

Per- and Polyfluoroalkyl Substances (PFAS) in Groundwater at Brookhaven National Laboratory

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Community Advisory Council



AGENDA

- What are Per- and Polyfluoroalkyl Substances (PFAS)?
- PFAS on Long Island
- PFAS Detection and Characterization on BNL Site
- Other Actions on PFAS

What are Per- and Polyfluoroalkyl Substances (PFAS)?

What are PFAS?

- Per- and Polyfluoroalkyl Substances are a diverse group of compounds that are resistant to heat, water and oil
- Used in many industrial applications and consumer products
 - Firefighting foam since 1960s. Used for Class B (hydrocarbon) fires
 - Class B fires include flammable liquids or gasses, such as gasoline, solvents, propane
 - Teflon-coated cookware
 - Stain-resistant carpets
 - Fast-food wrappers and other paper products
 - Water-resistant textiles (e.g., Gore-Tex)

Problems with PFAS

- PFAS contamination is an emerging issue internationally
 - There have been >3,000 PFAS compounds developed
 - Products can contain mixtures of these compounds
 - Persist in soils and groundwater for long periods of time
 - Potential health effects
- In drinking water, the current focus is on six PFAS compounds. In 2016, EPA established a Lifetime Health Advisory Level of 70 ng/L for two of the compounds PFOS/PFOA
 - PFOS = Perfluorooctane sulfonate
 - PFOA = Perfluorooctanoic acid
- PFOS/PFOA production in the US was phased out starting in the early 2000s due to environmental and health concerns

Possible Health Concerns

- PFOS and PFOA have been studied, however many of the other PFAS compounds have not
- Primary route of entry appears to be ingestion of contaminated water, food or dust.
- Long biological half-life in humans: 8 years for PFOA; 5.4 years for PFOS; 72 hours for PFBA
- According to a recent ATSDR report, in highly exposed communities near PFAS manufacturers there are increased rates of:
 - Pregnancy induced hypertension
 - Increased cholesterol levels
 - Liver damage
 - Thyroid disease
 - Asthma
 - Decreased fertility
 - Developmental delays in fetuses and children
 - Considered a possible carcinogen by EPA and IARC. Increased risk for certain cancers in highly exposed individuals (occupational exposures from manufacturing operations)
- Estimated to be present in blood of ~95% of the general US population

ATSDR = Agency for Toxic Substances and Disease Registry (part of DHHS)

