinking water contamination

- Share sampling results and updates with affected home owners

- Notify local officials, health, others

- Engage press, television, print, radio to ensure all know of public meetings and who to contact with questions

- Internal-ICS structure – Daily updates and weekly priorities

- Build and maintain university, government, and community partners

One Month Later....

DEC PFOA Response Organization

Week of 21-27 March 2016, as of 0745 on March 25

Public Information

- Public can call 2-1-1 for general information and referrals
- Specific questions go to leads as shown

Schedule Highlights

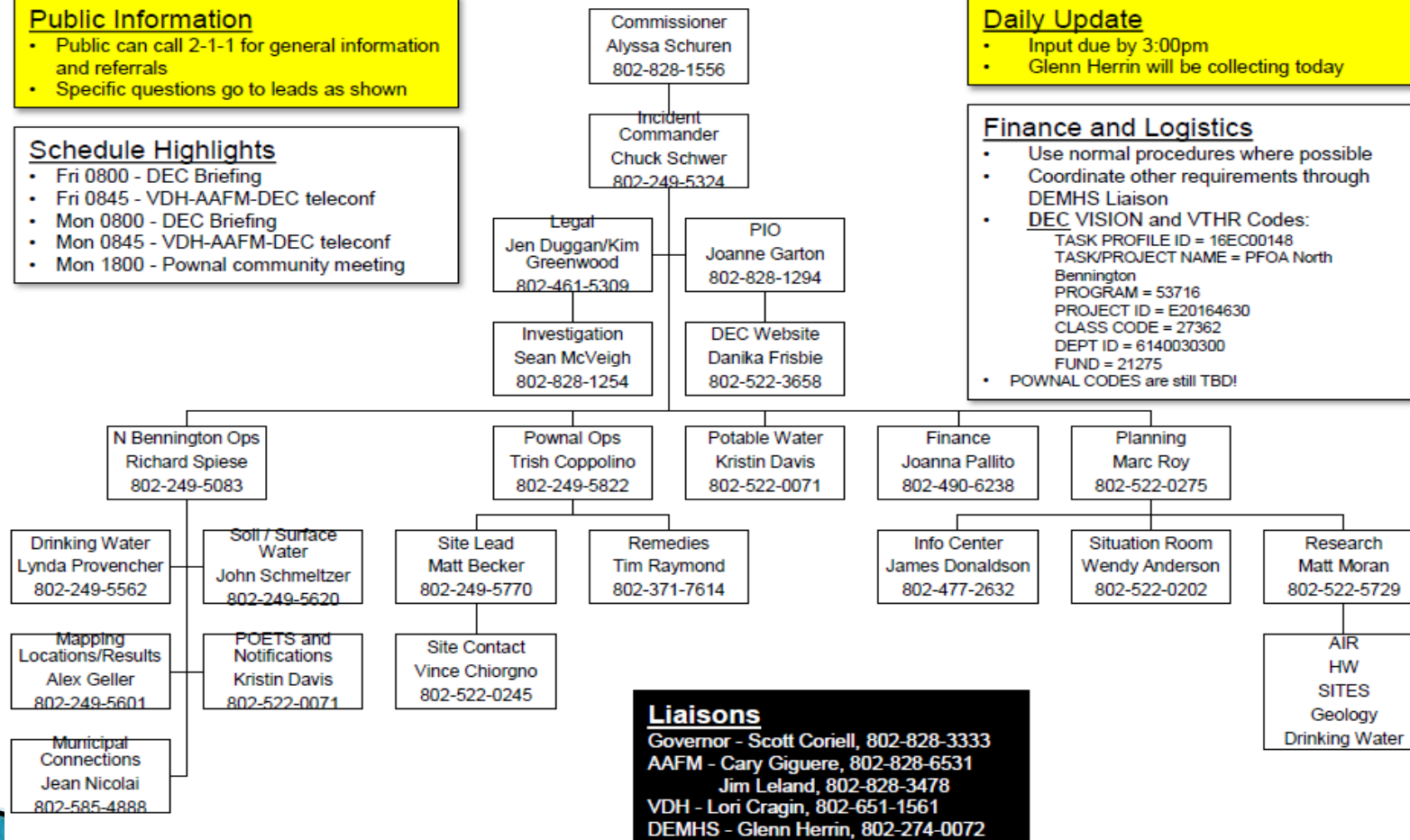
- Fri 0800 - DEC Briefing
- Fri 0845 - VDH-AAFM-DEC teleconf
- Mon 0800 - DEC Briefing
- Mon 0845 - VDH-AAFM-DEC teleconf
- Mon 1800 - Pownal community meeting

