

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Perfluoroalkyl Substances (PFAS) Contamination Status Report

JULY 2018



DEPARTMENT OF ENVIRONMENTAL CONSERVATION

INTRODUCTION:

In February 2016 the Department of Environmental Conservation (DEC) discovered a contamination problem in Bennington of perfluoroalkyl substances (PFAS) from a former Teflon coating factory in North Bennington.

Since that first discovery, the DEC has investigated numerous sources of PFAS using a strategic sampling strategy that is updated and adapted based on the latest scientific research.

This report provides an overview of the findings of this work and provides a look into additional work needed in the future.



SAMPLING SITES:

1. Wire coating facilities
2. Semi-conductor facilities
3. Battery manufacturing facilities
4. Fire-fighting foam locations and landfill leachate
5. Groundwater at landfills
6. Landfill leachate
7. Surface water, sediment and fish
8. Public drinking water supply testing
9. Wastewater treatment facilities
10. Tanneries

In December 2017, Governor Phil Scott joined the Bennington Delegation and State officials to announce the first house connected to the new municipal waterlines.

FACILITY-BASED RESULTS

Teflon Fabric Coating Facility

In February 2016 the Department of Environmental Conservation (DEC) initiated an investigation into potential perfluoroalkyl substances (PFAS) contamination from a former Teflon coating factory in North Bennington. This investigation led to the discovery of widespread contamination in over 300 drinking water wells in the Bennington area with mostly perfluorooctanoic acid (PFOA). Due to the extensive drinking water and groundwater PFOA contamination in the Bennington area, DEC began an investigation into other media which may have been contaminated by PFOA including soil, surface water, sediment and fish.

The Sampling Strategy:

DEC tested over 600 drinking water wells in Bennington and the two municipal water systems for Bennington and North Bennington. In addition to testing drinking water, approximately 800 soil samples were taken in the Bennington and North Bennington area.

The Results

- More than 400 wells tested positive for PFOA. More than 300 wells had concentrations at levels greater than the state's PFOA/PFOS drinking water standard of 20 parts per trillion (ppt). The maximum level of PFOA detected in a private drinking water well was 4,600 ppt.
- No PFAS was detected in either municipal system.
- The highest level of PFOA detected in a soil sample was 46 parts per billion (ppb), which was well below the Vermont Department of Health Soil Screening level for exposure of 300 ppb for PFOA in soils.

The Response

To address the widespread contamination in drinking water, point-of-entry treatment (POETs) systems were installed on all wells with contamination above the 20 ppt standard. In addition, most homes on the west side of the site will be connected to municipal water by the fall of 2018. This work is being performed by Saint-Gobain as required in the State of Vermont Consent Order with Saint-Gobain. On going work is being performed to determine responsibility for PFAS contamination on the east side of the site.

WIRE COATING FACILITIES

Former Warren Wire Facility

Shortly after the discovery of the problem in Bennington, the Warren Wire facility, a former wire coating facility in Pownal, was investigated for PFAS contamination.

The Sampling Strategy

As part of the investigation, DEC sampled over 150 drinking water wells in Pownal (Pownal Center, Pownal Village, North Pownal) for PFAS. Sampling also included testing at the Pownal Tannery Superfund site, another source of PFAS in Pownal. This included groundwater and landfill leachate sampling which was found to contain elevated levels of PFAS.

The Results

- A public water supply well (Fire District 2) which supplied water to 400 people and several private drinking water wells were contaminated with PFAS above the standard, associated from the Warren wire facility.
- Over 40 drinking water wells tested positive for PFAS and more than 30 had levels greater than the state's PFAS drinking water standard of 20 ppt. The maximum level of PFAS detected in a drinking water well was 110 parts per trillion (ppt).

The Response

A large-scale Granulated Activated Carbon (GAC) water treatment system was installed on the public well to remove the PFAS contamination, while private wells received POETs. An evaluation of Corrective Action Alternatives is currently being reviewed to determine the best remedy to ensure clean drinking water for the PFD2 water system. Additional site investigation and monitoring in Pownal is ongoing, which includes collecting soil and groundwater samples. These samples will help define the degree and extent of PFAS and to confirm the source(s) of PFAS. This work is currently being performed by APU (General Cable).

