

Strategy to Assess the Impact of Per- and Polyfluoroalkyl Substances on Private (Individual) Drinking Water Wells

Bureau of Water

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Acronyms Used

BLWM	Bureau of Land and Waste Management (SCDHEC)
BOW	Bureau of Water (SCDHEC)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
LHA	Lifetime Health Advisory
MCL	Maximum Contaminant Level
NHDES	New Hampshire Department of Environmental Services
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
ppt	Parts Per Trillion
SCDHEC	South Carolina Department of Health and Environmental Control
WRF	Water Resource Foundation
USEPA	United States Environmental Protection Agency

I. Introduction

Background – National

The presence of per- and polyfluoroalkyl substances (PFAS) in food and water are presenting a prominent public health and environmental issue in communities across the United States. PFAS have been used since the 1940s for their heat resistance and water-, oil-, and dirt-repellant. They are used in a wide variety of consumer, commercial and industrial applications; are mobile and persistent in the environment; bioaccumulate in the food web; and, can deleteriously affect human health.

Accordingly, the United States Environmental Protection Agency (USEPA) has:

- (a) enacted the [US PFAS Action Plan](#), which was updated in February 2020,
- (b) committed to [promulgating PFAS regulations](#) under the Safe Drinking Water Act, the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), and the Resource Conservation and Recovery Act
- (c) released the [PFAS Strategic Road Map](#) in October 2021

Although USEPA have not yet promulgated health-based or otherwise categorical standards, or criteria, for PFAS. They has issued guidance of a Lifetime Health Advisory (LHA) for PFOS and PFOA in drinking water. The upper bound LPHA concentration for drinking water is 70 parts per trillion (ppt) for either PFOA or PFOS, or their combined sum.

As work on understanding the public health and environmental attributes of PFAS continues at the Federal level, several states are in various stages of the same inquiry. This work includes, for example, proposing legislation; generating funding; reorganizing or adding personnel; conducting research on adverse human health and ambient ecological effects; executing sampling programs; updating permit requirements; establishing moratoriums on land application of biosolids to address PFAS.

Ongoing scientific studies and rule promulgation by USEPA and other States (Table 1 and links in Section IX) to establish drinking water standards, soil leaching values, and loading limits for PFAS-containing residuals, septage, and wastewater will likely take several years. Consequently, the South Carolina Department of Health and Environmental Control's (SCDHEC) Bureau of Water (BOW) has determined it is prudent and necessary to implement this Strategy to expedite the assessment of PFAS effects on and impacts to private (individual) drinking water wells in the State.

Background – South Carolina

The SCDHEC BOW has responded by preparing and implementing strategies to assess the impact of PFAS on waters of the State using a triad approach. Two (2) of the Strategies are presently being implemented:

- The **Public [Drinking Water Strategy](#)** formalized, January 30, 2020, focuses on 583 drinking water treatment plants using surface water and groundwater sources. Community (public) systems serve approximately four (4) million residents of the State. Sampling and analysis are ongoing; the acquired data can be accessed on the [SCDHEC BOW PFAS Webpage](#).
- The **Ambient [Surface Water Strategy](#)**, formalized on, April 30, 2021, focuses on determining how widespread PFAS are in ambient surface waters and the associated aquatic media by screening near suspected active and inactive sources across 48 priority watersheds. Sampling of surface waters, oysters, blue crabs, and fish tissues for analysis will begin summer of 2022. The results of this screening level program, along with the results of the Drinking Water Strategy, will inform future SCDHEC actions related to addressing possible human health and ecological impacts associated with PFAS exposure.

- The **Private (Individual) Well Strategy** presented herein is the third element in BOW’s triad-based approach for assessment of PFAS impacts on water resources of the State. In South Carolina, approximately one (1) in every five (5) residents depend on groundwater from private drinking water wells for potable water. Further, private (individual) wells generally and typically are shallow wells (*e.g.*, perhaps up to 100 feet or so below ground surface). community water system wells (*e.g.*, many hundreds to thousands of feet below ground surface). With at least one (1) million wells estimated to be currently in use, it is neither practical nor feasible to assess all of those wells directly. Consequently, this Strategy adopts the identification of wells for testing to be based on the vulnerability of the aquifer in which the well is located; the land-use practice(s) associated with the well location; and the susceptibility of the well affected by the associated land-use practice(s).

TABLE 1. SOME ONGOING PFAS RESEARCH AND REGULATORY TIMELINES

AGENCY	ACTION	COMPLETION DATE
USEPA	Update 2016 70 ppt LPHA for PFOA and PFOS	ASAP
NHDES	Residuals Loading Rule Changes	2026
USEPA	PFOA and PFOS MCLs	FALL 2023
USEPA	USEPA Method 1633 Multi-lab Validation	FALL 2022
USEPA	PFOA and PFOS Biosolids Risk Assessment	WINTER 2024
USEPA	CERCLA Designation	SUMMER 2023
INDIANA UNIVERSITY	Predicting and Communicating PFAS Exposure Risks from Rural Private Wells	FALL 2023
WRF	Unregulated Organic Chemicals in Biosolids: Prioritization, Fate and Risk Evaluation for Land Applications EPA 84024501	ONGOING
WRF	Assessing PFAS Release from Finished Biosolids	2022

The sources referenced in Table 1 and Section IX below, as well as the resources developed by the Interstate Technology Regulatory Council, are reliable sources of information regarding the history, properties, sources, fate and transport of these chemicals. Due to the increasing knowledge base and understanding of the physicochemical, toxicological and ecological aspects of PFAS, and the discussions of such in the Public Drinking Water and Ambient Surface Water Strategies developed and implemented by BOW, this Individual (Private) Well Strategy presented herein does not recapitulate that information and those discussions.