Daily Update

- Input due by 3:00pm
- Glenn Herrin will be collecting today

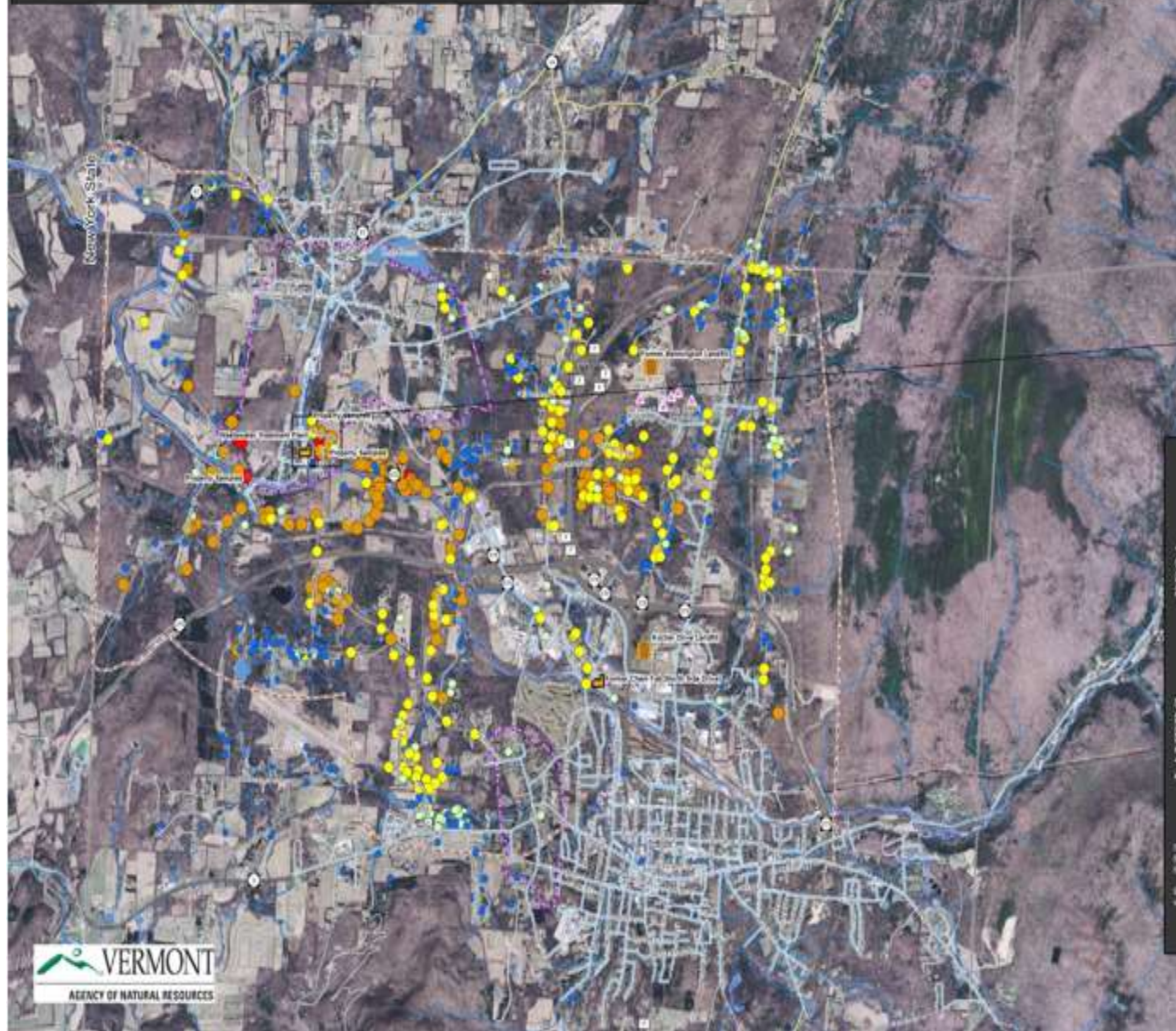
Finance and Logistics

- Use normal procedures where possible
- Coordinate other requirements through DEMHS Liaison
- DEC VISION and VTHR Codes:
 - TASK PROFILE ID = 16EC00148
 - TASK/PROJECT NAME = PFOA North Bennington
 - PROGRAM = 53716
 - PROJECT ID = E20164630
 - CLASS CODE = 27362
 - DEPT ID = 6140030300
 - FUND = 21275
- POWNAL CODES are still TBD!



North Bennington/Bennington PFOA

Sampling Test Results (Highest Concentration) - April 17, 2017



MAP LEGEND

- | | | | |
|---------------|---|--|---|
| PFOA | <ul style="list-style-type: none">• <6.7 ppt (Original Detection Limit)• 6.7 - 20 ppt (VDH Advisory)• 20 - 100 ppt• 100 - 1000 ppt• >1000 ppt | BOUNDARIES | <ul style="list-style-type: none">▭ Village Boundary (VCHI)▭ Sampling Boundary▭ Town Boundary |
| LAYERS | <ul style="list-style-type: none">▲ Landfill Monitoring■ Factory■ Landfill■ Wastewater Treatment Plant■ Town Water Sample— WaterLine | 
April 26, 2017 | |

Notes:
Source: Roads (VTTRANS), Seemap (VCHI), Geocoding (NCSA), Sampling Results (VTNR)/Weston & Simpson, Waterline (Olin Creek Engineering), Wetlands and Waterbodies (DNR).
Sampling locations are determined by geocoded addresses as provided. Latitude/Longitude used in instances where not locations were provided.

