

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)
DYNAMIC PLAN

Division of Waste Management

Florida Department of Environmental Protection

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EXECUTIVE SUMMARY:

The Department of Environmental Protection (DEP) has prepared this Dynamic Plan to provide a coordinated approach to the complex issues associated with per- and polyfluoroalkyl substances (PFAS). PFAS are a large and complex class of man-made chemicals that are resistant to heat, water and oil. PFAS have been used in a wide variety of consumer products since the 1940s, including stain and water repellents used in textile manufacturing, paper products, food packaging and cookware. These chemicals have also been used in various industrial processes, including the formulation of fire suppressant foams that are used at firefighting training facilities, airports, chemical plants and military installations. These chemicals have been identified as Contaminants of Emerging Concern (CEC). CEC are chemicals that have been recently detected in the environment which may pose public health or ecological risks.

When released to the environment, PFAS appear to persist and easily migrate in the environment causing contamination to soil and groundwater. Prior widespread use of PFAS has led to contamination of Florida groundwater resources, including: three areas identified under the federal third Unregulated Contaminant Monitoring Rule (UCMR3) sampling of public supply wells; 22 areas identified by DEP sampling of certified fire training facilities; 27 areas identified by sampling of select State Cleanup Program sites; 15 areas identified by DEP sampling of select dry-cleaning program sites; and 20 current and former federal facilities. In addition to the groundwater resource concerns, certain PFAS have been shown to bioaccumulate in animals and humans, and there is evidence that exposure to PFAS can lead to adverse health effects in humans. Our understanding of these chemicals and the impact they have on human health is incomplete and PFAS regulatory and technical developments are quickly evolving.

PURPOSE:

The DEP has prepared this Dynamic Plan to establish a comprehensive path forward with the understanding that it may be necessary to change the approach as the science associated with these emerging contaminants continues to develop. The Dynamic Plan describes the development of screening and provisional cleanup target levels that are protective of human health and the environmental resources of Florida. It summarizes data and lessons learned from prior and ongoing investigations that will be used to aid in future proactive investigations of potential PFAS contamination of drinking water resources. Future investigations will be based on potential risk and will include a continued coordinated response with the Florida Department of Health (DOH) to quickly evaluate and address any impacts to drinking water resources.

Dynamic Plan Objectives:

- Continue to be a national leader in response to PFAS concerns;
- Provide a technical and regulatory framework for the development of screening and cleanup target levels for the protection of human health and the environment;
- Implement a response strategy that minimizes risks to human health and protects Florida's resources;
- Identify PFAS contamination through site investigations;
- Continue efforts to prevent/reduce further impacts through outreach and communication; and
- Continue efforts to identify areas of potential or known contamination and address environmental impacts through risk mitigation and remediation.

ACTIONS TAKEN BY DEP:

DEP's Division of Waste Management routinely investigates sites where there is known or suspected soil and/or groundwater contamination statewide. These investigations have led to the discovery of PFAS impacts and have necessitated regulatory and technical developments.

Regulatory and Technical Developments

Objective: Continue to be a national leader in response to PFAS concerns.

DEP is the administrative agency of the state of Florida having the power and duty to protect Florida's natural resources and to administer and enforce the provisions of Chapters 376 and 403, Florida Statutes (F.S.) and the state cleanup rule Chapter 62-780, Florida Administrative Code (F.A.C.).

Responsible parties are subject to the requirements of the state cleanup rule. The rule establishes a process and schedule for assessing and remediating contaminated sites. Failure to address the cleanup requirements would subject a responsible party to legal enforcement action.

Coordination with State and Federal Agencies

DEP is coordinating with other state and federal agencies on regulatory and technical PFAS developments. By sharing information and developments, DEP is expanding its knowledge and understanding to develop best practices for addressing this multifaceted issue. Ongoing coordination with these agencies includes:

- Sharing site investigation data with DEP's district offices and counties that have been delegated for environmental response actions.
- Sharing site investigation data and private well sampling data with the five water management districts (WMD).
- Sharing information and following research projects that are being conducted by the University of Florida (UF) and University of Miami (UM).

- Coordinating with the U.S. Department of Defense (DOD) and the U.S. Environmental Protection Agency (EPA) on federal cleanup sites at military installations, with the National Aeronautics and Space Administration (NASA) on cleanup sites at Kennedy Space Center, with the Florida National Guard and National Guard Bureau and with the U.S. Coast Guard.
- Coordination with DOH on site investigation data, requests for private well sampling and communication on human health risks. DOH has and will continue to be integral in responding to private well sampling requests and answering health related PFAS questions or concerns.

In addition to state and federal partners, DEP is also participating in discussions with technical and regulatory agencies that are researching and sharing information on PFAS. A list of the agencies' PFAS websites may be found in Appendix A.

Research and Technical Advances

Objective: Provide a technical and regulatory framework for the development of screening and cleanup target levels for the protection of human health and the environment.

DEP is actively investigating the historic use of PFAS and potential impacts to the environment. The environmental investigations include current laboratory analysis of at least 23 PFAS constituents. However, evaluation of the assessment data has focused on the two most common and well-studied PFAS constituents, *Perfluorooctanoic Acid* (PFOA) and *Perfluorooctane Sulfonate* (PFOS).