Additional Wire coating operations

Following the discovery of contamination at the former Warren Wire facility, the DEC investigated seven additional wire coating facilities throughout Vermont:

- Phoenix Wire facility (South Hero)
- Champlain Cable facility (Colchester)
- Harbour Industries facilities (Shelburne and Colchester)
- Supertemp facilities (South Burlington and Winooski)
- Belden Wire & Cable facilities (Essex and Williston)

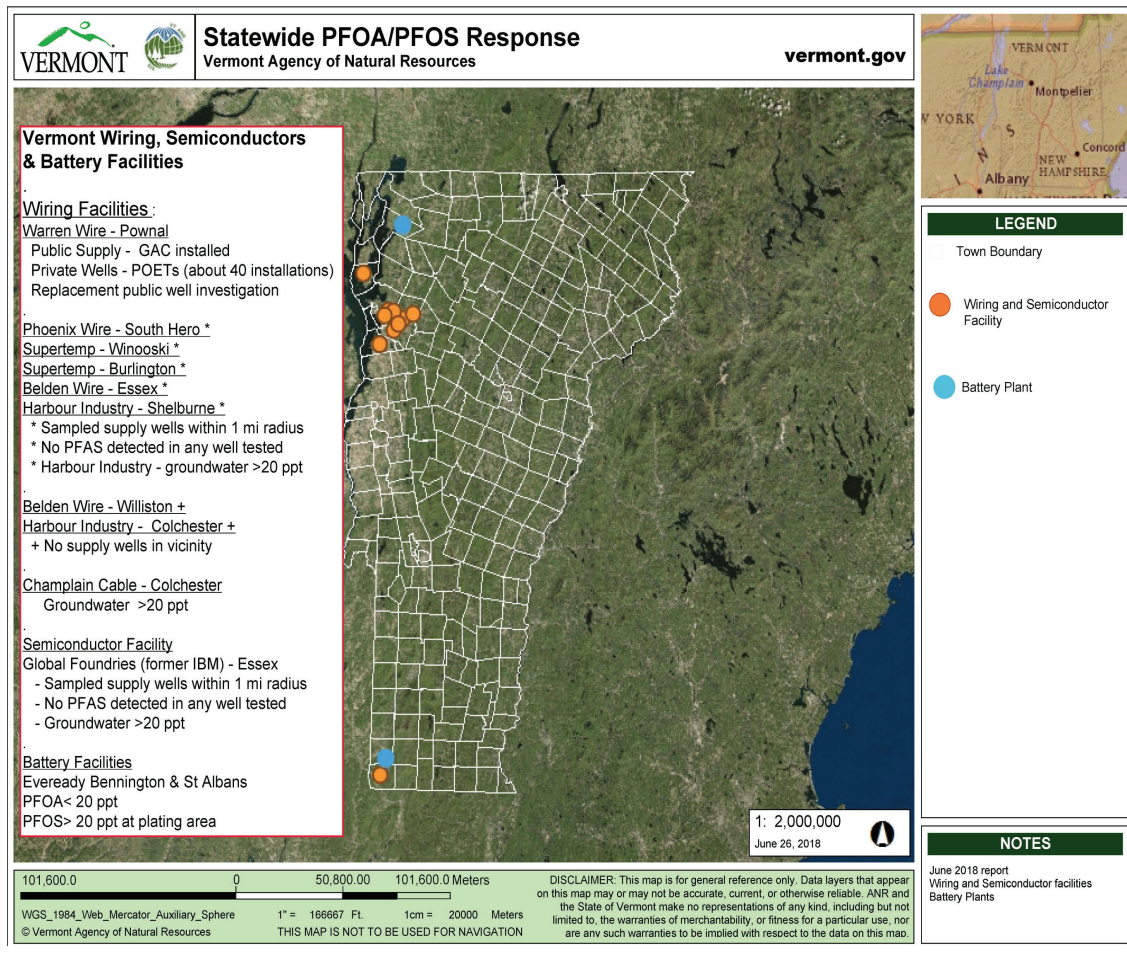
WIRE COATING FACILITIES

The Sampling Strategy

The investigation of these wire coating facilities included testing water supply wells within a one-mile radius around Phoenix Wire, Belden Wire (Essex), Supertemp (South Burlington and Winooski), and Harbour Industries (Shelburne). EPA Region 1's Pre-Remedial Program helped with the collection and analysis of samples at these facilities.