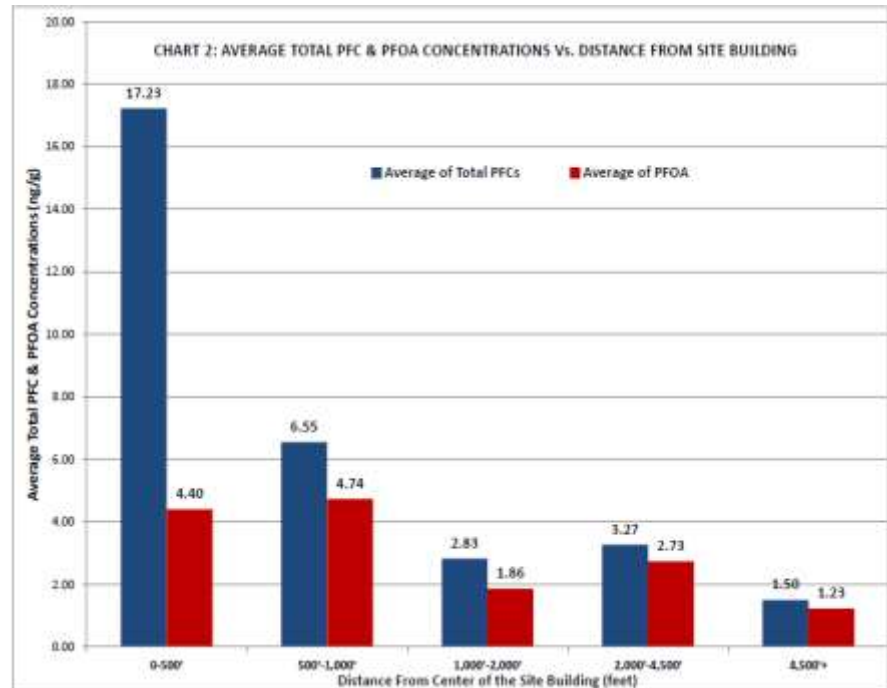
0 0.25 0.5 1 1.5 2
Miles

Bennington PFOA Private Well Results

- 581 samples collected from private wells
- >60% of all wells had some level of PFOA
- 208 results : ND (37%)
- 87 results : 0–20 ppt (14%)
- 286 results : >20 ppt (49%)
- Recent Re-sampling efforts have changed these results
14 of 140 wells that were <20 ppt now >20 ppt

Soil Results

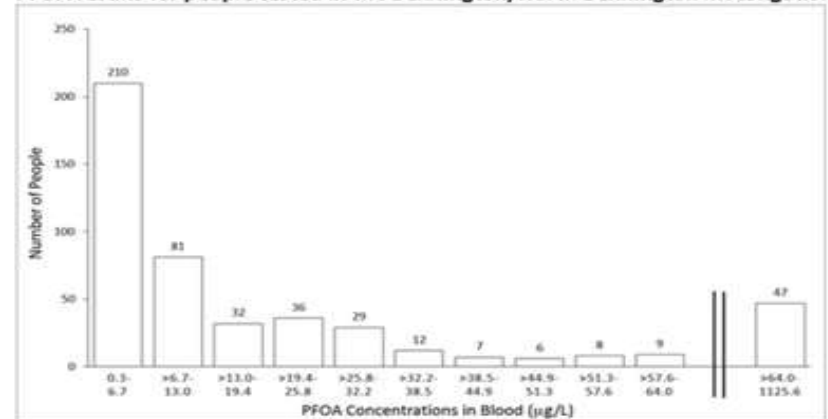
- Collected over 100 samples
 - Results ranged from ND – 45 ppb
 - Majority of results < 10 ppb
- VDH soil screening level : 300 ppb
- Surface soil remediation deemed not necessary for direct contact



VDH Blood Testing

- VDH tested more than 400 people
- PFOA in blood 0.3 – 1,126 ppb
- Average for Bennington – 10 ppb
 - 2.1 ppb – United States average
 - 33 ppb – Ohio workers
 - 1,130 ppb – Alabama workers
- PFOA half-life in blood: 2–4 years

PFOA results for people tested in the Bennington/North Bennington investigation



Note: The double black line (||) signifies a change in the PFOA concentration interval width in order to present all of the results on one chart – the range of test results represented in the bar on the far right is greater than the others presented. There is no clinical significance to this distinction.

Area-Wide Geologic and Aquifer Characterization to date

- ▶ Geologic and Surficial Mapping by Vermont Geological Survey with support from academic institutions
- ▶ Geophysical Logging 12+ wells
- ▶ Groundwater Geochemistry
- ▶ Geochronology of water in wells
- ▶ Area-wide groundwater flow direction integrating information from wells, topographic maps, and geologic maps.)



