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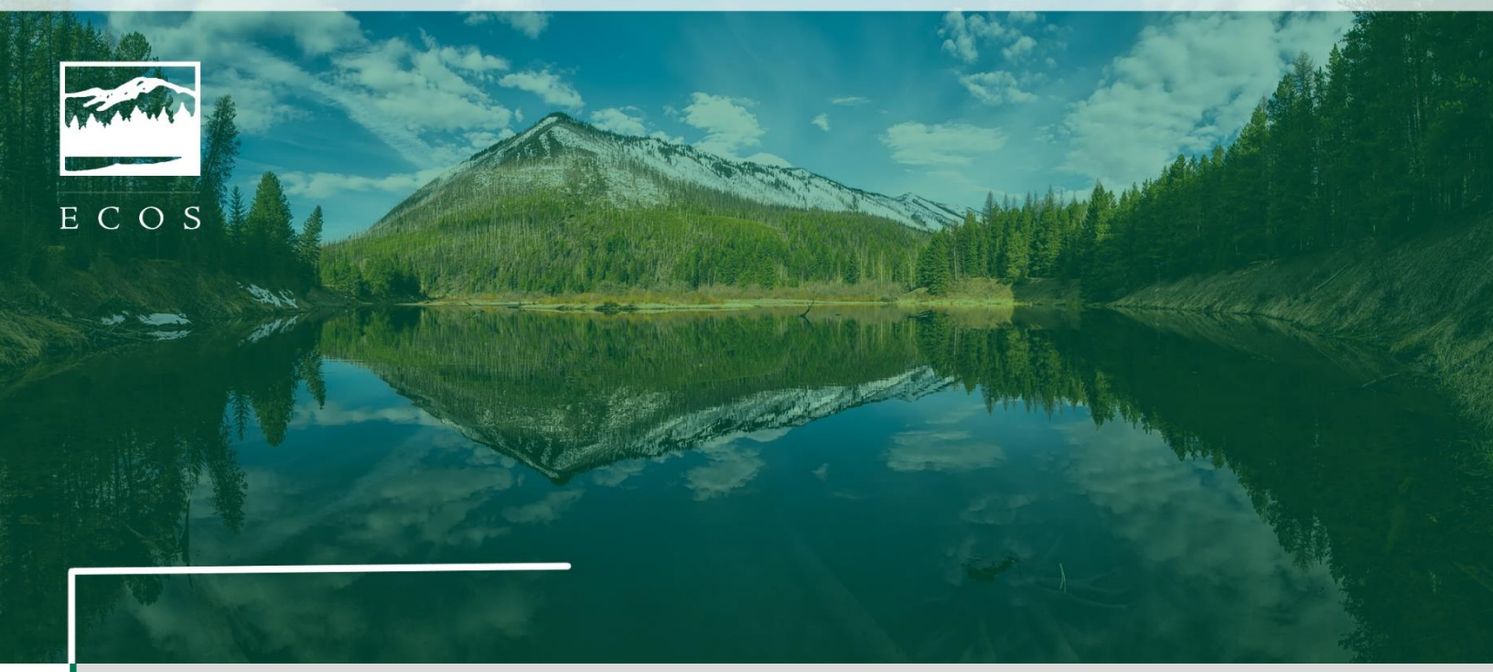