The Results

- No PFAS contamination was discovered in any of the water supplies tested.
- No drinking water supplies were identified near Belden Wire (Williston) and Harbour Industries (Colchester).
- The Champlain Cable property and the former Harbour Industries property (Shelburne) had elevated levels of PFAS contamination in groundwater.
- No PFAS was detected in any of the drinking water wells sampled within a one-mile radius of the Harbour Industries facility in Shelburne.



SEMI-CONDUCTOR FACILITY

The DEC requested that PFAS contamination be investigated at the Global Foundries (formerly IBM) facility in Essex. The results of the testing found elevated levels of PFAS contamination in groundwater. No PFAS was detected in any of the drinking water wells sampled within a one-mile radius of the facility.

BATTERY MANUFACTURING

The Sampling Strategy:

The DEC requested that Eveready Battery manufacturing facilities in Bennington and St Albans investigate their facilities to determine if PFAS contamination was present from their operations.

The Results

- Low levels of various PFAS (PFOA, PFHxA, PFBS, PFHxS and PFOS) were found in several existing monitoring wells located outside the former Eveready facility in St Albans. None of the concentrations were above groundwater enforcement standards.
- PFOS was found above groundwater enforcement standards in one well directly down gradient of the former metals plating area. The plating area (and the former plating processes) are the likely source of this PFOS.
- Although the available data indicate that it is unlikely that this contamination is widespread, Eveready conducted more PFAS sampling in March 2018 to determine the extent of the PFOS contamination. This sampling confirmed that the extent of the PFOS likely related to former plating activities is confined to the groundwater below the former plating room.
- Groundwater samples were collected from existing monitoring wells at and near the Eveready factory in Bennington. PFOA was found in very low concentrations in the existing monitoring wells located directly down gradient of the manufacturing facility. The PFOA found in these wells is likely from other sources in the Bennington area, most likely the Chemfab site. PFOA was found in a concentration of 20 ppt in one well significantly down gradient from the facility. This is not likely due to activities at the Bennington Eveready facility.

FIRE FIGHTING FOAM

The DEC investigated several locations where Aqueous Film-Forming Foam Concentrates (AFFF) fire-fighting foam was used. AFFF is used for emergency response and training and most of this foam contains PFAS.

The Sampling Strategy

The DEC sampled six locations known to use AFFF:

- Air National Guard facility (South Burlington)
- Camp Ethan Allen Training Site (Jericho/Underhill)
- Vermont Fire Training Academy (Pittsford) and
- Southern Vermont Airport (Clarendon)
- 2 locations where vehicle accidents occurred and AFFF foam was used to extinguish a chemical fire. This included a gasoline tank truck accident in Chester and a truck accident in Rockingham resulting in a 200-gallon diesel release.