IARC = International Agency for Research on Cancer

PFAS on Long Island

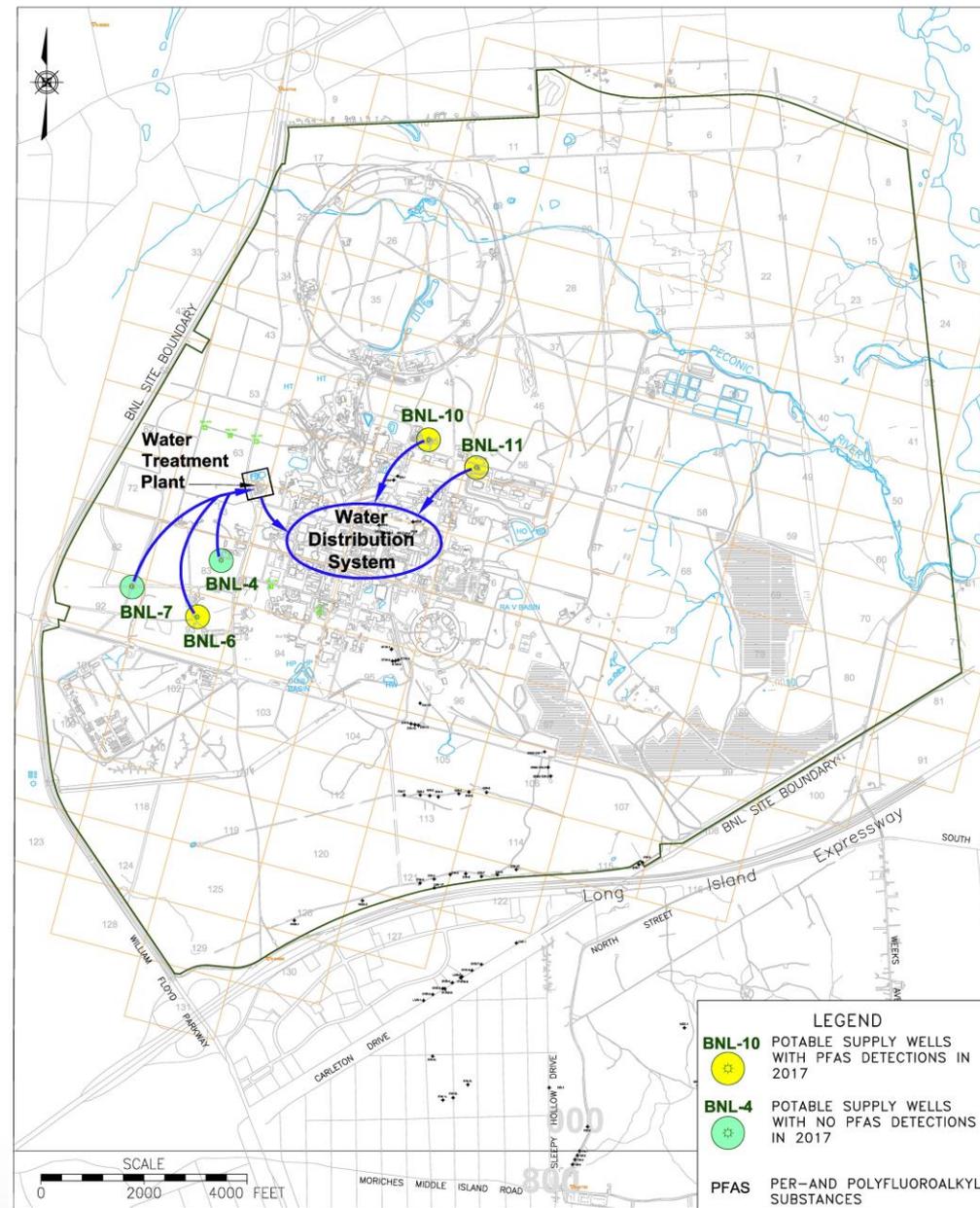
PFAS on Long Island

- Possible soil and groundwater contamination
 - Waste disposal
 - Landfills (e.g., East Quogue, NY)
 - Areas where firefighting foam was used
 - Airports
 - Regional fire training facilities
 - Local firehouses/substations?
- PFAS detected in Long Island groundwater linked to firefighting foam. Examples:
 - Yaphank Fire Training Facility
 - Former Grumman Site - Calverton
 - Air National Guard Base at Gabreski Airport
 - East Hampton Airport
 - Islip MacArthur Airport?
 - East Patchogue/Medford?
- Water can be treated by using granular activated carbon filters

PFAS Detection and Characterization on BNL Site

2017 - First Testing for PFAS in Groundwater at BNL

- Suffolk County tested water samples from BNL's potable water wells for PFAS
 - Tested for the six PFAS compounds evaluated under EPA's Safe Drinking Water Act program "Third Unregulated Contaminant Monitoring Rule"
 - Results compared with 70 ng/L Lifetime Health Advisory Level for PFOS/PFOA
- PFAS were detected in three of BNL's five active water supply wells.
 - Confirmed by analyzing multiple samples during 2017 and 2018
 - PFOS/PFOA concentrations
 - Wells 10 and 11: up to 27 ng/L
 - Most recent = 27 ng/L
 - Well 6: up to 70.4* ng/L
 - Most recent = 33 ng/L
- Routine testing for PFAS was added to potable water monitoring program in 2018



*QA problems with analysis of the June 2018 sample that indicated 70.4 ng/L. All other samples from well 6 have been <58 ng/L.

