INVESTIGATING AFFF USE AT A REGIONAL AIRPORT

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STATE OF VERMONT AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WASTE MANAGEMENT & PREVENTION DIVISION
SITES MANAGEMENT SECTION

DATE OF PRESENTATION:
MARCH 7, 2019
AQUEOUS FILM FORMING FOAMS (AFFF)

- AFFF is a concentrate that is blended with water to create a foam that is intended for fighting high-hazard liquid fires
- Of most concern are PFAS-containing Class B AFFF

AQUEOUS FILM FORMING FOAM (AFFF)

- Only 3% of fluorochemical production is for AFFF
  - 75% of AFFF production used by military
  - 25% used by oil refineries, municipal airports, fire stations, tank farms

Complex, proprietary mixtures

PFASs a few % in mixture but still g/L levels

Brief history
- Mid 1960s - 1970: 3M sole source supplier of AFFF
- 1973: National Foam
- 1976: Ansul
- 1994 to present: Angus, Chemguard, Fire Service Plus

Bottom line = multiple AFFFs used at most sites

Slide courtesy of ITRC (Interstate Technology & Regulatory Council)
WHERE CLASS B AFFF IS IN SERVICE/DISCHARGED:

- Chemical Plants
- Flammable liquid storage and processing facilities
- Larger Airports (aircraft rescue and firefighting, hangars)*
- State HAZMAT Team
- Military Facilities*
- Fire Training Facilities
- Local Fire Departments
- Merchant Operations (oil tankers, offshore platforms)

* Currently required to use AFFF that meets the requirements of the U.S. Department of Defense (DoD) Military Specification (MILSPEC) “Fire Extinguishing Agent, Aqueous Film-Forming Foam”

INVESTIGATING AFFF USE IN VERMONT

- Search the Vermont Spill Program’s spill reports for hazardous material fires, tanker fires, and other rollovers and crashes
- Identify military bases that have fire fighting capabilities
  - Vermont Air National Guard
  - Camp Ethan Allen Training Site
- Identify **FAA Part 139** Airports in the State
  - Burlington International Airport (BTV)
  - Rutland Southern Vermont Regional Airport (RUT)
- Identify fire training centers in the State
- Monitor incoming spill reports for accidents with fires that may have had AFFF releases as part of the emergency response
Part 139 Airports have operating certificates from the FAA that require certain safety and service requirements, including:

- Fueling Facilities
- Certain Terminal Requirements
- Night Operations
- Aircraft Rescue and Fire Fighting (ARFF)
AIRCRAFT RESCUE & FIRE FIGHTING (ARFF) REQUIREMENTS AT FAA PART 139 AIRPORTS

- Must have onsite ARFF capabilities including a pumper truck
- The pumper truck must be full of Class B AFFF at all times
- Required to use AFFF that meets the DoD MILSPEC for Aqueous Film-Forming Foam
- Airport must keep enough AFFF onsite to fill the truck 3 times in the event of an emergency
FAA-MANDATED AFFF AND EMERGENCY RESPONSE TESTING

- Each year, the FAA requires testing of the ARFF equipment, the AFFF, and First Responders

- **ARFF Equipment Testing:**
  - The pumper truck has its turrets and hand valves opened to ensure they effectively spray foam

- **AFFF Testing:**
  - The AFFF is tested to ensure it has the appropriate surface tension, expansion ratio, and other criteria

- **Emergency Response Testing:**
  - First Responders are tasked with responding to a mock emergency on the airfield. When they arrive on the scene, they are timed as to how long it takes for them to set up on a scene and run the pumps
DOES YOUR AIRPORT HAVE ONE OF THESE?

H₂O Capacity: 300 gallons
AFFF Capacity: 40 gallons
...OR ONE OF THESE?

H₂O Capacity: 1,250 gallons

AFFF Capacity: 130 gallons
**FAA LISTING OF PART 139 AIRPORTS**

https://www.faa.gov/airports/airport_safety/part139_cert/

<table>
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<th>State</th>
<th>Airports</th>
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<td>CA &amp; TX</td>
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</table>

Part 139 Airports by State

**Part 139 Airport Certification Status List (ACSL)**

The airport classifications listed below are PRELIMINARY and SUBJECT TO CHANGE. Please coordinate with your Regional Airports Office to ensure your airport has the appropriate airport classification in accordance with the revised Part 139.

Shaded rows indicate where state listings begin.