The Results and Response

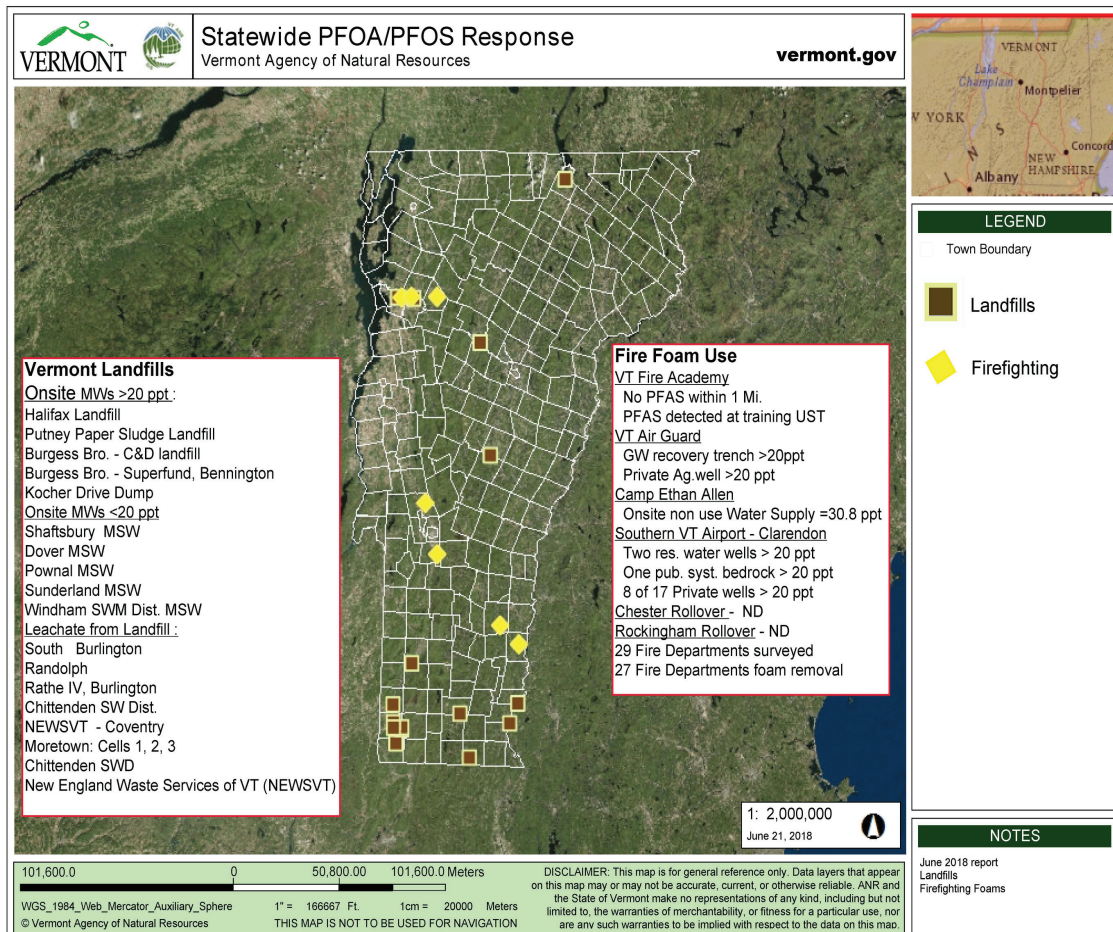
- PFAS was detected in water supply wells associated with both the Air National Guard site and the Ethan Allen Firing Range.
 - At the Air National Guard site, PFAS (mainly PFOS, PFHxS, and PFOA) were found at concentrations above standards in a groundwater recovery trench and in a private well that is used primarily for agricultural purposes. In response, a GAC water treatment system was installed on the agricultural well to remove the PFAS contamination.
 - At the Camp Ethan Allen Training Site, one onsite water supply well had PFOA at 30.8 ppt. At this time, this water supply is not being used for drinking.
 - No PFAS was found in drinking water supplies within one mile of the Vermont Fire Training Academy, although PFAS has been detected in an onsite water recycling underground tank.
 - At the Southern Vermont Airport in Clarendon, three private residential water supply wells and a public drinking water system with two bedrock wells serving the Rutland Business Park were found to be contaminated with PFAS above the standard. In response, GAC water treatment systems have been installed on these impacted wells. So far, 55 wells at and around the Airport have been sampled for PFAS with detections in 17 wells.
 - The investigations at the two vehicle accident locations in Chester and Rockingham did not find any drinking water well or groundwater contamination.
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FIRE FIGHTING FOAM

Determining additional sampling locations:

To determine other locations where AFFF foam was used and to determine how much older AFFF foam is in fire department inventories, the DEC worked with the Division of Fire Safety to send a survey to all fire departments in Vermont. 89 fire departments responded to the survey with 29 departments responding that they have Class B AFFF in storage.

In general, these departments are storing anywhere from several 5-gallon containers of AFFF to upwards of 100 gallons of AFFF. Of greatest concern are the old stocks (15+ year old) of AFFF which are more likely to contain PFOA and PFOS and/or precursor compounds that react to form PFOA and PFOS. Six departments have AFFF stocks that are 20+ years old and another 8 departments reported having stocks that are 11-20 years old. Twenty-seven fire departments responded that they are interested in having any Class B foams containing PFOA and/or PFOS removed from their site.