Aquifer Characterization Components

Bedrock Mapping



VGS website 5/23/2017

Surficial Mapping



VGS website 4/10/2017

GPS Well Locating



VGS website 5/23/2017

Groundwater Flow Direction Maps



VGS website 5/1/2017

Groundwater Chemistry



Ongoing w/ Middlebury College

Geophysical Well Logging



Ongoing w/ SUNY at Plattsburgh

Groundwater Age-Dating

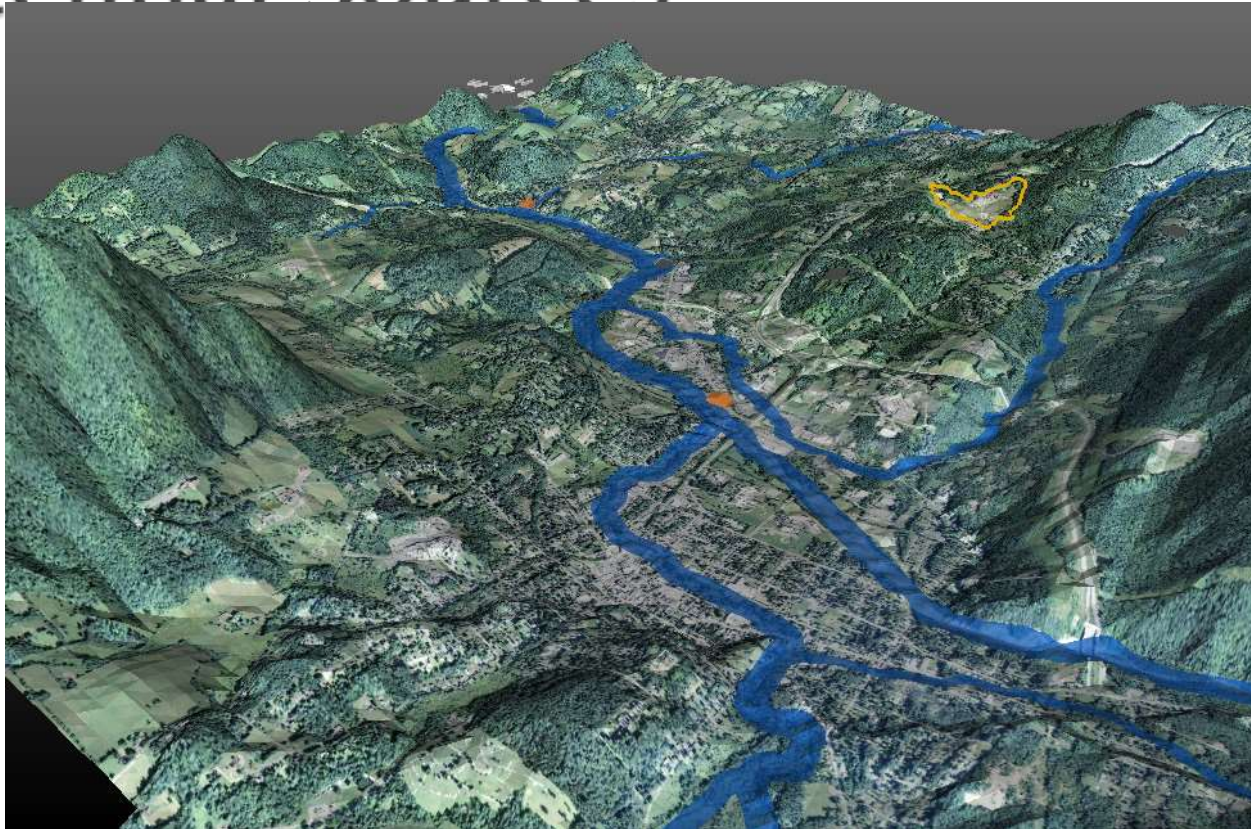


Ongoing w/ U.S.G.S.

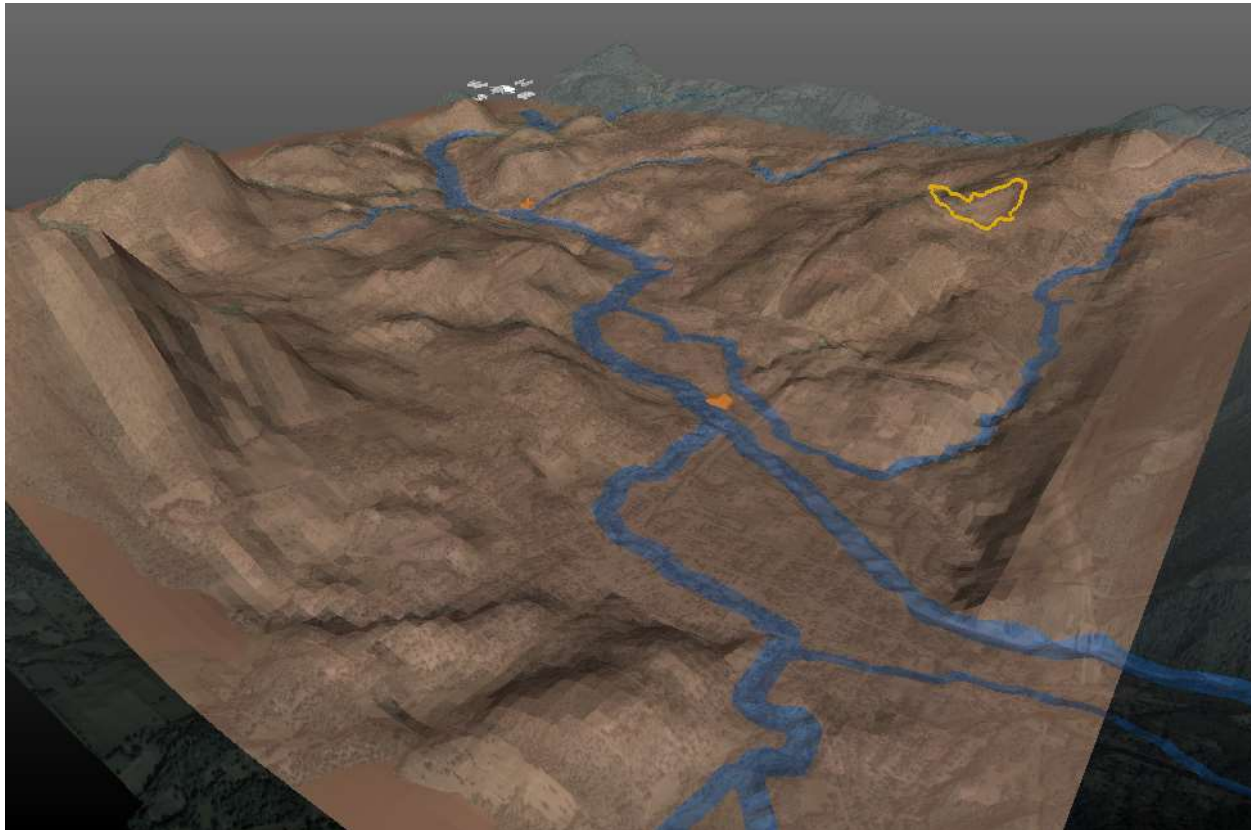
Additional Site Investigation– Related Activities