Water Treatment and Distribution

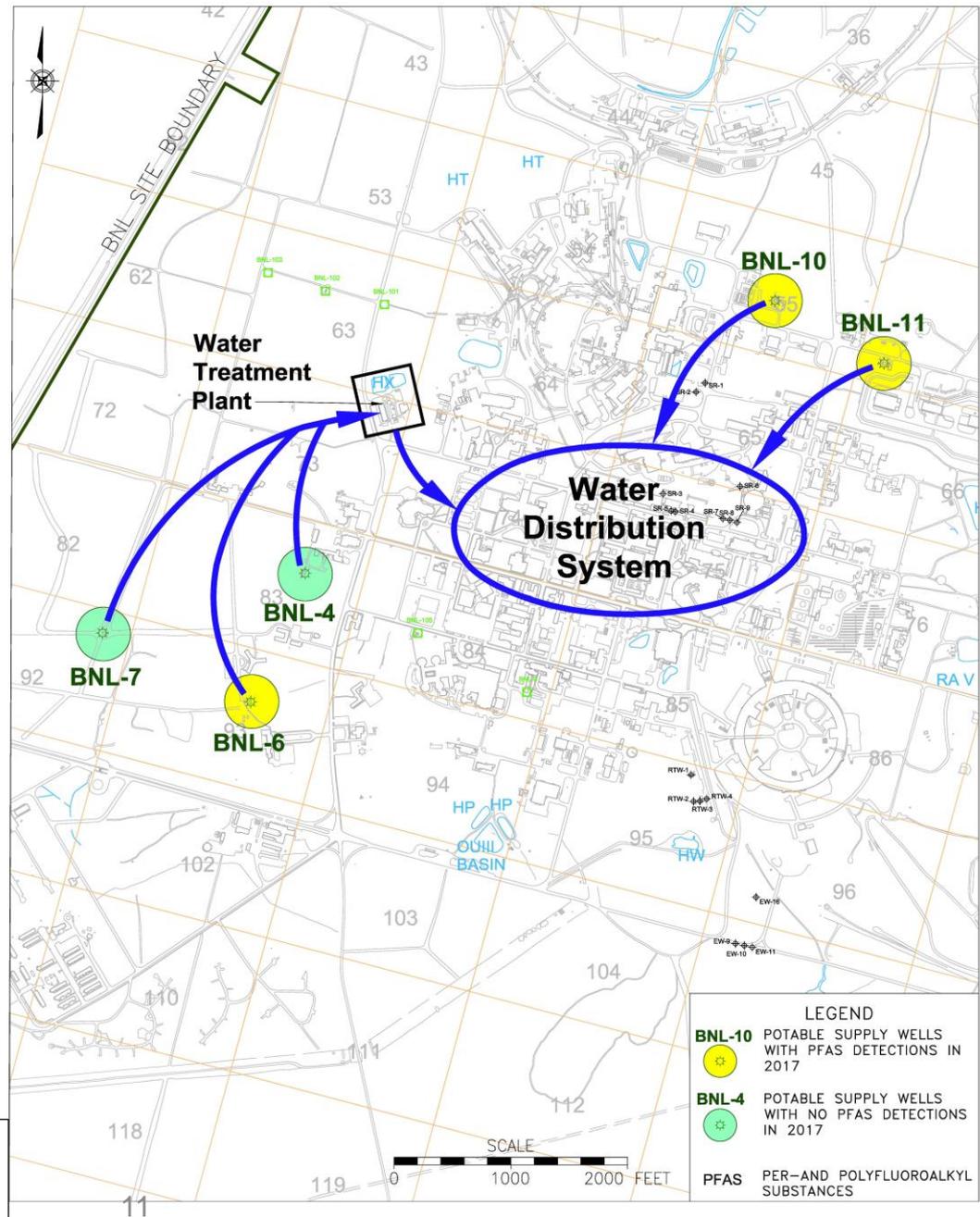
- Water from wells 4*, 6** and 7 has naturally high levels of iron, and is first sent to the Water Treatment Plant to:

- Reduce iron levels
- Adjust the pH level (raised with addition of lime)
- Chlorination for microbial control

Blending/treatment process reduces PFOS/PFOA levels to <3 ng/L

- Water from wells 10 and 11 has low iron levels, and can be sent into the distribution system after:

- pH adjustment
- Chlorination



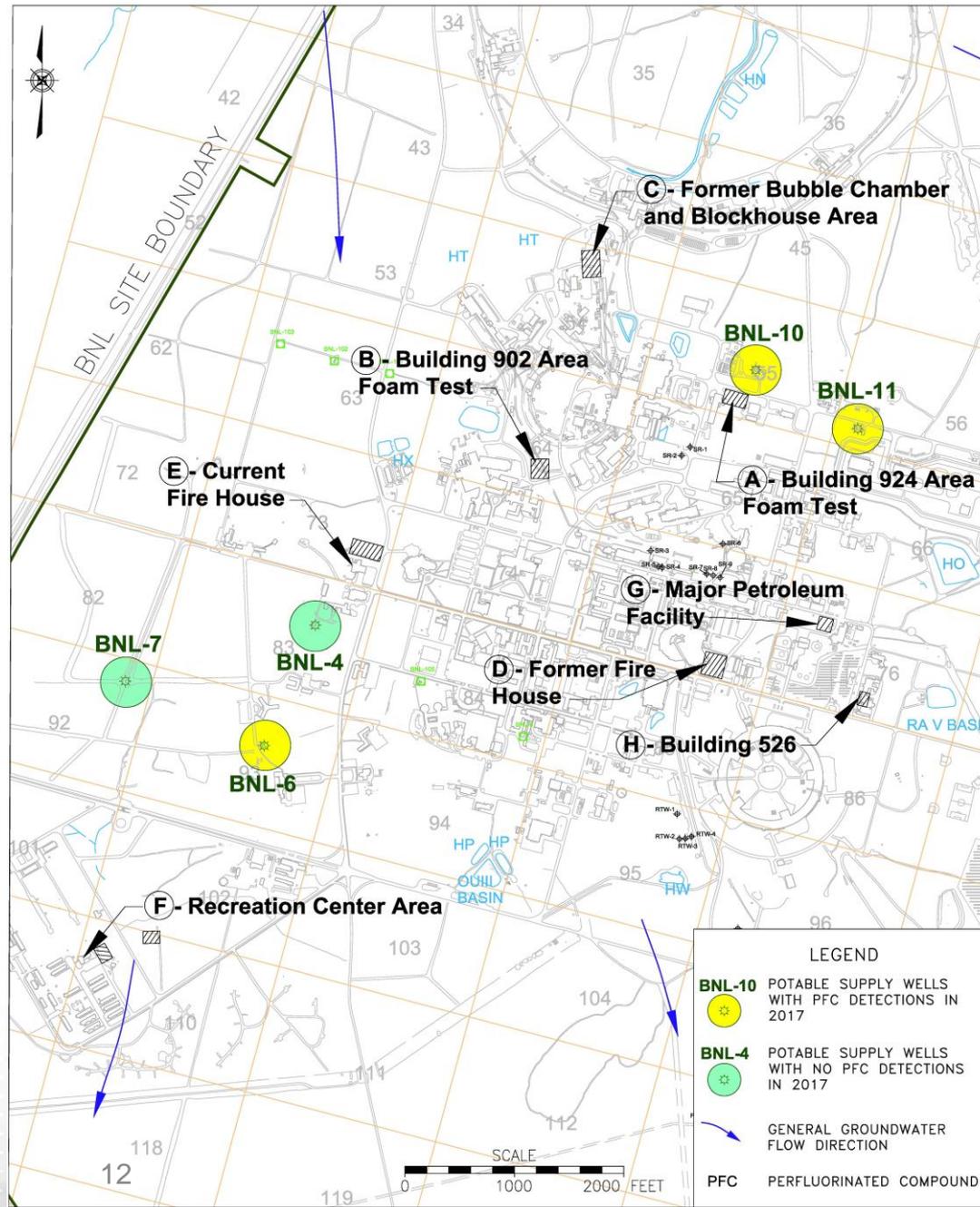
*Well 4 has been used infrequently for the last five years due to condition. Removed from service in July 2018.