LANDFILL GROUNDWATER

The Sampling Strategy

The DEC and the Environmental Protection Agency (EPA) investigated landfills in Bennington and Windham Counties. These included:

- Burgess Brothers construction and demolition (C&D) debris landfill and the Burgess Brothers Superfund site (Bennington)
- Municipal solid waste landfills (Pownal, Sunderland, Shaftsbury, Dover, Bennington and Halifax)
- Windham Solid Waste Management District MSW and Asbestos landfills
- Putney Paper sludge landfill (Putney)

The Results

- PFAS was found in the groundwater at all sites both above and below the standard.
- The Burgess Brothers C&D landfill, Putney Paper sludge landfill, Shaftsbury MSW landfill and Halifax landfill reported groundwater concentrations above the standard. A summary of these results can be found in Table 1 below.
- Drinking water supplies near these landfills were sampled and no drinking water well had PFAS concentrations above standards. The Shaftsbury Landfill had two supply wells with concentrations of PFAS at levels below the standard. The DEC continues to monitor these locations for changes in concentration levels. One of these supplies was found to be above the standard during a follow-up test. A POET has been installed on this supply.
- Groundwater was tested at the Pownal landfill. No PFAS compounds were detected.
- The Burgess Brothers Superfund site had PFOA detected in groundwater above the standard, however groundwater has been reclassified due to historic chlorinated solvent contamination and therefore cannot be used for as a drinking water source. Groundwater is also being collected in two treatment trenches and treated with GAC. The PFOA in the discharge water is non-detect.
- At the former Kocher Drive Dump, EPA sampled four onsite overburden monitoring wells, one offsite private supply well, an offsite geothermal well and an artesian well used by District Court House. Results indicated the presence of PFAS above drinking water standards in all wells sampled except the artesian well. The home with the impacted private well has been connected to municipal water.

Table 1. Landfill Groundwater Monitoring Well Sampling
Modified EPA Method 537 – Short List

<i>Units ng/l (ppt)</i>	Shaftsbury Municipal MSW	Halifax Municipal MSW	Dover Municipal MSW	Pownal Municipal MSW	Sunderland Municipal MSW	WSWMD Regional MSW	Putney Paper Paper Sludge	Burgess Brothers C&D	Burgess Superfund
Sample Date (month/year)	10/17	10/17	9/16	9/16	10/16	12/16	10/16	10/16	3/16
PFOA	11.3	44.9	8.43	14	2	8.99	18	900	64
PFOS	ND	37	4.98	5	ND	ND	11	140	ND
TOTAL	11.3	81.9	13.41	19	2	8.99	29	1040	64

LANDFILL LEACHATE

The Sampling Strategy

The DEC also requested sampling of leachate at the five landfills in the state with active leachate collection systems. These included the NEWSVT landfill in Coventry (Vermont’s only operating landfill) and the Moretown, Chittenden Solid Waste District, South Burlington, Rathe IV (owner-Burlington) and Randolph closed landfills.

Due to the challenges associated with analyzing leachate due to the presence of other compounds that can cause interference in the analysis, the DEC requested two separate analyses: MLA 110 method and Modified EPA Method 537. The MLA 110 method meets the requirements for the Department of Defense (DoD) QSM 5.1 and the National Environmental Laboratory Accreditation Program (NELAP) for the various matrix types. The Modified EPA Method 537 is a modified drinking water analytical method.

The Results

Table 2 provides a summary of these results. In general, the results showed elevated levels of PFOA and PFOS in all samples and for both methods with the highest concentrations at NEWSVT active landfill and the most recently closed landfills (Randolph and Moretown). Several other PFAS compounds were detected in this testing as well.