<table>
<thead>
<tr>
<th>State</th>
<th>Airport Name</th>
<th>Associated City</th>
<th>Airport Iden.</th>
<th>Inactive Status</th>
<th>Large Hub?</th>
<th>New Part 139 Classification</th>
<th>ARFF Index</th>
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<td>Cordova</td>
<td>COD</td>
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POTENTIAL AREAS OF CONCERN - AIRPORT

- AFFF Storage Areas
- Areas on the airfield where AFFF was applied as part of an emergency response (**ie. plane crashes**)
- Firefighting training areas, burn pits, or other areas where AFFF may have been discharged as part of training
- Areas where AFFF was discharged as part of FAA testing
- Areas where AFFF was loaded or removed from ARFF vehicles during maintenance
- Historical disposal areas
- Airport stormwater system discharge points
- Pipeline terminals/bulk storage areas
- Hangars with engineered fire suppression systems using AFFF

Sources, Pathways & Receptors

Airport Firefighting

Located in Clarendon, VT
BEFORE THE AIRPORT

Pictures are courtesy of the Historical Society of Clarendon Vermont
AIRPORT CONSTRUCTION

Begins in 1942

Pictures are courtesy of the Historical Society of Clarendon Vermont
RUTLAND AIRPORT - 1946
GEOLOGY

- **Bedrock - Two Types:**
  - **Clarendon Springs Formation (Upper Cambrian)**—Steel-gray-weathering, light-gray, massive calcitic dolostone grading upward into darker, more fissile calcitic dolostone containing white quartz knots near top; unit locally brecciated. Locally contains light-blush-gray to whitish-gray calcite marble (CspL) within dolostone and beneath the calcitic marbles of the overlying Shelburne Marble
  - **Winooski Dolostone (Middle Cambrian)**—Well-bedded dolostone weathering beige, cream, and buff, with green, red, or gray phyllite, siliceous partings, and thin beds of blue-quartz-pebble conglomerate and quartzite

- **Surficial Geology:**
  - Recessional moraine deposits on most of the site
  - Kame moraine deposits with sand deposits and ice contact outwash gravel in the eastern part of the site
CLARENDON GORGE

BEDROCK OUTCROPS
DRINKING WATER WELLS NEAR THE AIRPORT

- Within 1/4-mile of airport:
  - 83+ Private Wells
  - 5 Public Wells (3 at airport)
  - 2 Source Protection Areas*
    *both located on airport property

- Within 1-mile of airport:
  - 253+ Private Wells
  - 9 Public Wells
  - 3 Source Protection Areas
WHEN DID THE AIRPORT START USING AFFF?

Before the August 6, 1986 Crash & Fire

- Learjet took off from the wrong runway (too short)
- Plane went thru fence at end of the runway and came to rest in a field on the other side of Route 7B
- The plane was carrying 1,000lbs of Jet Fuel
- Fire broke out and was extinguished with AFFF
- According to fire officials the plane was covered in AFFF throughout the salvage operation as well
The fuel tank in the right wing apparently burned, Lloyd said. Firefighters covered the plane with foam and water to prevent explosions and further fire from two remaining intact fuel tanks, he said. The plane was carrying about 1,000 pounds of aviation fuel, he said.
AVIATION ACCIDENT RESEARCH

- Review NTSB Aviation Accident Database
  
  
  - Doesn’t always pinpoint the exact location of the crash
  - Doesn’t specifically indicate if AFFF was applied

- Interview First Responders
- Talk to Airport Employees
- Talk to Residents & Town Officials
- Review Historic Newspapers
- State Police Reports are also available
AIRPORT AFFF OPERATIONS
AIRPORT AFFF OPERATIONS

Main AFFF Testing Area

ARFF Building

Airport Business Park Water System Wells

Rutland Airport Water System Well
WATER SUPPLY TESTING SUMMARY

- 77 Bedrock supply wells sampled
- PFAS detections in 25 wells
- 4 Springs sampled; 2 with PFAS > VGES
- Treatment systems installed on 8 bedrock supply wells
  - 5 Residential Point of Entry Treatment (POET) Systems
  - 1 Agricultural POET
  - Airport Business Park Water Treatment System (2 wells)
- Furthest wells with detections are 1-½ miles southwest of the Airport
### Business Park Water System Wells