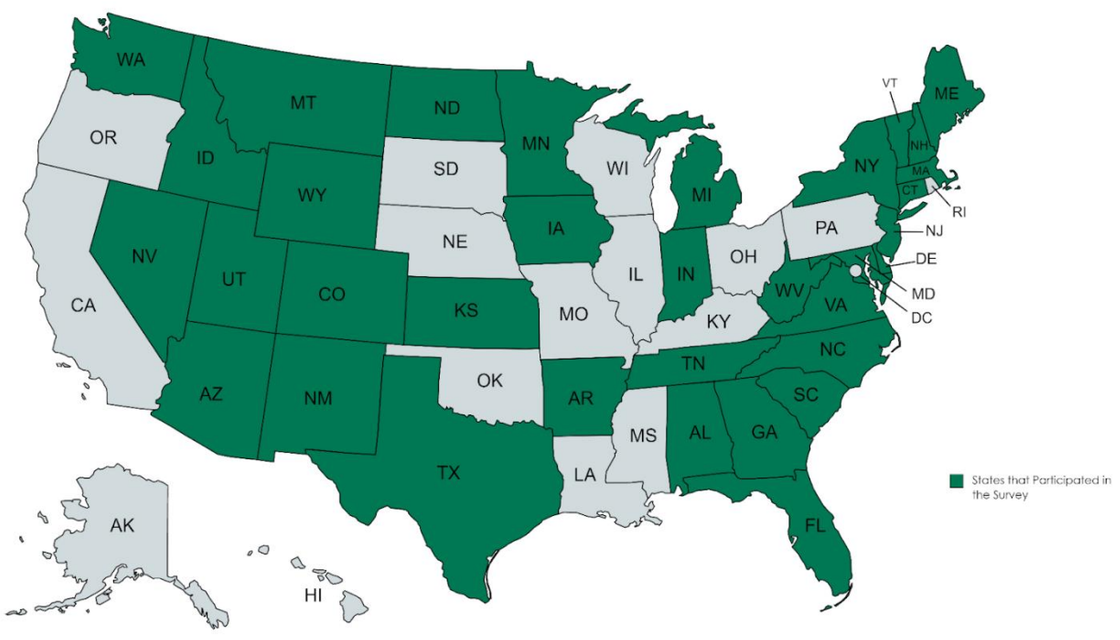
PFAS in Biosolids: A Review of State Efforts & Opportunities for Action

By Sarah Grace Hughes, Senior Project Manager, ECOS

Executive Summary

For years, states have been actively working to address per- and polyfluoroalkyl substances (PFAS) contamination in a variety of environmental media. One recent challenge is the management of solids, which may be contaminated with PFAS as a result of its discharge to sewer systems from industry, businesses, and households and subsequent accumulation in biosolids produced from municipal wastewater treatment processes. This challenge encompasses a variety of considerations about testing, disposal, treatment, migration to groundwater and drinking water, and potential uptake to crops and animals if land applied. As there is no federal regulation or guidance for PFAS-contaminated biosolids, it is currently up to individual states to determine best practices for managing these contaminated wastewater residuals.

The Environmental Council of the States (ECOS) in November 2022 collected information from state environmental agencies on policies, testing, research gaps, and risk communication challenges related to PFAS in biosolids. Thirty-four states, shown in green in the map below, responded to the survey. This paper outlines ECOS' findings on how these states manage biosolids, and where opportunities exist for regulation, research, and risk communication.



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Introduction

Biosolids Regulations & Management

Biosolids are the semisolid product resulting from the municipal wastewater treatment process at thousands of publicly owned treatment works (POTWs) nationwide. Wastewater agencies typically manage biosolids through incineration, landfilling, or land application, each method requiring adherence to state and federal regulations.

Federally, the U.S. Environmental Protection Agency (EPA) under the Clean Water Act (CWA) Section 405(d) regulates standards for the use or disposal of sewage sludge (biosolids) in 40 Code of Federal Regulations (CFR) Part 503. **40 CRF Part 503** includes pollutant limits, requirements for pathogen and vector attraction reduction, management practices, monitoring and reporting, and other requirements, and applies to any person or treatment works that prepares, applies, or incinerates sewage sludge, and the owners and operators of surface disposal sites.[1] These regulations are intended to ensure that biosolids are handled properly to best protect human health and the environment.

There are three main management approaches for biosolids.

Incineration

Sewage sludge incineration uses thermal oxidation to convert the organic compound-rich biosolids into gaseous, inorganic products for disposal. Incinerators are subject to a range of requirements under the CWA to meet risk-based pollutant limits, as well as under the Clean Air Act (CAA) section 129 to set numerical emissions standards for pollutants, among other conditions.