Table 2. Landfill Leachate PFAS Sampling Results (3/13/2018)

MLA 110 Method

Units ng/l (ppt)	Recommended Guidelines: Concentration requiring no restrictions	South Burlington	Randolph	Randolph (duplicate)	Rathe (Burlington)	Chittenden Solid Waste District (CSWD)	New England Waste Services of Vermont (NEWSVT)
PFOA	120,000	79.5	2,110	2,030	110	379	1,850
PFOS	1,000	29.6	278	217	99.1	22.5	244

Modified EPA Method 537

Units ng/l (ppt)	Recommended Guidelines: Concentration requiring no restrictions	Moretown: Cell 1 *	Moretown: Cell 2 *	Moretown: Cell 3 *	Chittenden Solid Waste District (CSWD) *	New England Waste Services of Vermont (NEWSVT)
PFOA	120,000	1,400	2,800	1,900	418	1,050
PFOS	1,000	250	300	270	ND	110

* denotes a sample that was taken and analyzed independently by the landfill owner and reported to the SWMP

LANDFILL LEACHATE

The Results, Continued

In all cases, the results were below DEC-recommended guideline concentrations that would require treatment by the landfill prior to off-site management. In the absence of national regulatory surface water standards, these guidelines were developed based on a review of ambient surface water criterion for PFOA and PFOS. Utilizing the most stringent ambient surface water criterion reviewed for PFOA and PFOS, the Landfill Leachate Guideline Limits were derived to ensure receiving waters of facilities permitted to receive landfill leachate do not exceed the most stringent ambient surface water criterion for PFOA and PFOS. As such, if these guidelines are followed there should be no adverse impact to the environment or human health.

MEDIA-BASED RESULTS

Public Drinking Water Supply Testing

Over two dozen public water supplies in Vermont have been tested for PFAS. Much of this was done as part of an EPA effort (known as the Third Unregulated Contaminant Monitoring Rule, or UCMR3) to identify the occurrence and extent of PFAS throughout the country.

Results of that effort indicated that detectable PFOA contamination in public water supplies tends to be associated with localized air emissions or discharges. Of the public water supplies tested in Vermont, 21 systems were found to be below detection limits for any PFAS contamination. Of the five public water systems that tested positive for PFAS, three were part of the Bennington PFOA problem (TNCs), one was the public water supply found to be contaminated in Pownal (Pownal Fire District 2) and the other was the public well serving the Airport Business Park in Clarendon. The public water supplies serving both Bennington and North Bennington were tested and PFAS was not detected in numerous samples collected. Additional public water supplies will be tested near known PFAS sources.

MEDIA-BASED RESULTS

Surface Water, Sediment and Fish

Some limited work has been conducted to evaluate PFAS contamination in surface waters, sediment and fish tissue, samples were collected and analyzed using EPA Method 537 modified for 6 PFAS compounds, which include PFOS and PFOA. In Bennington, a total of 10 sediment samples were taken from Paran Lake, Paran Creek, the Walloomsac River and a small pond all near the former Chemfab plant on Water Street in North Bennington. The highest level of PFOA in sediment was 2.4 ppb in the Walloomsac River below the confluence of Paran Creek.

Surface water was also collected at these sites, the highest concentration of PFOA found was in the Bennington College pond at 79.3 ppt. Surface water samples from Paran Creek, below the Chemfab facility ranged from 22.9 - 37.6 ppt -PFOA. PFOA concentrations observed in the sediment and surface water were considerably lower than the concentration that would pose a risk to human health or the most sensitive aquatic species.

Fish were collected from Lake Paran, Paran Creek and the Walloomsac River. Fish tissue fillet samples from 15 fish representing five species of fish were analyzed using EPA Method 537 modified for six PFAS, which include PFOA and PFOS. The results showed a maximum concentration of PFOA and PFOS of 2.5 ppb and 4.68 ppb respectively. These levels were determined not to pose a risk to the public consuming these fish.

Wastewater Treatment Facilities and Sludge/Biosolids

With the discovery of PFAS contamination in Bennington and the high probability of discharge of PFAS to the sewer and to the Bennington Wastewater Treatment Facility (WWTF), samples of sludge were collected at the Bennington WWTF in April 2016 and analyzed for PFOA and PFOS using EPA modified method 537. The results of this testing showed PFOA and PFOS at an average concentration of 7 µg/kg and 8 µg/kg (ppb), respectively. Bennington WWTF sludge was also analyzed using a synthetic precipitation leaching procedure (SPLP) and PFOA was detected in the leachate from the sludge at 68 ng/L (ppt) while PFOS was not detected.