**March 2018**

<table>
<thead>
<tr>
<th></th>
<th>Well #1 (ng/L)</th>
<th>Well #2 (ng/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfluoroheptanoic Acid (PFHpA)</td>
<td>19</td>
<td>28</td>
</tr>
<tr>
<td>Perfluorooctanoic Acid (PFOA)</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>Perfluorononanoic Acid (PFNA)</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Perfluorobutanesulfonic Acid (PFBS)</td>
<td>14</td>
<td>ND&lt;1.8</td>
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<tr>
<td>Perfluorohexane Sulfonic Acid (PFHxS)</td>
<td>140</td>
<td>4.5</td>
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<tr>
<td>Perfluorooctane Sulfonic Acid (PFOS)</td>
<td>26</td>
<td>6.1</td>
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<tr>
<td>Perfluorohexanoic Acid (PFHxA)</td>
<td>45</td>
<td>83</td>
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</table>

**TOTAL PFAS INCLUDED IN DWHA** *

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Well #1 - Northern One</strong></td>
<td>960' Deep, Pump ø +/- 300'</td>
</tr>
<tr>
<td><strong>Well #2 - Southern One</strong></td>
<td>580' Deep, Pump ø +/- 300'</td>
</tr>
</tbody>
</table>

*NOTE:* As of the date of this presentation (March 7, 2019), the Vermont Drinking Water Health Advisory (DWHA) is 20 parts per trillion (ppt) for the sum of PFHpA, PFOA, PFNA, PFHxS, and PFOS.
AIRPORT BUSINESS PARK WATER SYSTEM

- PFAS Contamination Discovered in March 2018
- Bottled water and water totes provided to businesses and industries in the park
- Engineered treatment system constructed
  - Average Daily Demand = approx. 3,000 gal/day
  - Granulated Activated Carbon-based system
  - 4-48”x72” vessels that contain 54ft³ of GAC
- ‘Do Not Drink’ Order lifted on Sept. 1, 2018
SELECT RESIDENTIAL SUPPLY WELL RESULTS

<table>
<thead>
<tr>
<th>Bedrock Supply Well</th>
<th>Concentration</th>
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<tbody>
<tr>
<td>Perfluorobutanoic Acid (PFBA)</td>
<td>3.2 ng/L</td>
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Bedrock Supply Well - 165ft Deep

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<tr>
<td>Perfluorobutanoic Acid (PFBA)</td>
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<tr>
<td>Perfluorooctanoic Acid (PFOA)</td>
<td>16 ng/L</td>
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<tr>
<td>Perfluoropentanoic Acid (PFPeA)</td>
<td>79 ng/L</td>
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<tr>
<td>Perfluorohexane Sulfonic Acid (PFHxS)</td>
<td>3.6 ng/L</td>
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<tr>
<td>Perfluorohexanoic Acid (PFHxA)</td>
<td>45 ng/L</td>
</tr>
<tr>
<td>Perfluoroctane Sulfonic Acid (PFOS)</td>
<td>7.1 ng/L</td>
</tr>
<tr>
<td>Perfluorononanoic Acid (PFNA)</td>
<td>4.5 ng/L</td>
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<td>Perfluoroheptanoic Acid (PFHpA)</td>
<td>28 ng/L</td>
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<tr>
<td>TOTAL PFAS INCLUDED IN DWHA</td>
<td>59.2 ng/L</td>
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<tr>
<td>Bedrock Supply Well - Depth Unknown</td>
<td>Concentration</td>
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<tr>
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<tr>
<td>Perfluoroheptanoic Acid (PFHpA)</td>
<td>2.4 ng/L</td>
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<tr>
<td>Perfluorooctanoic Acid (PFOA)</td>
<td>6.3 ng/L</td>
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<tr>
<td>Perfluorohexanoic Acid (PFHxA)</td>
<td>3.7 ng/L</td>
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<tr>
<td>Perfluoroctane Sulfonic Acid (PFOS)</td>
<td>12 ng/L</td>
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</table>
JUNE 2002: TWO PLANE CRASHES IN ONE MONTH!

Both of these crashes did not have fires as a result of the crash

AFFF was applied as a precaution

Exact locations of these crashes were difficult to find through research*

Local fire departments could apply non-military spec foam on crashes

Articles from the Rutland Herald
### Spring at Barn

<table>
<thead>
<tr>
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<tr>
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<tr>
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<td>Perfluorohexanoic Acid (PFHxA)</td>
<td>140 ng/L</td>
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<td>Perfluorononanoic Acid (PFNA)</td>
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<td>Perfluorobutane Sulfonic Acid (PFBS)</td>
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<tr>
<td><strong>TOTAL PFAS INCLUDED IN DWHA</strong></td>
<td><strong>202.4 ng/L</strong></td>
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### Barn Bedrock Supply Well (480ft)