Development of the Health Advisory Level

The EPA and DOH have established a lifetime drinking water health advisory level (HAL) for PFOA and/or PFOS of 70 nanograms per liter (ng/L). The HAL of 70 ng/L is for PFOA and PFOS combined or individually. Health advisory levels are based on the best available peer-reviewed science, including laboratory and epidemiological studies regarding exposure to certain chemicals and compounds. While HALs do not establish a regulatory limit or "maximum contaminant level" for drinking water, they do provide guidance to state and local officials in evaluating drinking water quality based on levels below which adverse health effects are not anticipated to occur over a lifetime of exposure.

DEP has coordinated with DOH on responding to PFAS contamination that has been identified in private and public water supply (PWS) wells. The coordinated response has used the HAL of 70 ng/L to determine appropriate response actions.

DEP Laboratory Capabilities

The Chemistry Program of the Division of Environmental Assessment and Restoration acquired the necessary instrumentation and began providing analytical services for PFAS analysis in water matrices in November 2018. Soil matrix analytical services were added in January 2019. Initially, 14 PFAS compounds were reported, but this has since been expanded to 30 analytes, including the "GenX" compound, *hexafluoropropylene oxide dimer acid*. DEP's laboratory currently has four

high-performance liquid chromatography-tandem mass spectrometry (HPLC/MS/MS) instruments capable of PFAS testing. The laboratory's routine capacity exceeds 200 samples per month, with capacity for periodic surges of more than 500 samples per month. A list of PFAS compounds and minimum detection limits (MDLs) reported by the laboratory are provided in Table 1.

Table 1 - List of Current PFAS Compounds Reported by DEP's Laboratory

Compound	Compound Name	Water MDL (ng/L)	Soil MDL (µg/kg)
ADONA	4,8-Dioxa-3H-perfluorononanoic acid	0.40	0.10
FBSA	Perfluoro-1-butane sulfonamide	0.40	0.10
FHxSA	Perfluoro-1-hexane sulfonamide	0.40	0.10
FOSA	Perfluoro-1-octane sulfonamide	0.40	0.10
HFPO-DA	Hexafluoropropylene oxide dimer acid	4.0	0.40
PFBA	Perfluorobutanoic acid	4.0	0.20
PFBS	Perfluorobutanesulfonic acid	0.40	0.10
PFDA	Perfluorodecanoic acid	4.0	0.40
PFDoA	Perfluorododecanoic acid	2.0	0.20
PFDS	Perfluorodecanesulfonic acid	0.40	0.10
PFHpA	Perfluoroheptanoic acid	2.0	0.20
PFHpS	Perfluoroheptanesulfonic acid	0.80	0.10
PFHxA	Perfluorohexanoic acid	2.0	0.20
PFHxS	Perfluorohexanesulfonic acid	0.40	0.10
PFNA	Perfluorononanoic acid	2.0	0.20
PFNS	Perfluorononanesulfonic acid	0.40	0.10
PFOA	Perfluorooctanoic acid	2.0	0.20
PFOS	Perfluorooctanesulfonic acid	2.0	0.20
PFPeA	Perfluoropentanoic acid	2.0	0.20
PFPeS	Perfluoropentanesulfonic acid	0.40	0.10
PFTeA	Perfluorotetradecanoic acid	2.0	0.20
PFTriA	Perfluorotridecanoic acid	2.0	0.20
PFUnA	Perfluoroundecanoic acid	2.0	0.20
N-MeFOSAA	N-Methylperfluorooctane sulfonamidoacetic acid	0.80	0.10
N-EtFOSAA	N-Ethylperfluorooctane sulfonamidoacetic acid	0.80	0.10
4:2 FTS	4:2 Fluorotelomer sulfonate	2.0	0.20
6:2 FTS	6:2 Fluorotelomer sulfonate	4.0	0.40
8:2 FTS	8:2 Fluorotelomer sulfonate	2.0	0.20
9Cl-PF3ONS	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	2.0	0.20
11Cl-PF3OUdS	11-Chloroelcosafluoro-3-oxaundecane-1-sulfonic acid	2.0	0.20

Although EPA currently has no approved methods for the analysis of PFAS in anything other than drinking water, there are a variety of draft methods, general organic methods, and PFAS specific reference methods that may be used for non-potable waters, wastes and solids:

- EPA SW-846 Method 8321B (HPLC/MS/MS) - general LC method for surface water, groundwater and wastewater.
- EPA SW-846 draft Method 8327 (HPLC/MS/MS) – draft method for PFAS in surface water, ground water and wastewater.
- ISO Method 25101:2009 - for surface water, groundwater and wastewater.
- ASTM Method D7979-17 (HPLC/MS/MS) - for surface water and sludge water.
- ASTM Method D7968-17a (HPLC/MS/MS) - for soil.
- EPA SW-846 Method 8321B (LC/MS/MS) - general LC method for soil and other solids.

The DEP Laboratory utilizes its internally developed method DEP LC-001-3 when reporting PFAS results. This internal PFAS method references EPA method 8321B and incorporates isotope dilution mass spectrometry (IDMS) to enhance the accuracy of the measurement results. It is important to note that laboratory methodologies for analysis of PFAS are evolving. EPA 8321B is a general HPLC method that does not specifically mention PFAS or IDMS but allows for the addition of non-listed analytes as long as all quality control objectives are achieved. EPA is currently validating methods to measure PFAS in groundwater, surface water, wastewater and solids, but these methods are still in draft form.

