

# **PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)**

## **DYNAMIC PLAN**

**Division of Waste Management**

**Florida Department of Environmental Protection**

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## EXECUTIVE SUMMARY

The Florida 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 synthetic 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 used at firefighting training facilities, airports, chemical plants and military installations.

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. When released in the environment, PFAS easily migrate and are persistent. These chemicals have been identified as Contaminants of Emerging Concern (CEC). CECs are chemicals recently detected in the environment that may pose public health or ecological risks. The science involved with CECs, especially with PFAS, is rapidly evolving.

Widespread use of PFAS has led to contamination of Florida groundwater resources, including private and public potable supply wells. DEP has investigated and found PFAS at fire training facilities, State Funded Cleanup sites and Drycleaning Solvent Cleanup Program sites. PFAS contamination also has been identified at current or former federal facilities in Florida.

This dynamic plan is intended 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 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 and to protect Florida's communities from PFAS exposure.
- 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 natural resources.
- Identify PFAS contamination through site investigations.

- Continue efforts to prevent/reduce further impacts through outreach and communication.
- 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 statewide where there is known or suspected contamination even if there is no viable responsible party. These investigations have led to the discovery of PFAS impacts and have necessitated regulatory and technical developments.

### **Regulatory and Scientific Developments**

***Objective: Continue to be a national leader in response to PFAS concerns and to protect Florida's communities from PFAS exposure.***

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, which 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 coordinates with federal and other state 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 Florida counties that have been delegated for environmental response actions.
- Sharing site investigation data and private well sampling data with the five water management districts (WMDs).
- Sharing information and following research projects being conducted by the University of Florida and University of Miami.
- 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.
- Coordinating with DOH on site investigation data, requests for private well sampling, and evaluation and communication on possible 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 agency 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 up to 36 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.

The current understanding of PFAS on human health and the environment is rapidly evolving. It is anticipated that health-based standards for these chemicals will vary and may change as scientific understanding continues to grow.

There are no public drinking water facilities in the state of Florida currently in violation of the HAL for PFOA and PFAS established by EPA. In the event there is a detection, immediate action is taken by the facility to address any identified elevated levels to protect public health and the environment.

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 lifetime HAL of 70 ng/L to determine appropriate response actions.

### **DEP Laboratory Capabilities**

The Chemistry Program of DEP’s 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 36 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
NFDHA	Nonafluoro-3,6-dioxaheptanoic acid	8.0	0.80
PFDoA	Perfluorododecanoic acid	2.0	0.20
PFDS	Perfluorodecanesulfonic acid	0.40	0.10
PFECHS	Perfluoro-4-ethylcyclohexanesulfonic acid	5.0	0.25
PFEESA	Perfluoro(2-ethoxyethane)sulfonic acid	5.0	0.25
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
PFMBA	Perfluoro-4-methoxybutanoic acid	5.0	0.25
PFMPA	Perfluoro-3-methoxypropanoic acid	5.0	0.25

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
PFPrS	Perfluoropropanesulfonic acid	5.0	0.25
PFTeA	Perfluorotetradecanoic acid	2.0	0.20
PFTriA	Perfluorotridecanoic acid	2.0	0.20
PFUnA	Perfluoroundecanoic acid	2.0	0.20
NMeFOSAA	N-Methylperfluorooctane sulfonamidoacetic acid	0.80	0.10
NEtFOSAA	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	16	1.6
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-Chloroelcosafuoro-3-oxaundecane-1-sulfonic acid	2.0	0.20

Currently the EPA has published three analytical methods for the analysis of PFAS in drinking water, EPA 533, EPA 537 and EPA 537.1. The EPA has one approved method validated for the analysis of PFAS in surface water, groundwater and wastewater matrices, EPA 8327. This method may be applicable to other environmental matrices. EPA 8327 does not use the technique of isotope dilution mass spectrometry (IDMS), which has become something of an industry standard in the field of PFAS analysis and thus has been referred to as a screening method. In addition, EPA has published draft method 1633 for the analysis of PFAS in eight different environmental media: wastewater, surface water, groundwater, soil, biosolids, sediment, landfill leachate and fish tissue.

The DEP Laboratory utilizes its internally developed method, DEP LC-001-3, when reporting PFAS results. This DEP method is consistent with methods used by many of the large commercial laboratories performing PFAS analysis. Method DEP LC-001-3 references EPA method 8321B and incorporates 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 include PFAS or IDMS but allows for the addition of non-listed analytes as long as all quality control objectives are achieved.

### **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's Division of Waste Management provided a status of 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 DEP website provided in Appendix A, 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 provided to the public and private sectors for practical applications.