- ▶ ANR created a model to estimate degree and extent of PFOA deposition from air emissions
 - ▶ Water supply sampling around Bennington Landfill for non-PFOA contaminants
 - ▶ Hired AMEC, Foster, Wheeler a.k.a. AMEC out of Portland Maine to provide technical support and expertise and to assist us in evaluating PFOA fate and transport and reviewing technical submittals
 - Models helps in identifying relationships and patterns
 - Helps identify data gaps
- 

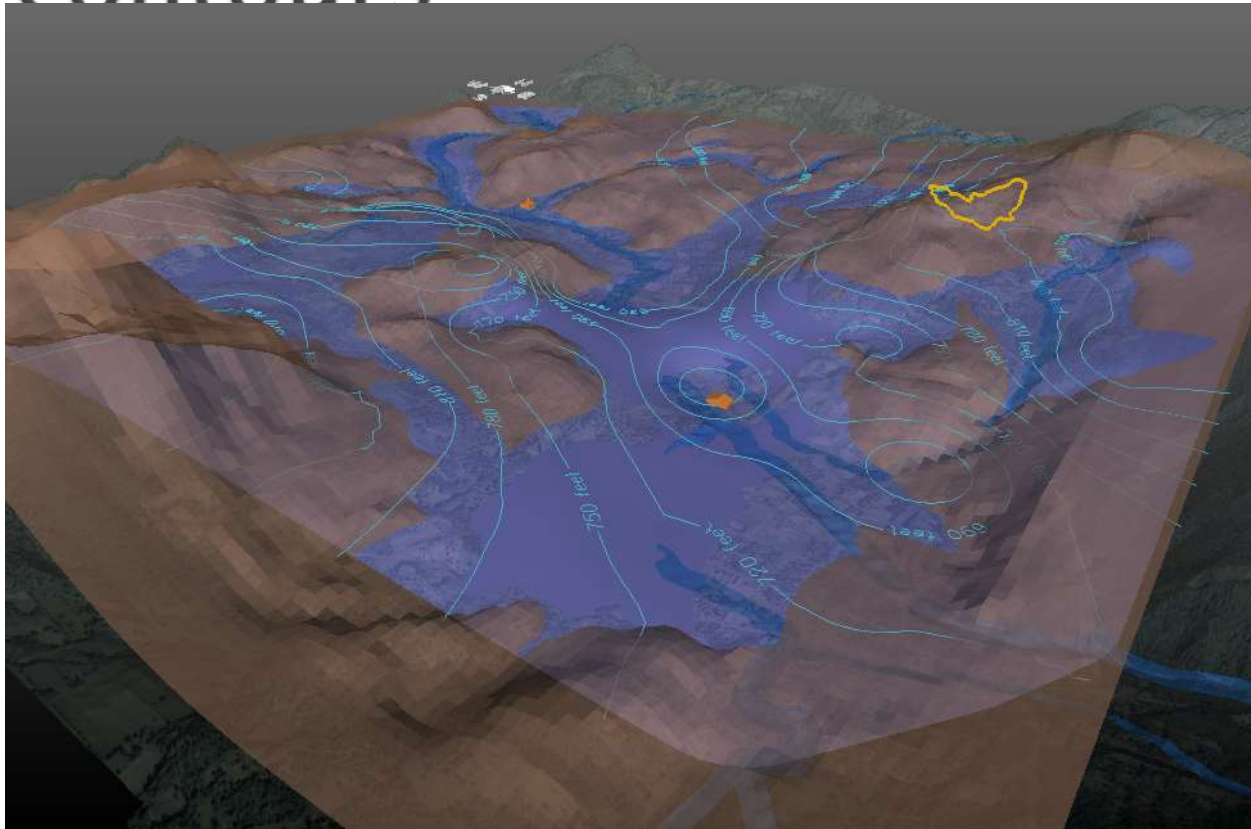
Topography and Potential Sources



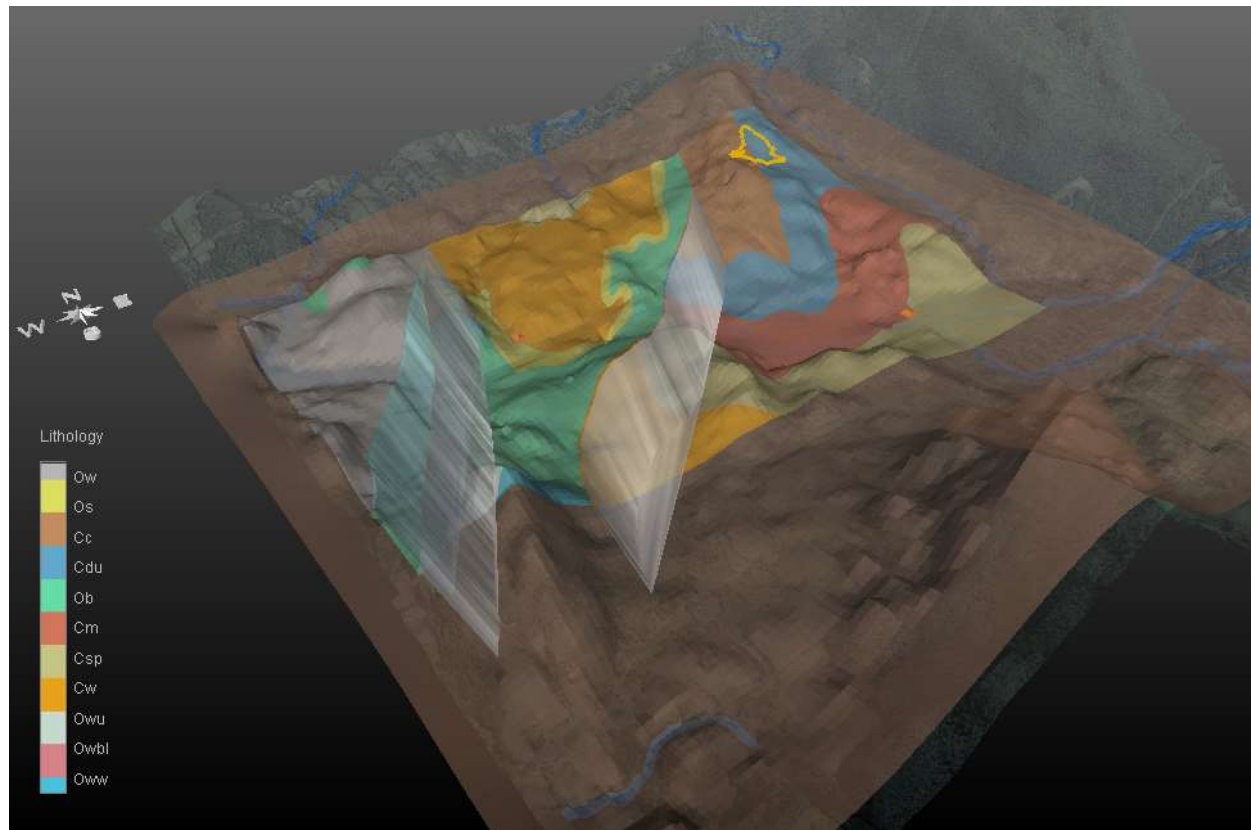
Bedrock Surface



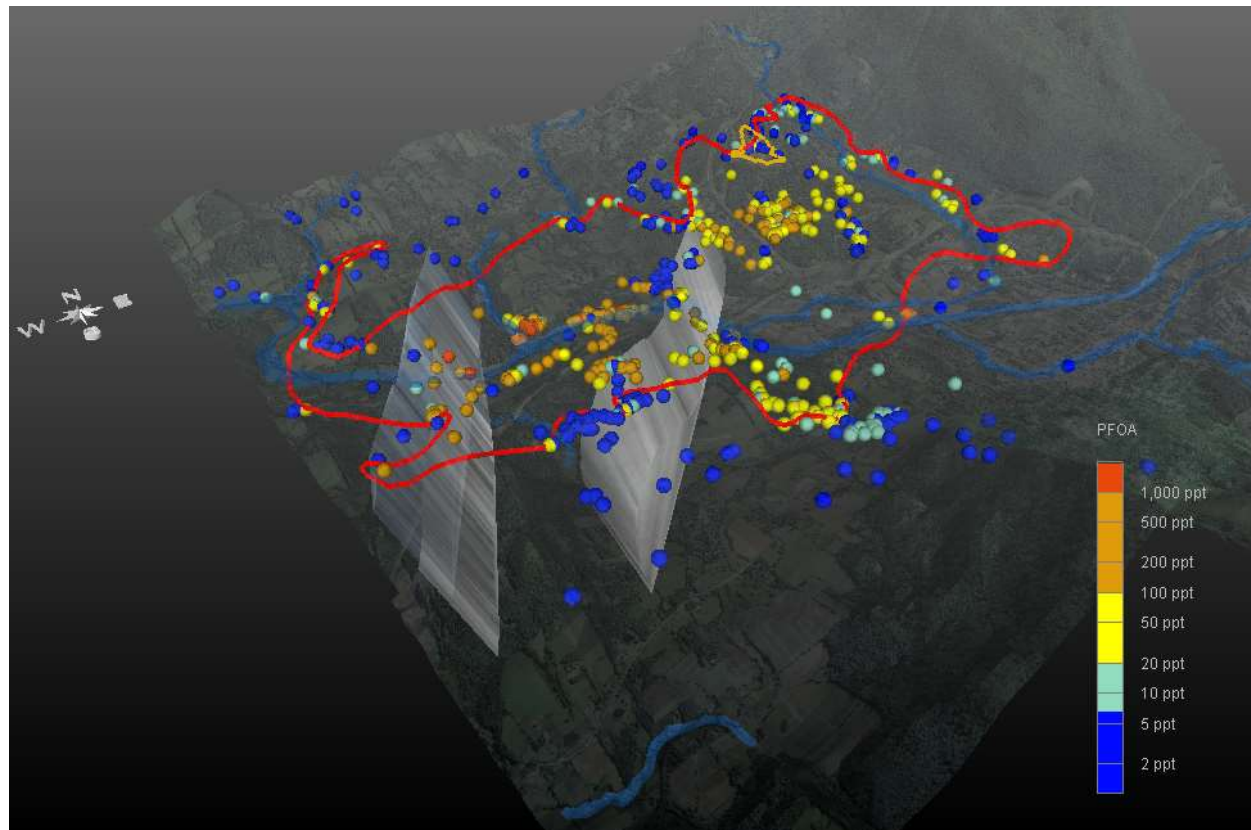
Bedrock Surface and GW Surface w/ contours