DEP Contaminated Media Forum

DEP engages with interested parties from academic, regulatory and technical backgrounds through the Contaminated Media Forum (CMF). A CMF was held in September 2019, to provide a venue for interested parties to discuss DEP’s provisional cleanup target levels for PFOA and PFOS in groundwater and soil as well as the development of draft surface water screening levels for the environment and human health. DEP provided a status of the Division of Waste Management’s PFAS investigation efforts, including laboratory analytical methods and best management practices. Interested parties were invited to attend the CMF and encouraged to provide DEP with comments, suggestions and feedback. Those comments have been published on the website and DEP has held meetings with each of the respondents to discuss their comments.

The Hinkley Center for Solid and Hazardous Waste Management

The Hinkley Center for Solid and Hazardous Waste Management is a statewide center that provides leadership in waste management research with the goal of preserving and protecting the state’s natural resources. The program focuses on methods and strategies for managing solid and hazardous wastes. Research results are transferred to the public and private sectors for practical applications. Recent research funded by the Hinkley Center includes the following:

- **PFAS Releases from Landfills in Florida (funded for 2020 – this study is a follow-up to the study below)** - EPA has shown that PFAS are released in the leachates from landfills in Florida. However, no work has yet been done to quantify the amount of PFAS found in landfill storm water and groundwater. In addition, a mass balance analysis is lacking to quantify how much

PFAS (kilograms per unit time) is released at landfills, through leachate, stormwater and groundwater. The objectives of this proposal are to: a) expand the sampling program for PFAS to include additional PFAS species in leachates plus the inclusion of stormwater and groundwater at landfills, and b) conduct a mass balance analysis of PFAS at landfills using a readily available landfill modeling software combined with PFAS measurement data. The results will be used to focus efforts in terms of treatment of potential water sources at landfills that carry PFAS.

- **Characterization of PFAS in Landfill Leachate and Preliminary Evaluation of Leachate Treatment Processes (funded from 2017-19)** - This study evaluated 11 PFAS species (7 carboxylic acids, 3 sulfonic acids and 5:3 FTCA) in different types of landfill leachates: municipal solid waste (MSW), construction and demolition (C&D), MSW ash (MSWA) and MSWA with landfill gas condensate. Leachates were also analyzed before and after onsite treatment at two of these facilities. Results indicate that MSWA leachate had significantly lower PFAS levels relative to other leachate types. The correlation between total PFAS and incineration temperature for the ash leachates was significant, with lower total PFAS concentration associated with an increase in incineration temperature. PFAS levels in untreated C&D and untreated MSW leachate were similar, suggesting that both waste sources are a significant source of PFAS. This is particularly relevant since some C&D landfills in Florida are not lined.

University Research Projects and Case Studies:

There are several research projects and environmental case studies that are being conducted by the University of Florida (UF) and the University of Miami (UM). Several of these projects are supported by the Hinkley Center and EPA. Preliminary information on these studies is provided below and in Appendix A.

- The University of Florida is undertaking a Florida water quality project studying the prevalence of PFAS in surface waters across the state. The project, funded by UF, has resulted in the collection of approximately 1,700 surface water samples. The samples will be analyzed for 125 PFAS compounds. Data is expected to be mapped and placed on a publicly available website in the summer of 2021.
- Research funded by EPA on the Potential Environment Impacts of PFAS in Substances in Waste Streams. The researchers from UF and UM are investigating what happens when PFAS enters a solid waste stream and a landfill. Several studies are being completed over a three-year timeframe by undergraduate and graduate students.
- Research is being completed by UF with funding from EPA to better understand how flooding, caused by extreme weather events, influence distribution and environmental transport of PFAS. Project results are anticipated to provide a library of PFAS characterized; a comprehensive data set of PFAS diversity and concentration ranges in soil, sediment, surface water, groundwater, drinking water and biological media; data on sorption, desorption and partition coefficient of

selected PFAS under varying environmental conditions; and a validated transport and exposure risk model for PFAS following flooding events in Brevard County.

Contracted Toxicological Support

DEP has a contract for toxicological support services through the UF’s Center for Environment and Human Toxicology. This contract provides DEP with ready access to expert information and advice. DEP works with UF to develop and update the PFAS provisional screening and cleanup target levels. Provisional groundwater and soil cleanup target levels were calculated in accordance with Chapter 62-777 and 62-780, F.A.C., and include updated exposure assumptions and toxicity values. The surface water screening levels were developed using a modified equation from EPA.

Development of Provisional Cleanup Target Levels for Groundwater and Soil

To aid in the assessment and remediation of PFAS contamination in Florida, and as per rules 62-780.150 and 62-780.650, F.A.C., DEP has derived provisional groundwater cleanup target levels (CTLs) as of Aug. 16, 2018, and soil CTLs as of April 16, 2018, and updated for leachability to groundwater as of Jan. 3, 2019 for PFOA and PFOS. These provisional CTLs were generated using the process established in this publicly promulgated rule.