Recent Hinkley Center projects that have dealt with PFAS include *Remediation of Perfluoroalkyl and Pharmaceutical Substances in Landfill Leachate via Solar Simulated Photocatalysis*; *PFAS Releases from Landfills in Florida*; *Break the Loop of PFAS Cycling in Landfills: Aqueous PFAS Destruction or Solid Thermal Incineration*; *Non-Thermal Plasma Degradation of Per- and Polyfluoroalkyl Substances from Landfill Leachate*; *Characterization and Management of Per- and Polyfluorinated Alkyl Substances (PFAS) Remediation Residuals*; and *Remediation of Perfluoroalkyl Substances in Landfill Leachate via Solar Photocatalysis*. Additional information on these projects may be found at [HinkleyCenter.org](http://HinkleyCenter.org)

### **University Research Projects and Case Studies**

There are several research projects and environmental case studies being conducted by the University of Florida (UF), Florida International University (FIU) 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 as follows and in Appendix A.

- UF is undertaking a Florida water quality project studying the prevalence of PFAS in surface waters across the state. The UF funded project has resulted in the collection of approximately 1,700 surface water samples. The samples will be analyzed for 125 PFAS compounds.

- In research funded by EPA on the potential environmental impacts of PFAS in substances in waste streams, 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 influences 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.
- FIU is working on the development of an analytical method able to detect PFAS more reliably at low concentrations. They have conducted a study that has sampled surface waters from Biscayne Bay, adjacent canals and tap waters for PFAS in southeast Florida. The information will help provide data on the occurrence and distribution of PFAS in South Florida.
- Research is being completed by UF on the remediation of PFAS contaminated soils through thermal treatment technologies. Existing pilot scale research is limited in terms of PFAS species examined and understanding potential transformations that occur with volatilization of PFAS. The University of Florida intends to investigate these gaps in knowledge by retrofitting a traditional soil treatment plant for PFAS monitoring throughout the pyrolysis process. The state funded grant is being managed by DEP.

### **Contracted Toxicological Support**

DEP has a contract for toxicological support services through 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, 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 as follows:

**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 has developed screening levels to evaluate potential risk based on exposure to water from irrigation wells and surface water. Also, the screening levels for surface water 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 natural 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.

DEP began conducting investigations in 2018 of contaminated sites across the state where PFAS contamination was known or suspected even if there was no viable responsible party. 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 contracts 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

ng/L = nanograms per liter (parts per trillion)

## **DEP 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 lifetime 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 even if there is no viable responsible party. 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**

The EPA released a list of 30 CECs in 2012 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 indicate three public well systems in Florida produced samples with the sum of PFOA and PFOS concentrations exceeding the EPA HAL of 70 ng/L. 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 immediately 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. Martin County and the city of Stuart 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 and is monitored to

ensure compliance. 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 affected well owner with concentrations exceeding the HAL.

### **Fire Training Facility 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 completed survey 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 26 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, or 30 constituents using DEP SOP Method LC-001-3. 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 26 active facilities identified with known or suspected use of AFFF, the investigations indicate that 23 of the 26 had analytical results for PFOA and PFOS above the provisional groundwater CTL.

The initial SIS work at the 26 FTF provided assessment information on six that are located on state-owned lands. DEP will continue overseeing the assessment work on these six 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 continue to identify additional locations of former FTF.

### **Drycleaning Solvent Cleanup Program Sites**

The Division of Waste Management's Drycleaning Solvent Cleanup Program (DSCP) manages the cleanup of eligible drycleaning or wholesale supply facilities. The DSCP selected 15 drycleaning sites located across Florida for a limited PFAS sampling effort. The initial effort included sampling two on-

site monitoring wells at each site for PFAS. Based on the results of the initial sampling, DSCP completed additional assessment at 10 of the 15 sites.

**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 ng/L	Five	No further sampling	No well survey

ng/L = nanograms per liter (parts per trillion)

The site assessment goal was to determine if PFAS was related to drycleaning operations. Sampling of available solvents seems to indicate that it is unlikely that drycleaning solvents contain PFAS. Based on the summary findings presented in the Florida Statewide PFAS Pilot Study at Drycleaning sites (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 drycleaning 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 drycleaning 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 parts per trillion (ppt) levels to low parts per billion (ppb) levels. The DSCP plans to continue evaluating the potential impacts and exposure risk at additional drycleaning sites. A phased approach will be implemented with investigation beginning at sites with a nearby private well that are currently undergoing site rehabilitation by the DSCP. Thus far, an additional 20 drycleaning sites have had analytical results for PFOA and PFOS above the provisional groundwater CTL.