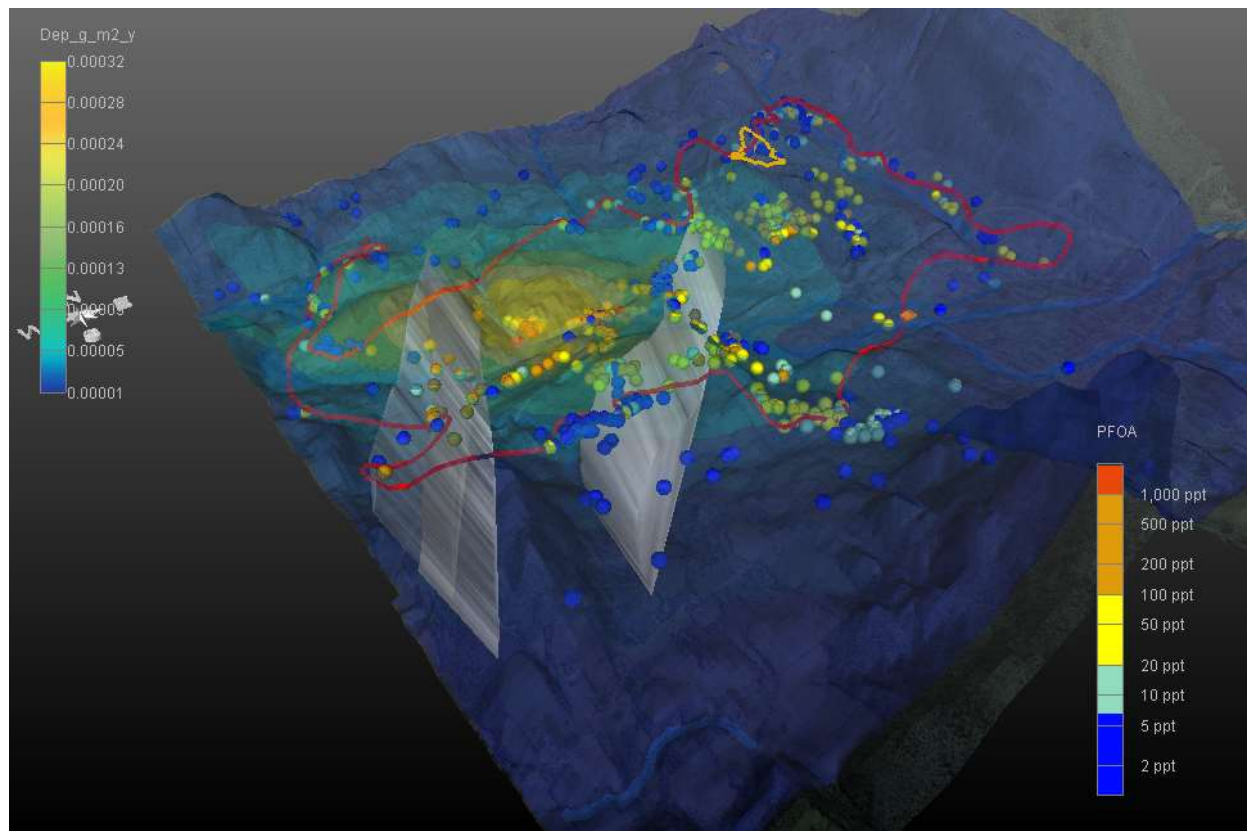
Bedrock Type and Fault Zones



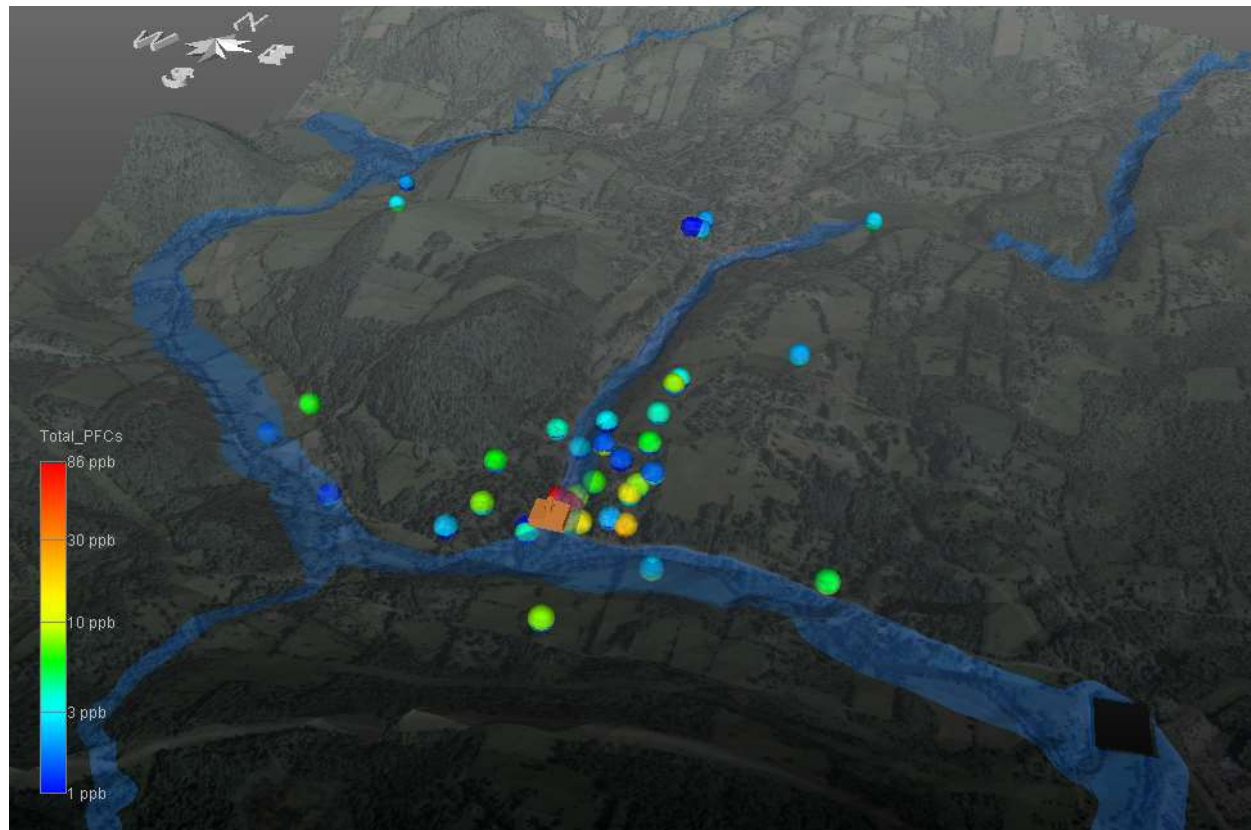
PFOAs in GW, all wells



PFOAs in GW with 20 ppt line and Estimated Air Deposition



Surface Soil Samples



Next Steps–Site Investigation

- ▶ Additional Soil Sampling and testing
- ▶ Soil borings and monitoring wells (overburden and bedrock wells)
- ▶ At this time, EPA, at the request of VT ANR, is installing additional monitoring wells and soil borings at the Bennington Landfill

Goal of this additional work is to provide more data to help answer questions, such as

- What are the source(s) of the PFOA contamination for the eastern area?
 - How much PFOA remains in the soil? Is it a threat to further contaminant groundwater?
 - Are PFOA concentrations in groundwater stable, decreasing, or increasing?
 - Where is PFOA in groundwater and how is it moving?
- 

Contaminated Wells in Pownal



Picture of Pownal Water Filtration System



Statewide PFOA Response

- Reviewed limited state information on use of PFASs
- Prioritized industries to target
 - Semiconductor, wire coating, fire fighting training centers
- Also prioritized based on sensitive receptors (# of drinking water wells within ½ mile of facility)
- Phased sampling over 4–8 week period
- 11 Locations chosen for sampling
- Results showed 6 of these sites have PFASs released to the environment
- Include IBM, Air Guard Base, Pittsford Fire Training Center, etc

Challenges to PFOA Response

- Magnitude of effected area
- Public Outreach very time consuming
- Developing health advisory levels for water, soil, crops, fish, etc.
- Messaging of health advisory level in Vermont
 - Blood sampling results
- Understanding the fate and transport
- Presence of Arsenic from point-of-entry treatment systems
- Superfund sites – do we reopen?

Lessons Learned

- 2-1-1 support
- Importance of immediate public meetings
- Weekly emails to community
- Importance of establishing clear Incident Command Structure
 - (assistance from VEM, DOH, Ag)
- Importance of reaching out to other states
 - (NY, NJ, NH, MN)

Questions?

Thank you!

Contact information:

Richard Spiese

802-249-5083

richard.spiese@vermont.gov