Provisional CTLs are allowable per Chapter 62-777, F.A.C., and are enforceable CTLs under Chapter 376.30701(2), F.S., {protection of the health of all people}, Chapter 376.30701(2)(g), F.S., {where standards do not exist, the cleanup target levels for groundwater shall be based on the minimum criteria specified in Chapter 62-777, F.A.C.} and 62-780.150(7), F.A.C. Assessment and remediation pursuant to these provisional CTLs ensures compliance with remediation requirements of Chapter 62-780, F.A.C.

Persons responsible for site rehabilitation have the option to propose alternative CTLs for PFOA and/or PFOS. Proposed alternative CTLs would have to be evaluated pursuant to statute and rule. The provisional CTLs for groundwater and soil are presented in the following tables:

Table 2 - Provisional Groundwater Cleanup Target Levels

PFOA	70 ng/L	ng/L = nanograms per liter (parts per trillion)
PFOS	70 ng/L	
PFOA + PFOS	70 ng/L	Recommendation based on similarity in effect and potency

Table 3 - Provisional Soil Cleanup Target Levels

	Residential	Commercial/industrial	Leachability
PFOA	1.3 mg/kg	25 mg/kg	0.002 mg/kg
PFOS	1.3 mg/kg	25 mg/kg	0.007 mg/kg

mg/kg = milligram per kilogram (parts per million)

Development of Provisional Screening Levels for Irrigation Water and Surface Water

DEP developed screening levels to evaluate potential risk based on exposure to water from irrigation wells and surface water. Also, for surface water the screening levels consider the protection of human health for the consumption of freshwater and estuarine finfish and shellfish. These screening levels are not considered CTLs and they are not enforceable. Irrigation water screening levels (IWSL) are very conservative, and concentrations reported above the IWSL do not necessarily indicate an elevated risk. However, reported concentrations that exceed screening levels may require further risk evaluation.

Table 4 - Provisional Irrigation Water Screening Levels (IWSL)

	Residential	Commercial/Industrial	Produce
PFOA	6.7 µg/L	750 µg/L	NA
PFOS	72 µg/L	370 µg/L	0.6 µg/L

µg/L = micrograms per liter (parts per billion)
 NA = not applicable, model not applicable based on K_{ow}

Table 5 - Surface Water Screening Levels

Human Health *		Ecological		
Freshwater and Estuarine Finfish and Shellfish		Freshwater		Marine
PFOA	0.5 µg/L	PFOA	1,300 µg/L	ND
PFOS	0.01 µg/L	PFOS	37 µg/L	13 µg/L

*Human Health values are based on a Probabilistic Risk Assessment
 µg/L = micrograms per liter (parts per billion)
 ND = No data available to calculate

Addressing and Mitigating Exposures

OBJECTIVE: Implement a response strategy that minimizes risks to human health and protects Florida’s resources.

The following sections outline the specific actions being taken or planned by DEP and its coordination with other agencies, to address PFAS impacts and respond to exposure risks.

In 2018, DEP began conducting investigations of contaminated sites across the state where PFAS contamination was known or suspected. These investigations were completed in close coordination with DOH. The response strategy that was implemented and continues to be followed by DEP and DOH is provided below.

Coordination with Florida Department of Health

DEP and DOH have coordinated on all PFAS assessment efforts. For sites where investigative results indicate groundwater above the HAL for PFOA/PFOS, DEP has contracted DOH to complete well

surveys to identify and sample private wells within a 1-mile radius. Analytical results of this sampling determine what steps are taken regarding possible future assessment and outreach.

Table 6 – DEP Investigation and DOH Response

PFOA/PFOS Results (Groundwater)	DEP Action	DOH Action
>70 ng/L	DEP “triggers” DOH well survey	Well survey, sample private wells within 1-mile radius
35 to 70 ng/L	Quarterly sampling	No well survey unless results from quarterly monitoring > 70 ng/L
< 35 ng/L	No further sampling	No well survey

- [Additional DOH Information on PFAS.](#)

DEP’s Water Supply Restoration Program

The Water Supply Restoration Program provides access to bottled water or an alternative water supply to any affected well owner whose test results exceed the HAL. This voluntary program also provides funding for a filter, well restoration or connection to a public water system, as necessary, to ensure a safe drinking water supply. A temporary water supply is provided until a long-term solution is established.

- [Water Supply Restoration Program Information](#)
- [Request for Water Supply Restoration or Replacement Form](#)

Identification and Site Investigation

OBJECTIVE: Identification of PFAS contamination through site investigation.

DEP will continue to perform PFAS site assessments to provide a preliminary evaluation of the extent of PFAS groundwater impacts at various suspected source sites. DEP’s Division of Waste Management routinely investigates sites where there is known or suspected soil and groundwater contamination statewide. CECs, such as PFAS, have been recently detected in the environment and have resulted in several site investigation efforts.

PFOA and PFOS Sampling Efforts Associated with Public Well Systems in Florida

In 2012, the EPA released a list of 30 CECs to be monitored under the third Unregulated Contaminant Monitoring Rule (UCMR3). The UCMR provides for nationwide sampling and reporting of public well systems for CECs. Included within the UCMR3 list are PFOA and PFOS. Results of the UCMR3 monitoring effort indicated three public well systems in Florida produced samples with the sum of PFOA and PFOS concentrations exceeding the EPA HAL of 70 ng/L. The DEP’s Site Investigation

Section (SIS) conducted preliminary assessments associated with these three public well systems to determine likely sources of the contaminants.