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<tr>
<td>Perfluorohexanoic Acid (PFHxA)</td>
<td>38 ng/L</td>
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<td><strong>TOTAL PFAS INCLUDED IN DWHA</strong></td>
<td><strong>46.8 ng/L</strong></td>
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### Garage Bedrock Supply Well (445ft)

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<tr>
<td>Perfluoropentanoic Acid (PFPeA)</td>
<td>2.1 ng/L</td>
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<tr>
<td>Perfluorohexane Sulfonic Acid (PFHxS)</td>
<td>4.3 ng/L</td>
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<td>Perfluorohexanoic Acid (PFHxA)</td>
<td>1.9 ng/L</td>
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<tr>
<td>Perfluorooctane Sulfonic Acid (PFOS)</td>
<td>2.0 ng/L</td>
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<tr>
<td><strong>TOTAL PFAS INCLUDED IN DWHA</strong></td>
<td><strong>9.3 ng/L</strong></td>
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SITE INVESTIGATION CHALLENGES...

OFFSITE SOURCES?

BACKGROUND CONDITIONS?

🌟 - Soil Sample Location
<table>
<thead>
<tr>
<th>Concentrations reported as nanograms per kilogram - ng/kg</th>
<th>Airport Taxiway</th>
<th>Lower Clarendon Gorge State Forest</th>
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<td>ND&lt;103.64</td>
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<td>ND&lt;6.82</td>
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<td>ND&lt;7.81</td>
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<td>ND&lt;10.83</td>
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<td>ND&lt;13.01</td>
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ARFF BUILDING GROUNDWATER MONITORING WELL MW-1S

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<td>2,900 ng/L</td>
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<tr>
<td>Perfluoroheptanoic acid (PFHpA)</td>
<td>1,100 ng/L</td>
</tr>
<tr>
<td>Perfluoroheptane sulfonic acid (PFHpS)</td>
<td>69 ng/L</td>
</tr>
<tr>
<td>Perfluoroctanoic acid (PFOA)</td>
<td>340 ng/L</td>
</tr>
<tr>
<td>Perfluoroctane sulfonic acid (PFOS)</td>
<td>760 ng/L</td>
</tr>
<tr>
<td>Perfluorononanoic acid (PFNA)</td>
<td>6.1 ng/L</td>
</tr>
<tr>
<td>Perfluorodecanoic acid (PFDA)</td>
<td>ND</td>
</tr>
<tr>
<td>6:2 Fluorotelomer sulfonic acid (6:2 FTS)</td>
<td>1,200 ng/L</td>
</tr>
<tr>
<td>Analyte</td>
<td>Concentration</td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Perfluorobutanoic acid (PFBA)</td>
<td>1,200 ng/L</td>
</tr>
<tr>
<td>Perfluorobutane sulfonic acid (PFBS)</td>
<td>3.3 ng/L</td>
</tr>
<tr>
<td>Perfluoropentanoic acid (PFPeA)</td>
<td>4,300 ng/L</td>
</tr>
<tr>
<td>Perfluoropentane sulfonic acid (PFPeS)</td>
<td><em>Not Analyzed</em></td>
</tr>
<tr>
<td>Perfluorohexanoic acid (PFHxA)</td>
<td>2,500 ng/L</td>
</tr>
<tr>
<td>Perfluorohexane sulfonic acid (PFHxS)</td>
<td>41 ng/L</td>
</tr>
<tr>
<td>Perfluoroheptanoic acid (PFHpA)</td>
<td>1,200 ng/L</td>
</tr>
<tr>
<td>Perfluoroheptane sulfonic acid (PFHpS)</td>
<td>2.3 ng/L</td>
</tr>
<tr>
<td>Perfluorooctanoic acid (PFOA)</td>
<td>500 ng/L</td>
</tr>
<tr>
<td>Perfluorooctane sulfonic acid (PFOS)</td>
<td>6.6 ng/L</td>
</tr>
<tr>
<td>Perfluorononanoic acid (PFNA)</td>
<td>73 ng/L</td>
</tr>
<tr>
<td>Perfluorodecanoic acid (PFDA)</td>
<td>ND</td>
</tr>
<tr>
<td>6:2 Fluorotelomer sulfonic acid (6:2 FTS)</td>
<td>1,100 ng/L</td>
</tr>
</tbody>
</table>
NEXT STEPS

- Assess the potential for additional contributing sources
- Investigate stormwater discharge areas
- Investigate additional foam testing area
- Install additional groundwater monitoring wells
- Surface water sampling
- Bedrock Geologic Mapping
- Surficial Geologic Mapping
- Geophysical Logging of Bedrock Wells
- Groundwater and Surface Water Chemistry Studies