MEDIA-BASED RESULTS

Wastewater Treatment Facilities - Influent/Effluent

The DEC also investigated PFAS contamination at six WWTFs that receive leachate from Vermont landfills. These WWTFs included Randolph, Barre, South Burlington-Airport Parkway (AP), Burlington-Main, Newport and Montpelier. In January 2018, influent, effluent and sludge/biosolid samples were collected from these WWTF's and analyzed via two methods: EPA modified 537 and MLA 110. Results of this testing showed PFAS contamination in the part per trillion (ppt; ng/L) range in wastewater influent and effluent samples and concentrations in the part per billion (ppb; µg/kg) range for sludge/biosolids samples. The two methods of analysis used for wastewater influent and effluent samples showed that the detection limits of the modified 537 method were much higher than MLA 110, therefore, MLA 110 achieved more reliable results. PFOA concentrations in wastewater influent and effluent samples, analyzed by MLA 110, ranged from non-detect to 94 ppt (average 19 ppt) and 3.1 to 50 ppt (average 22 ppt), respectively, and PFOS concentrations in wastewater influent and effluent samples ranged from non-detect to 16 ppt (average 7 ppt) and 1.2 to 10 ppt (average 4 ppt), respectively.

A comparison of influent to effluent sample concentrations of PFOA and PFOS within the same WWTF, analyzed by MLA 110, shows a lack of consistent trends. For example, concentrations of PFOA and PFOS in influent samples were greater than in effluent samples collected from the Montpelier WWTF, but effluent concentrations were greater than influent for samples collected from the Newport WWTF. Furthermore, samples collected from the Randolph WWTF, showed that the concentration of PFOA was six times greater in effluent but concentrations of PFOS were eight times greater in influent samples. Research has shown that there are many parameters affecting the formation and transformation of PFAS during wastewater treatment, and it is not uncommon to observe higher concentrations of some PFAS in the effluent, then are observed in the influent. Since Bennington WWTF hauls sludge to the Hoosick Falls Water Quality District (Williamstown, MA) for composting to biosolids, samples of composted biosolids were also collected in June 2016. Biosolids were analyzed by EPA method 537 and PFOA and PFOS were not detected in samples, however, SPLP (leachability testing) detected PFOA and PFOS in the leachate from the biosolids at 61 and 11 ng/L (ppt), respectively.

Samples of septage were collected from residential septic tanks in Bennington in May and June 2016. Septage was analyzed by method 537 and PFOA was detected at 69 ug/kg (ppb) while PFOS was not detected. Septage was also analyzed using the SPLP method (leachability) and PFOA was detected at 430 ng/L (ppt) while, similarly, PFOS was not detected.