The city of Stuart identified three public supply wells with HAL exceedances for PFOA and PFOS, and those wells were quickly shut down. Assessments conducted by the city and supplemented by DEP have determined that aqueous film forming foam (AFFF) is a significant source of the contamination. DEP is expanding the assessment to determine if other sources are present. The city of Stuart and Martin County are also conducting site assessment activities within potential source areas.

The city of Zephyrhills identified one public supply well containing levels of PFOA and PFOS exceeding the HAL. That well has been shut down. DEP conducted a preliminary assessment and determined that AFFF was responsible for the contamination.

The Emerald Coast Utilities Authority in Escambia County identified two public supply wells near the Pensacola International Airport containing levels of PFOA and PFOS exceeding the HAL. One well has been shut down; the other has been retrofitted with a suitable treatment system. DEP conducted a preliminary assessment and determined that AFFF is a source of the contamination, although other sources may exist.

DEP has coordinated with DOH on the above sites, contracting DOH to conduct well surveys to determine the locations of private supply wells located within the area and sample any identified private drinking water wells. Through DEP's Water Supply Restoration Program, alternative sources of water are provided for any private wells with concentrations exceeding the HAL.

Fire Training Facilities Sites

DEP's Site Investigation Section has performed PFAS investigations on fire training facilities (FTF) across the state. The studies were warranted due to documented links between PFAS and AFFF, which is a type of fire suppressant. A survey completed to determine historical use of AFFF and proximity to private supply wells triggered an evaluation of 45 currently certified fire training facilities, with a prioritization of 25 facilities selected for field investigations based on known or suspected use of AFFF. These investigations included sampling of groundwater, surface water, soil and sediment. The samples were analyzed for 22 PFAS constituents using EPA Method 8321B. Concentrations in groundwater and soil were compared to the provisional CTLs, and the results from surface water and sediment were evaluated to identify potential exposure pathways and/or potential PFAS sources.

Of the 25 active facilities identified with known or suspected use of AFFF, the investigations indicate that 22 of the 25 had analytical results for PFOA and PFOS above the provisional groundwater CTL.

The initial SIS work at the 25 FTF provided assessment information on five FTF that are located on state-owned lands. DEP will continue overseeing the assessment work on these five FTF and will conduct site remediation that may be needed. The State-Owned Lands Cleanup Program will provide funding for assessment and remediation efforts. Assessment work will continue at the remaining FTF by the site property owners with oversight by the department's district offices.

DEP is conducting research to identify former locations of FTF across the state. So far, 23 former state certified FTF have been identified and two of those facilities were confirmed to have used AFFF in training. Both of the former FTF are on state-owned lands and SIS is conducting assessment on each. Analytical data from both of the former FTF indicate exceedances of the provisional groundwater CTL for PFOA and PFOS. The State-Owned Lands Cleanup Program will provide funding and resources for continued assessment and remediation at these two former state-owned lands FTF sites. Efforts to identify additional locations of former FTF continues.

Drycleaning Solvent Cleanup Program Sites

The Division of Waste Management’s Drycleaning Solvent Cleanup Program (DSCP) manages the cleanup of state-funded eligible dry-cleaning or wholesale supply facilities. The DSCP selected 15 dry-cleaner sites located across Florida for a limited PFAS sampling effort. The initial limited sampling included sampling two onsite monitoring wells at each site for PFAS-related chemicals. Additional assessment was completed at 10 of the 15 sites based on the results of the initial sampling.

Table 7 - Results of Initial Sampling and Response by DEP and DOH

PFOA/PFOS Results (Groundwater)	# of DSCP Sites	DEP Action	DOH Action
>70 ng/L	10	Additional site assessment	Well survey, sample private wells within 1-mile radius
35 to 70 ng/L	1	Quarterly sampling*	No well survey unless warranted*
< 35 ng/L	4	No further sampling	No well survey

* Additional site assessment and a DOH well survey will be initiated at a site if quarterly monitoring indicates an exceedance of 70 ng/L.

The site assessment was conducted to determine if PFAS-related contamination could be related to dry-cleaner operations. Sampling of available solvents seems to indicate that it is unlikely that dry-cleaning solvents contain PFAS. Based on the summary findings presented in the PFAS Pilot Study at Dry-cleaning Sites Report (PFAS “White Paper”) and site specific information presented in PFAS investigation reports for the 10 pilot study sites, elevated concentrations of PFAS in wastes and discharges following dry-cleaning and wet laundering processes indicate that PFAS may be leaching from fabrics during these processes. Waste stream sampling in conjunction with groundwater and soil assessment, indicates dry-cleaning and wet laundering processes are contributing to elevated PFAS concentrations found at the pilot sites. The study found that the PFAS concentrations varied by one to two orders of magnitude, from low ppt (ng/L) levels to low parts per billion (ppb) levels. The DSCP plans to continue evaluating the potential impacts and exposure risk at additional drycleaner sites. A phased approach will be implemented with investigation beginning at sites currently undergoing site rehabilitation by the DSCP and that have nearby private supply wells.