II. Purpose

The purpose of this Strategy is to evaluate equitably, systematically and reliably private (individual) drinking water wells for PFAS effects and/or impacts for public health protection by using the concepts of aquifer vulnerability, well susceptibility and well location-associated land-use practices into an integrated approach.

III. Data Acquisition; Decision Rule; Points of Inquiry

Data Acquisition

Assessment of PFAS in private well water under this Strategy will comply with an approved Quality Assurance Project Plan (QAPP) that will specify, among many attributes, how samples will be collected and analyzed.

Decision Rule

The QAPP will also specify how the ensuing data will be used:

1. The decision rule for data outcomes for drinking water from private wells will resemble the following:
 - a. Affected -- PFAS analytes reported but no exceedance of USEPA LHA by PFOA/PFOS
 - b. Impacted -- either PFOA or PFOS, or their sum concentration, exceeds USEPA LHA of 70 ppt) or any South Carolina or Federal standard, established since the publication of this document[A1]
 - c. Unaffected/Unimpacted – no PFAS analytes reported[A2]

Points of Inquiry

Data acquired from implementation of this Strategy will be used to inform and elucidate answers to the following questions:

1. What is the scope of private (individual) drinking water wells that are located proximal to known or reasonably-suspected PFAS sources (per Sections V and VI, below)?
2. Are private (individual) drinking water wells proximal to the specified associated land-use(s) either affected or impacted by PFAS?
3. At locations where private well drinking water is found to be either affected or impacted, what are the measurable concentrations of PFAS, as determined to be applicable to the specific situation, in plausible sources and/or, by association with, transport media:
 - a. in localized groundwater, surface water, stormwater and/or soil?
 - b. in areal groundwater related to nearby potential sources.
 - c. in sludge, septage, and wastewater, if being land-applied?

Also, at these affected/impacted private well locations, are PFAS:

- d. in crops, hay *etc.*, if grown on associated land?
- e. in livestock, including milk, if grazed on associated land or fed impacted hay?
- f. in sludge, septage, and wastewater proposed for new land application, if so intended/planned?

IV. Basis

The BOW will evaluate the susceptibility of private wells to PFAS from various land-use practices and associated with known or reasonably-suspected PFAS sources, using the relative vulnerability of regional aquifers based on geographic/physiographic location within the State. The State's hydrogeology is divided into three (3) geographic areas of relative vulnerability: Aquifers in the Upper Coastal Plain and Piedmont area of State are considered more vulnerable to activities at land surface with the sandhills region being

most susceptible. Aquifers in Lower Coastal Plain are generally considered the least vulnerable, relative to the aquifers of the Piedmont and Upper Coastal Plain. The susceptibility of private wells to contamination originating from the land surface takes into account the innate vulnerability of the aquifers and the presence of a potential PFAS source.

V. Well Selection Factors and Attributes

The following factors will be used to establish priority of well selection for assessment:

- Aquifer Vulnerability
 - location
 - areal hydraulic characteristics
 - areal geologic characteristics
- Well Susceptibility
 - well location relative to source [*e.g.*, fire training sites and response sites (training academies, civilian airports, military bases), industrial sites, landfills, biosolids land application sites and wastewater treatment facilities]
 - well depth
 - well condition
 - soil type(s)
 - historical nearby land-uses
- Associated Land-use Practice(s) [Known or Suspected PFAS Source Contributions]
 - documented PFAS in groundwater, surface water and/or soil from nearby sources
 - inferred likelihood of PFAS in groundwater, surface water and/or soil from nearby potential sources (see Section IV)

VI. Assessment Implementation

Once areas have been prioritized as described above, assessment will be implemented generally as follows:

- Prioritize areas within each land-use categorical type to determine plausible potential likelihood of PFAS affects and/or impacts on private (individual) drinking water wells proximal to:
 - Civilian airports
 - Military bases
 - Fire response training centers
 - Industrial sites
 - Wastewater treatment facilities
 - Biosolids land application sites
 - Landfills
- Communicate, educate and discuss the Department's desire to sample a private well with the well's owner and user, if different parties, to receive permission to collect a sample
- Sample and analyze private wells for PFAS, upon receipt of well owner's permission, identified during the prioritization process
- Sample and analyze wastewaters and/or biosolids associated with wells of concern, as indicated by the private well sampling results

- If indicated to be warranted by data acquired from wells, sample and analyze soil, groundwater, stormwater, vegetation in the well area, as deemed appropriate
- Publish data on the BOW PFAS web with identifiers of individual residents redacted

VII. Key Administrative Actions

The following actions will be pursued to facilitate implementation of this Strategy

Develop and publish an approved QAPP

- Estimate cost for Strategy implementation, i.e., analytical costs
- Pursue internal and external funding for analytical costs
- Dedicate staff resources to perform sample collection
- Update existing Geographical Information System database (*land application provisional*) of current and historical land application sites, including cumulative loading rates
- Place a hiatus on new land application sites until source(s) to be applied is/are confirmed to be of no risk

VIII. Uncertainties

This Strategy is designed to have the flexibility to be dynamic and to be adjusted to ongoing development findings; emerging guidance and requirements from USEPA; and, information developed by other States applicable to South Carolina.

IX. Links to Some Actions by Other States

[ARIZONA](#)
[CALIFORNIA](#)
[CONNECTICUT](#)
[DELAWARE](#)
[ILLINOIS](#)
[MASSACHUSETTS](#)
[MAINE](#)
[MARYLAND](#)
[MICHIGAN](#)
[MINNESOTA](#)
[NEW HAMPSHIRE](#)
[NEW YORK](#)
[OHIO](#)
[OREGON](#)
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