**Well 6 was placed in a standby mode in July 2018.

Source of PFAS = Firefighting Foam

Based upon review of available records and interviews with current long-term firefighters and retirees, identified eight locations where foam was stored or released:

- A. Trailer near Building 924 (1970)
- B. Area near Building 902 (1970)
- C. Former Bubble Chamber Experiment and Blockhouse Area (1973 [2 times], 1980)
- D. Former Firehouse (1966-1985)
- E. Current Firehouse (1986-2008)
- F. Recreation Center Area (1978, 1980)
- G. Major Petroleum Facility (1986)
- H. Building 526 (no documented releases)



Firefighter Training

Example: Former Firehouse Area (September 1966)



Building Fire Suppression System Testing

Example: Area East of Building 902 (September 1970)



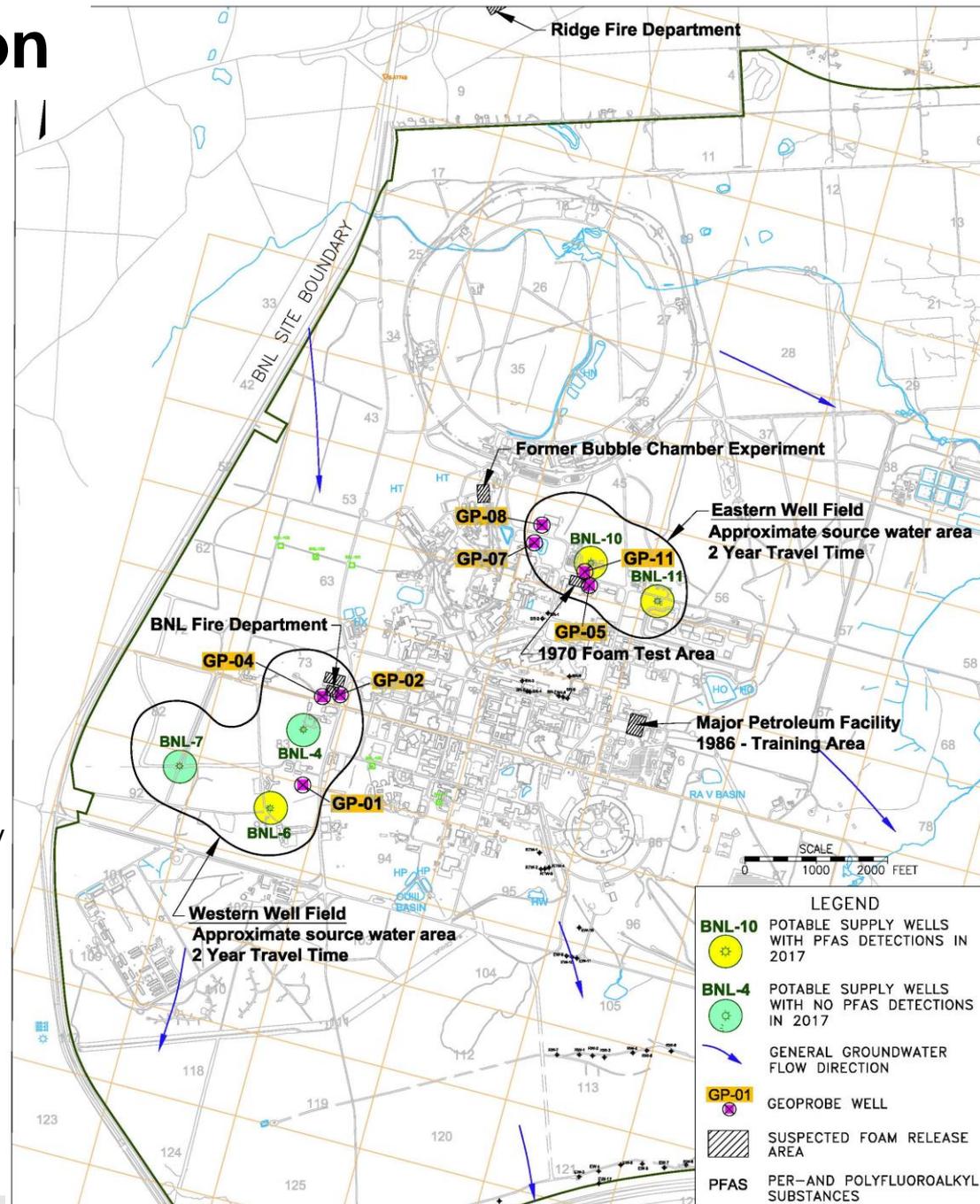
Foam Chemistry

- Foam formulations for Class B Fires (examples)
 - Protein-based Foam: Biodegradable. Developed in 1940s
 - Fluoro-protein Foam and Aqueous Film-Forming Foam (AFFF): Developed in 1960s. Contained complex mixtures of PFAS (e.g., long carbon-chained fluorinated surfactants such as PFOS). These compounds help foam to spread over a fire
- Information on old foam formulations and amount used at BNL is not available
 - However, groundwater monitoring results indicate the foam contained PFOS/PFOA and other PFAS compounds
- Current inventory of Class B foam = Alcohol Resistant-AFFF
 - Doesn't contain PFOS/PFOA
 - Contains shorter carbon-chained fluorinated surfactants
 - Shorter environmental and biological half-life
 - Potential health and environmental effects are not well understood
 - The foam is not used for training, and there are no active foam fire suppression systems