Table 8 – Prioritization of DSCP Sites

Prioritization	DEP Early Action	DEP Continuation Action	Approximate Number of sites
Phase 1, Tier 1- Sites currently undergoing site rehabilitation with a private well located within ¼ mile	Sample up to 5 monitoring wells for PFAS	Additional site assessment for sites with groundwater >70 ng/L No further action if < 70 ng/L	Subset of sites currently undergoing site rehabilitation (current subset of 277 sites)
Phase 1, Tier 2 – Remaining sites currently undergoing site rehabilitation	Sample up to 5 monitoring wells for PFAS	Additional site assessment for sites with groundwater >70 ng/L No further action if < 70 ng/L	Remaining sites undergoing site rehabilitation
Phase 2- Remaining sites that are currently awaiting site rehabilitation	Sample up to 5 monitoring wells for PFAS at sites with new site assessments.	Additional site assessment for sites with groundwater >70 ng/L No further action if < 70 ng/L	Sites awaiting site rehabilitation (currently ~ 877 sites)

State Funded Cleanup Sites

The Division of Waste Management’s Waste Site Cleanup Section (WSCS) oversees the cleanup of State Funded Cleanup Sites. These are sites where there are no viable responsible parties, the site poses an imminent hazard, and the site does not qualify for Superfund or is a low priority for EPA. The WSCS is investigating 27 state sites based on the site’s former operational history and likely use of PFAS related chemicals. Sites that were included under this sampling effort included former landfills, metal plating facilities, chemical manufactures, electroplaters and users of various solvents. Two monitoring wells were selected from each site for initial screening. After initial screening, the WSCS used the same criteria as the DSCP to determine whether additional monitoring or assessment was necessary.

Table 9 - Results of Sampling and Response by DEP and DOH

PFOA/PFOS Results (Groundwater)	Number of State Sites	DEP Action	DOH Action
>70 ng/L	14	Additional site assessment	Well survey, sample private wells within 1-mile radius
< 35 ng/L	13	No further sampling	No well survey

*Additional site assessment and DOH well survey will be initiated at a site if quarterly monitoring indicates an exceedance of 70 ng/L.

The purpose of the additional assessment is to determine if the site is a source of PFAS and, if determined to be a source, to assess and remediate PFAS contamination that is associated with the site.

Federal Facilities in Florida

With the emergence of concerns regarding PFAS, DEP has been coordinating with U.S. DOD and NASA since 2017 on investigation of the use of, and historic discharges of, AFFF and its related chemicals. Investigative work for AFFF source areas at DOD facilities and NASA’s Kennedy Space Center in Florida is in the early stages with some preliminary sampling completed to confirm PFOA/PFOS presence and some sampling to be completed at suspected AFFF potential release areas. More recently, DEP became aware of PFAS investigations due to AFFF use at Florida National Guard installations and by the U.S. Coast Guard. DEP will continue to work closely with our federal and state partners in order to investigate and mitigate for PFOA and PFOS, with an initial emphasis to identify and protect drinking water resources and ultimately to be protective of human health and the environment. Due to agency guidance and funding limitations, each federal program is working on a different schedule with varying progress made with respect to collecting historical information regarding storage and use of AFFF, evaluating potential PFAS sources and collecting samples. To date, 20 federal facilities in Florida have confirmed the presence of PFOA/PFOS in soil and/or groundwater.

Table 10 - Summary of Ongoing PFAS Investigations at Federal Facilities in Florida

PFOA/PFOS Work at Federal Facilities	Assessment Activities	Assessment Results Greater Than HAL	Potable Well Off-Site Impacts
Air Force	8 base-wide site inspections completed	Yes, at 8 of 8 bases	No data
Air Force Base Realignment and Closure (BRAC) sites	1 site inspection completed	No groundwater data received; PFAS present in soil	No data
Navy, including outlying landing fields (OLFs)	6 base-wide preliminary assessments completed	Yes, at 3 bases and 3 OLFs	Yes; 14 private wells above HAL
Navy BRAC	2 base-wide assessments ongoing	Yes, 2 bases	Sampling complete; no impacts
Air National Guard	1 base-wide site inspection completed	Yes	No data

Army National Guard	9 preliminary assessments completed, and 4 site inspections planned	No data received	No data
Defense Logistics Agency's Fleet Logistics Center - Jacksonville	1 preliminary assessment completed	No data received	No data
Army - formerly used defense sites (FUDS)	No investigations planned by U.S. Corps of Engineers	No data received	No data
NASA's Kennedy Space Center	1 base-wide phase I site assessment completed with additional investigation ongoing	Yes	No data
Coast Guard	2 air station preliminary assessments completed	No data received	No data

- U.S. DOD's Florida Response** - To date, two installations have off-base private well impacts above the HAL. As a short-term solution, the U.S. DOD provides access to bottled water or other alternative water supply to any affected well owner whose test results exceed the HAL. Long-term alternative water supply solutions are evaluated and implemented by the U.S. DOD in order to mitigate for PFAS impacts to private wells.

DEP may request additional sampling by DOH for private well owners and, upon homeowner request, can provide assistance with either hookup to an alternative water supply or installation of a home water filtration system.