**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 five monitoring wells for PFAS	Additional site assessment for sites with groundwater >70 ng/L No further action if < 70 ng/L	~ 70 sites with a nearby private well will be sampled in 2021 and 2022
Phase 1, Tier 2 – Remaining sites currently undergoing site rehabilitation	Sample up to five monitoring wells for PFAS	Additional site assessment for sites with groundwater >70 ng/L No further action if < 70 ng/L	Remaining sites (~200) undergoing site rehabilitation

Phase 2 – Remaining sites that are currently awaiting site rehabilitation	Sample up to five 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 ~ 87)
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**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 each site’s former operational history and likely use of PFAS related chemicals. Sites under this sampling effort included former landfills, metal plating facilities, chemical manufacturers, electroplaters, drycleaners and users of various solvents. 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

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. Based upon their operational history and likely use of PFAS related chemicals, other State Funded Cleanup sites are being assessed for PFAS investigation and new State Funded Cleanup sites will be assessed for PFAS if appropriate.

**Federal Facilities in Florida**

With the emergence of concerns regarding PFAS, DEP has been coordinating with 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 Army National Guard installations and by the U.S. Coast Guard.

DEP will continue to work closely with federal and state partners in order to investigate and mitigate for PFAS, 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 in appropriate media types. 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	Eight base-wide site inspections completed	Yes, at eight of eight bases	Yes, for two bases
Air Force Base Realignment and Closure (BRAC) sites	One site inspection completed	No groundwater data received; PFAS present in soil	No data
Navy including outlying landing fields (OLFs)	10 base-wide preliminary assessments completed and site inspections initiated	Yes, at three bases and four OLFs	Yes, for one base and one OLFs
Navy BRAC	Two base-wide assessments ongoing	Yes, two bases	Sampling complete; no impacts
Air National Guard	One base-wide site inspection completed	Yes	No data
Army National Guard	Nine preliminary assessments completed and four site inspections planned	No data received	No data
Defense Logistics Agency's Fleet Logistics Center - Jacksonville	One 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	Hydrocarbon Burn Facility and base-wide phase I site assessments completed with additional investigation ongoing	Yes	No data
Coast Guard	Two air station preliminary assessments completed	No data received	No data

- **DOD’s Florida Response** - To date, three installations and one OLF have off-base private well impacts above the HAL. As a short-term solution, the federal 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 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.
- **DOD’s National Response** - The 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.](#)

**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 PFAS website and will continue to update this information as new data is obtained. The webpage is dedicated to making this information readily available and accessible to the public regarding DEP’s efforts.

- [DEP’s Efforts to Address PFAS in the Environment](#)

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 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 FAQ documents and maintain informational resources on the DEP website.
- Continue to collaborate with other states and EPA for the advancement of PFAS knowledge.
- Request DOH sampling of private drinking water wells as appropriate for cleanup actions at sites that have exceedances of PFOA and PFOS provisional groundwater CTLs.
- Provide a geographic information system (GIS) database layer that identifies the sites with PFAS investigations that are occurring throughout the state.
- 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 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.
- Continue 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 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. 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, and methods for analyzing PFAS in environmental media are in various stages of development and validation.

Currently, EPA has one approved method validated for the analysis of 24 PFAS analytes in surface water, groundwater and wastewater matrices (EPA 8327). EPA has also published draft method 1633 for the analysis of 40 PFAS analytes in different environmental media including wastewater, surface water, groundwater, soil, biosolids, sediment, landfill leachate and fish tissue.

- Site access – Obtaining site access has been shown to cause significant delays in DEP’s ability to perform assessment and cleanup activities. Property owners typically 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. The compounds are very persistent in groundwater, and impacts to drinking water aquifers may be long lasting. In addition, 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 that 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 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, the energy intensity requirements currently 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 provided below 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 to review its list of state sites to identify others that may require PFAS investigations. The WSCS will conduct initial sampling at any new state-funded cleanup sites suspected to have PFAS related impacts.
- 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 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 the EPA 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 on 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

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### Resources

- [DEP's Efforts to Address PFAS in the Environment.](#)
- [DEP's Office of District and Business Support, Risk Assessment: References and Scenarios.](#)
- [DEP's Office of District and Business Support, Contaminated Media Forum.](#)
- [Florida Department of Health.](#)
- [U.S. Environmental Protection Agency.](#)
- [Association of State and Territorial Solid Waste Management Officials.](#)
- [Interstate Technology and Regulatory Committee.](#)
- [Agency for Toxic Substances and Disease Registry.](#)
- [Environmental Council of the States.](#)
- [Assistant Secretary of the Navy \(Energy, Installations and Environment\) – PFAS.](#)
- [Air Force Civil Engineering Center – PFAS.](#)
- [ARMY PFAS Status](#)
- [National Guard Bureau – PFAS.](#)

### Case Studies/Research Projects

- [Florida Statewide PFAS Pilot Study at Drycleaning Sites.](#)
- [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.
- [FIU Institute of Environment PFAS Toxicity Study.](#)
- [UF. Building Resilience to PFAS Exposure on Vulnerable Coastal Communities Prone to Extreme Weather Floods: Brevard County as a Case Study.](#)
- [SERDP / ESTCP – U.S. Department of Defense Environmental Research Programs.](#)