PFAS Characterization

Phase 1: Source Water Areas

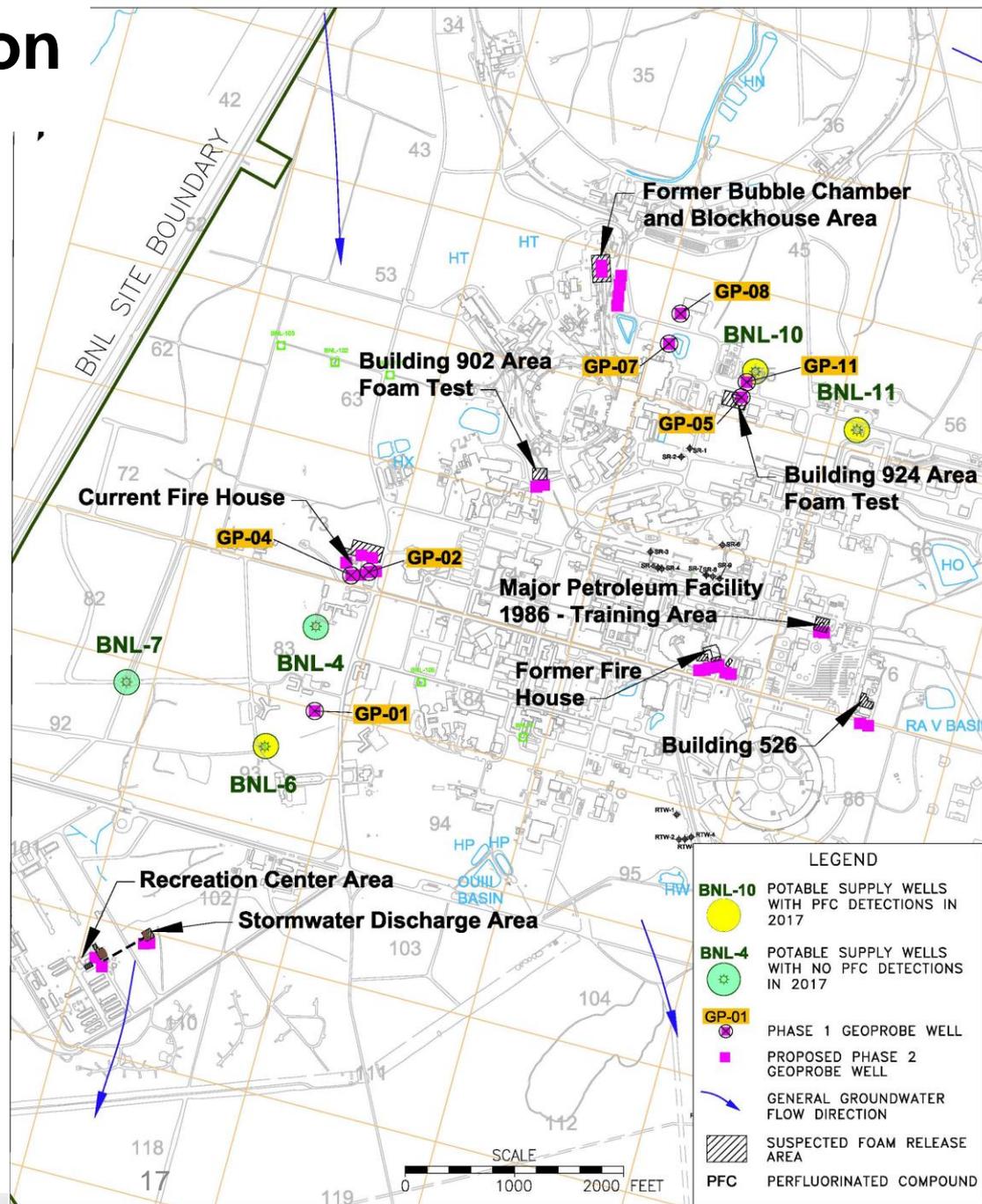
- In May 2018, installed 7 temporary wells. Objectives:
 - Determine the distribution and concentrations of PFAS within the source water areas
 - Determine whether PFAS concentrations could impact supply well operations
- Analyzed the samples for 21 PFAS
 - Requested by regulatory agencies
- Results for western well field:
 - PFOS/PFOA concentrations up to 3,124 ng/L at the Current Firehouse
 - Other PFAS compounds were also detected
 - These high concentrations would prevent the continued use of Supply Well 4 without treatment
- Results for eastern well field:
 - PFOS/PFOA concentrations up to 18 ng/L near supply well 10
 - Other PFAS compounds were also detected
 - PFAS originates from Former Bubble Chamber and 1970 foam test area



PFAS Characterization

Phase 2: Foam Release Areas

- Focus on foam release sites
- To date, installed 19 of the planned 32 temporary wells. Available results:
 - Former Firehouse
 - PFOS/PFOA up to 5,371 ng/L
 - Major Petroleum Facility
 - PFOS/PFOA up to 47 ng/L
 - Building 526
 - PFOS/PFOA up to 46 ng/L
 - Recreation Center & Stormwater Discharge Area
 - PFOS/PFOA up to 31 ng/L
- Complete Phase 2 wells by late October. Remaining areas:
 - Current Firehouse
 - Former Bubble Chamber Area
 - Building 902 Test Area