- U.S. DOD's National Response** – The U.S. DOD formed a national PFAS Task Force in the Summer of 2019 and released a PFAS Task Force Progress Report in March 2020. [View the U.S. DOD's national response and the PFAS Task Force's work online.](#)

DOD is also funding a number of PFAS-related research projects. <https://www.serdp-estcp.org/Featured-Initiatives/Per-and-Polyfluoroalkyl-Substances-PFASs>

Outreach and Communication

OBJECTIVE: Continue efforts to prevent/reduce further impacts through outreach and communication.

DEP has taken steps to provide the above-mentioned areas of investigation on its PFOA and PFOS website and will continue to update this information as new data is obtained. The webpage will be dedicated to making this information readily available and accessible to the public regarding DEP's efforts.

DEP also provides notification to all property owners who have either had contamination detected on their property or contamination has been inferred to be on or beneath their property based on nearby sampling locations. This notification includes PFAS contamination detected above DEP's provisional CTLs. The notification provides contact information regarding the site's project manager, how to obtain more information through the DEP's information portal, and contact information with DOH should there be any health-related questions or concerns.

DEP is committed to providing timely information to the public regarding these efforts. DEP will continue to share site investigation data and current PFAS developments across agencies and with the public to provide current and transparent information on this issue. Additional future steps to address PFAS are anticipated to include:

- Continue development and dissemination of educational information for the public to increase awareness and understanding of PFAS impacts and relative risk of exposure to PFAS through drinking water and other exposure pathways.
- Update frequently asked question (FAQ) documents and maintenance of informational resources on the DEP's website.
- Continue to collaborate with EPA and other states for the advancement of PFAS knowledge.
- Request DOH sampling of private drinking water wells as appropriate for site cleanup actions that have exceedances of PFOA and PFOS provisional groundwater CTLs.
- Develop a geographic information system (GIS) database layer that identifies the universe of PFAS investigations and the areas of known groundwater contamination.
- Continue to provide updated results on areas of provisional groundwater CTL exceedances to Florida's five WMDs so they can add these areas to the water management databases for evaluation of well construction permitting and to provide areas where PFAS impacts exist.
- Continue engagement and sharing of information with the DOD on facilities in Florida with known PFAS impacts. Update locations sampled by U.S. DOD and continue to provide this information on DEP's website.
- Continue tracking sites that have begun assessment and cleanup activities by private parties or through voluntary cleanup actions.
- Continued use of existing statutory authority to engage responsible parties in conducting site assessments and remedial actions at sites where PFAS is a contaminant of concern.

FUTURE AREAS OF INVESTIGATION AND EMERGING ISSUES:

Objective - Continue efforts to identify areas of potential or known contamination and address environmental impacts through risk mitigation and remediation.

DEP is working to identify other potential sites and areas that may require investigation. The list of potential industries and/or sources will likely expand as our understanding of PFAS increases. DEP is also identifying the challenges that are impacting PFAS investigative work and will continue to expand this list of emerging issues as this work evolves.

Emerging PFAS Challenges

Several challenges facing PFAS investigative work have been identified below. DEP will continue to navigate these challenges and track new advances as our experience develops.

- Analytical Methods – There are more than 4,700 PFAS compounds; understanding which compounds can be quantified/identified by current methods can be a challenge; methods for analyzing PFAS in environmental media are in various stages of development and validation. The U.S. EPA is currently working to develop validated analytical methods for groundwater, surface water, wastewater, soils, sediments, biota and biosolids. Validated Method 537.1 ensures that analytical laboratories can measure 18 PFAS compounds in drinking water. Other validated methods may take many months to years to finalize.
- Site Access – Obtaining site access has been shown to cause significant delays in the DEP’s ability to perform assessment and cleanup activities. Typically, property owners are unwilling or reluctant to provide access to conduct necessary assessment work due to concerns over potential liability for cleanup.
- Investigation Derived Waste (IDW) – The disposal of PFAS IDW and potential costs associated with waste disposal are uncertain due to liability concerns by landfill operators and waste haulers.
- Source Identification and Assessment – PFAS compounds are generally soluble and very mobile in the environment; PFAS compounds are very persistent in the groundwater and impacts to drinking water aquifers may be long lasting; groundwater transport can be beyond the original source area to form large plumes and merging PFAS plumes can make source determinations complex. As identified releases are found for sites, it is likely additional plumes and sources will be identified. Forensic analysis in support of source determinations is in its infancy and appears to be challenging, but there are some helpful tools available and the science continues to evolve.
- Groundwater Remediation – Currently, the most widely used remedial technology is granulated activated carbon. This is primarily being utilized by drinking water supply systems i.e., wellhead treatment. To date, PFAS remediation approaches generally fall into two categories: (1) separation and (2) destruction. Separation includes filtration, coagulation, sorption and ion exchange. Sorption (including granulated activated carbon) and ion exchange show promising results. Destruction type treatment options include incineration, chemical oxidation, electrochemical, photochemical and

plasma. Although these might be promising treatment options, currently the energy intensity requirements make them expensive options. There are also challenges and limitations for allowing the treatment options to be effective and include intermediates or byproducts that may form, precursors and co-contaminants impacts; there are technical challenges to in-situ treatment and there are limited field-scale examples. Much more research is required to improve treatment option efficiencies, effectiveness and permanence of treatment.