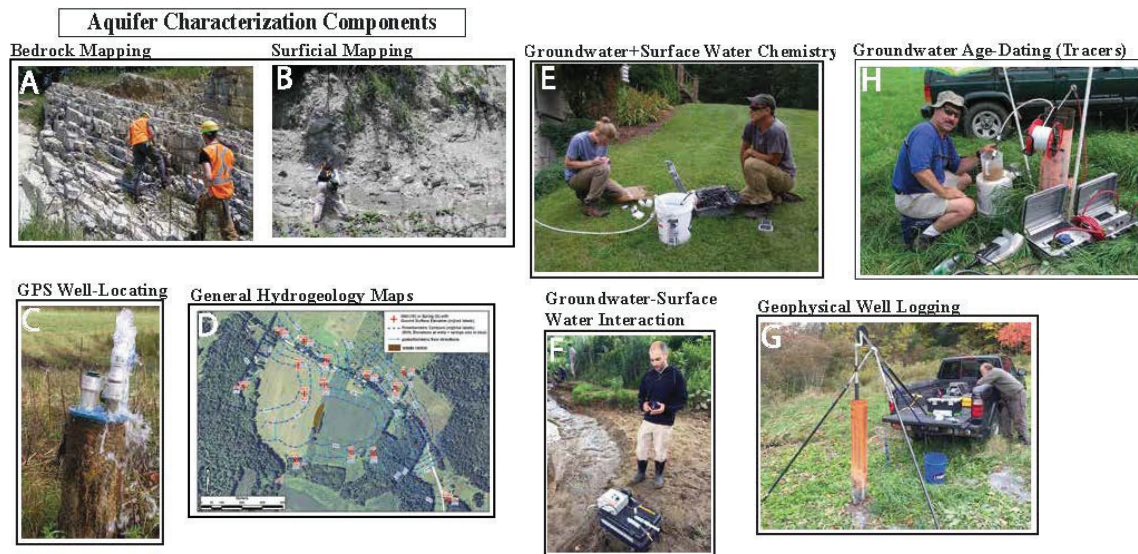
MEDIA-BASED RESULTS

Wastewater Treatment Facilities - Influent/Effluent, Continued

Similar to wastewater influent and effluent samples, analysis of sludge/biosolids via MLA 110 achieved more reliable results. In fact, analysis of sludge/biosolids using modified EPA method 537 did not yield results for any PFAS compounds above detection limits. Sludge/biosolids samples analyzed by MLA 110 resulted in PFOA concentrations ranging from 0.67 to 13 ppb, with the highest concentration detected in sludge samples from the Randolph WWTP. PFOS concentrations ranged from 5.6 to 17.7 ppb, with the highest concentration detected in biosolids samples collected at the South Burlington-AP WWTP. SPLP analysis was carried out on samples of sludge collected from South Burlington-AP and Burlington-Main and detected PFOA in leachate from sludge at 4.99 and 4.25 ppt, respectively, and PFOS at 22.7 and 3.34 ppt, respectively.

Geologic Investigations

The Vermont Geology Division has worked extensively with multiple academic and federal partners to better understand the fate and transport of PFOA in Bennington area. Our aquifer characterization group includes DeSimone Geoscience Investigations; Middlebury College, Bennington College, University of Massachusetts/Amherst, and EPA Region I; State University of New York at Plattsburgh; and the U.S. Geological Survey. The Geology Division has completed tasks A, C, and D and is collaborating with the partners on tasks E, F, G, and H. Ongoing fieldwork includes the geophysical logging of 8 additional wells and groundwater-surface water interaction sampling. Groundwater age dates should be available to us by the end of this year.



FUTURE STATEWIDE RESPONSE

The Vermont Department of Health issued a revised Health Advisory level on July 10, 2018. This Advisory added three additional PFAS compounds to the 20 ppt standard. These are PFHxS (perfluorohexane sulfonic acid), PFHpA (perfluoroheptanoic acid) and PFNA (perfluorononanoic acid). Test results from the previously identified sites have been evaluated to determine if these additional PFAS compounds are present. Additional compounds were found in a limited number of locations and the effect on the overall response has been limited.

The DEC will continue to investigate other potential sources of PFAS to ensure Vermonters have safe drinking water. Based on initial research by the DEC, a number of Vermont industries and businesses may have used PFAS in the state. The DEC is looking to gather additional information on the processes used at these industries before moving forward with requests for PFAS testing.

These industries include:

- electroplating
- specialty/Performance coatings (e.g., PTFE coated ductwork, circuit boards)
- capacitor manufacturing
- aircraft turbine manufacturing
- impregnated/coated paper products
- plastic injection molding
- plastic extrusion (PFAS based plastics)
- paint manufacturers
- car washes
- tanneries
- AFFF fire-fighting foam locations

In addition, the DEC has begun an investigation into the use of floor cleaners and floor waxes used at schools. The DEC has strategically identified several schools with on-site drinking water wells. The DEC plans to sample these wells in July 2018.

The DEC has also requested that all closed, regulated landfills in the state sample for PFAS analysis in conjunction with regularly scheduled sampling that occurs at these landfills. This request went to 32 landfills and the sampling will occur in May or October of 2018.



PFAS STATUS REPORT

VERMONT'S STATEWIDE
PFAS SAMPLING PLAN

STAY
UPDATED

[DEC.VERMONT.GOV/COMMISSIONERS-
OFFICE/PFOA/COMMUNITIES](http://DEC.VERMONT.GOV/COMMISSIONERS-OFFICE/PFOA/COMMUNITIES)

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