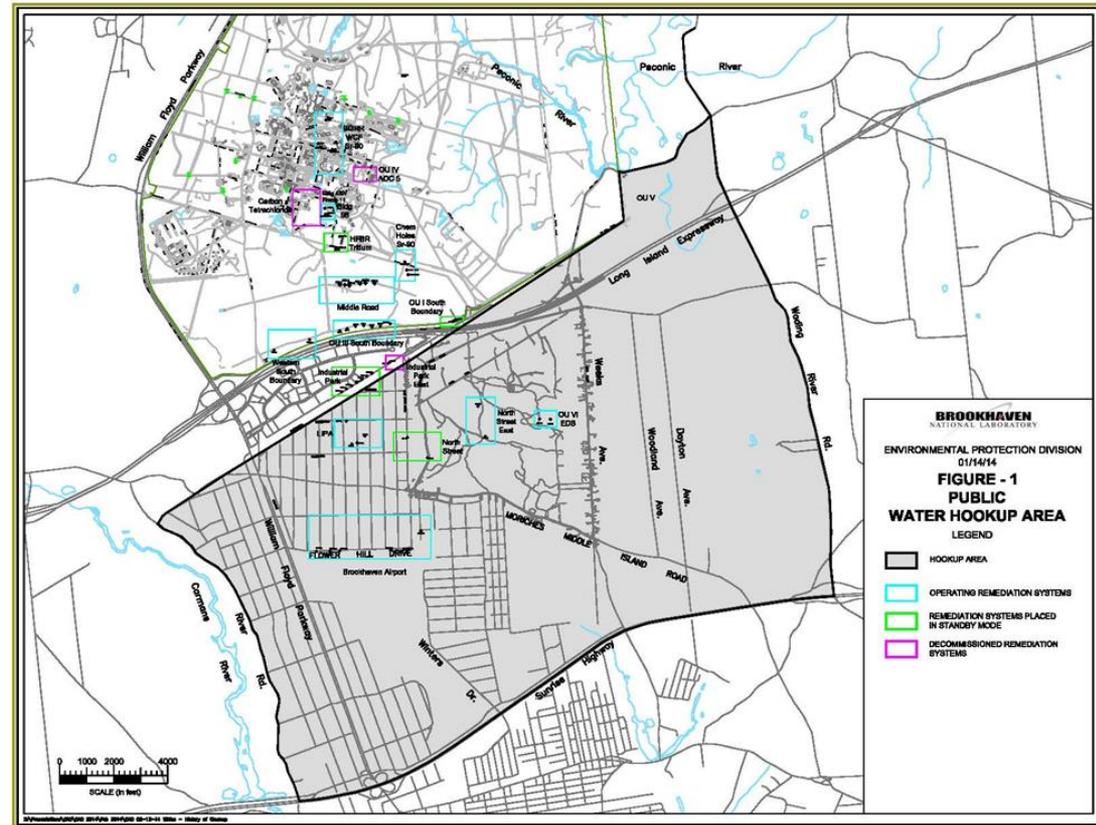


Other Actions on PFAS

Private Well Sampling for PFAS

In coordination with SCDHS, collected samples October 1-2 for PFAS analyses during routine annual sampling of five private wells south of BNL

- Joint SCDHS/BNL program of offering free annual testing private wells not connected to public water in the DOE-designated hook-up area has been ongoing since 2001
- DOE/BSA are discussing with SCDHS its request to include in the program ~97 recently identified properties that may have private wells. 28 of the properties are located in the hook-up area



1996-1998 Public Water Hook-up Area (~1,500 Homes)

- Teflon plumbing components may complicate testing – possible false positives
- Other potential off-site sources

Return Carbon Filters to Service

Although PFOS/PFOA levels in drinking water are below the current health advisory level, BNL will proactively refurbish and return to service the carbon filters that were previously installed at potable supply wells 10 and 11

- The carbon filters were originally installed in the 1980s in response to volatile organic compound contamination
- Filters were disconnected in 2008
- Plan is to refurbish the filters at Well 11 first
 - Goal to return filters to service by early 2019

Establishing Drinking Water Standards

NYS Drinking Water Council was commissioned to recommend drinking water standards for PFAS

- Schedule for setting standards?
 - Recommendations were originally due by October 2, 2018
- Unclear whether standards will be set for compounds other than PFOS and PFOA
- Will the NYS drinking water standard for PFOS/PFOA be less than the current 70 ng/L EPA Health Advisory Limit?
 - Several states are proposing/setting lower drinking water standards or notification guidelines. Examples:
 - NJ and CA: PFOS = 13 ng/L and PFOA = 14 ng/L
 - MN: PFOS = 27 ng/L and PFOA = 35 ng/L
 - MA and CT: Total for five PFAS compounds = 70 ng/L
- Final standards could have a significant impact on future actions and requirements

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