Prioritization and Investigation of Likely PFAS Sources

DEP has identified several potential areas of investigation or “sites” that will likely require some research and possible sampling efforts. These areas of investigation or sites are provided below and are anticipated to expand or change with time:

- Former FTF Sites – DEP has confirmed the locations of two former FTF and assessment has begun at those facilities. Both are on state-owned lands. SIS is actively conducting research to identify the locations of other former FTF throughout the state and to determine the likelihood of past AFFF usage. This information will allow DEP to prioritize the locations and provide recommendations for future sampling.
- State-funded Cleanup Sites – The WSCS continues review its list of state sites to identify others that may require PFAS investigations. The WSCS will conduct initial sampling at any newly identified sites to determine if there are PFAS related impacts at these state-funded cleanup sites.
- The DSCP recently received site assessment reports on PFAS contamination at 10 DSCP pilot study sites and a PFAS White Paper that summarizes data from the PFAS pilot study. Based on the findings of the PFAS Pilot, DSCP is moving forward with an expanded evaluation of drycleaner sites that are currently undergoing cleanup.
- Solid Waste Facilities – Recent research funded by the Hinkley Center for Solid and Hazardous Management has shown that the levels of PFAS in untreated C&D and untreated MSW leachate were similar, suggesting that both waste sources are a significant source of PFAS. This is particularly relevant since most C&D landfills in Florida are not lined. Investigation of unlined solid waste facilities as potential PFAS sources could be a priority.
- Wastewater Treatment Plants, Reclaimed Water Spray fields and Biosolid Disposal Facilities – Recent data has suggested that these areas could potentially be impacted by PFAS and may require additional investigation.
- Fire Stations, Airports, Bulk Storage Tank Facilities and Ports (shipyards, cruise terminals) – These types of facilities are anticipated to require additional investigation due to the potential storage or use of AFFF.
- Manufacturing facilities for textiles, wiring and plating – It is anticipated that some of these facilities may have used PFAS constituents.
- Papermills – These facilities may have used PFAS constituents to provide oil, grease and/or water repellent to paper products.

- Superfund Sites – Several Superfund sites may require PFAS sampling based on historic manufacturing practices.
- Areas where AFFF may have been applied to address a flammable liquids incident such as tanker spill, train derailments, and other accidents or fires.

Technical Developments

It is anticipated that as additional data and assessment work continues, DEP will continue to improve its technical understanding and operating procedures. Efforts will continue within the following areas to increase the technical understanding of PFAS.

- Continue tracking of PFAS knowledge development and regulatory activities in other states.
- Continue to support agency participation in PFAS workgroups and training events to maintain knowledge and capacity for addressing PFAS.
- Continue working with EPA's State Science Partnership Program to evaluate new assessment techniques, including forensic analyses and computer modeling.
- Continue to follow research and environmental case studies conducted by UF and UM.
- Investigate additional environmental media, including estuaries, lakes, canals and streams to determine PFAS presence and transportation potential.
- Investigate PFAS impacts to air quality and landfill leachate.
- Continue evaluation of ecological risks.
- Develop remediation technologies to address environmental PFAS impacts.
- Conduct PFAS soil excavations and monitor results to determine effectiveness in groundwater and other media.
- Continue evaluation of appropriate PFOA/PFOS cleanup criteria for soil and groundwater and assess the need to address other PFAS compounds besides PFOA/PFOS.
- Consider rulemaking and rule revisions to address PFAS (e.g. 62-777).

APPENDIX A

Resources

- Florida Department of Health (DOH): <http://www.floridahealth.gov/environmental-health/hazardous-waste-sites/contaminant-facts/hw-pfas.html>
- Environmental Protection Agency (EPA): <https://www.epa.gov/pfas>
- Association of State and Territorial Solid Waste Management Officials (ASTSWMO): <http://astswmo.org/pfas/>
- Interstate Technology & Regularly Committee (ITRC): <https://www.itrcweb.org/Team/Public?teamID=78>
- Agency for Toxic Substances and Disease Registry (ATSDR): <https://www.atsdr.cdc.gov/pfas/index.html>
- Environmental Council of the States (ECOS): <https://www.ecos.org/pfas/>
- SERDP / ESTCP – U.S. Department of Defense’s (DOD’s) Environmental Research Programs: <https://www.serdp-estcp.org/Featured-Initiatives/Per-and-Polyfluoroalkyl-Substances-PFASs>

Case Studies/Research Projects:

- Researchers from UF and UM are investigating what happens when PFAS enters a solid waste stream and a landfill. Research funded by EPA on the Potential Environment Impacts of PFAS in Substances in Waste Streams: <https://www.eng.ufl.edu/newengineer/essie/uf-engineering-hopes-to-curb-harmful-chemicals-in-landfills-with-epa-grant/>
- Building Resilience to PFAS Exposure on Vulnerable Coastal Communities Prone to Extreme Weather Floods: Brevard County as a Case Study: https://cfpub.epa.gov/ncer_abstracts/index.cfm/fuseaction/display.abstractDetail/abstract/11080/report/0