Landfilling

Biosolids can be disposed of at landfills, either in monofils (landfills that accept only wastewater treatment plant [WWTP] biosolids, regulated under 40 CFR Part 503) or in co-disposal landfills (landfills that combine biosolids with municipal solid waste, regulated under 40 CFR Part 258).[2] While it is a widely accepted method for biosolids management, landfilling can lead to challenges due to limited capacity.

Land Application

Land application involves spreading the biosolids to supply nutrients to soil and replenish organic matter. It has been a primary method of biosolids management due to its beneficial uses, such as improving crop yields or reducing the need for synthetic fertilizers. 40 CFR Part 503 divides biosolids into Class A and Class B biosolids, dependent on pathogen reduction requirements. Per the North East Biosolids and Residuals Association (NEBRA), Class A biosolids are virtually free of pathogens and can be used anywhere. Class B biosolids still have some pathogens and must be managed at sites with little public contact and with various restrictions. These biosolids are mostly used on farms, in highly-managed forestry, for land reclamation, and so forth, and are considered safe because natural forces in the environment help to further reduce pathogens. Some states require site permits for Class B biosolids.[3] Both classes of biosolids are subject to management practices.

PFAS in Biosolids

PFAS enter WWTPs from a variety of industrial, commercial, and domestic sources and are not fully removed during the standard treatment process, resulting in biosolids that contain PFAS.[4] Therefore, when the biosolids are land applied, landfilled, or incinerated, there are risks of contamination and further complications of uptake and distribution. According to the Interstate Technology and Regulatory Council (ITRC), incineration is a mature technology that is proven effective to destroy some contaminants in biosolids, but is a topic of current study to better understand its ability to destroy PFAS due to possible incomplete combustion and byproduct generation.[5] Landfilling may pose challenges because landfill leachate, which may be a significant source of PFAS release to the environment, requires further treatment at WWTPs and may have fate and transport implications. The land application of biosolids may introduce PFAS to the environment, allowing it to enter surface or groundwater, and there are still many unknowns about the movement of PFAS in biosolids in terms of animal grazing, plant uptake, and other factors of this management approach.

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[1] Webpage: **Biosolids Laws and Regulations**, EPA
[2] Fact Sheet: **Use of Landfilling for Biosolids Management**, EPA
[3] Webpage: **About Biosolids**, NEBRA
[4] Document: **Biosolids and PFAS: Maintaining Management Options is Critical to Communities and Sustainability**, National Association of Clean Water Agencies (NACWA), June 2022
[5] Fact Sheets: **Biosolids and PFAS** and **Treatment Technologies and Methods for PFAS**, ITRC

There have been a number of efforts to better understand the challenges associated with PFAS in biosolids. These include a 2020 **review of models** for evaluating PFAS in land applied residuals and biosolids (contributed to by Arcadis, the National Council for Air and Stream Improvement, Water Environment Federation, American Forest & Paper Association, and NACWA); a 2022 **Northeast Regional Sludge End-Use and Disposal Estimate** from the New England Interstate Water Pollution Control Commission (NEIWPCC); and the biosolids **fact sheet** from ITRC, among other resources. EPA in its PFAS Strategic Roadmap also committed to completing by December 2024 a risk assessment for two PFAS, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) in biosolids.

In the meantime, the risks and unknowns of the effects of PFAS in biosolids have spurred public concern and states have taken or are considering taking various steps towards management. ECOS is working with EPA, the National Association of State Departments of Agriculture (NASDA), the U.S. Department of Agriculture (USDA), and others to better understand state and federal perspectives and to ensure coordination on the matter. As shown by the results of the survey outlined below, states have different policies and procedures related to biosolids. However, states collectively emphasize the need for improved and unified risk communication, source control, and research on challenges such as fate and transport, and they look forward to the opportunity to engage with federal partners and other stakeholders to better manage and communicate about PFAS in biosolids.

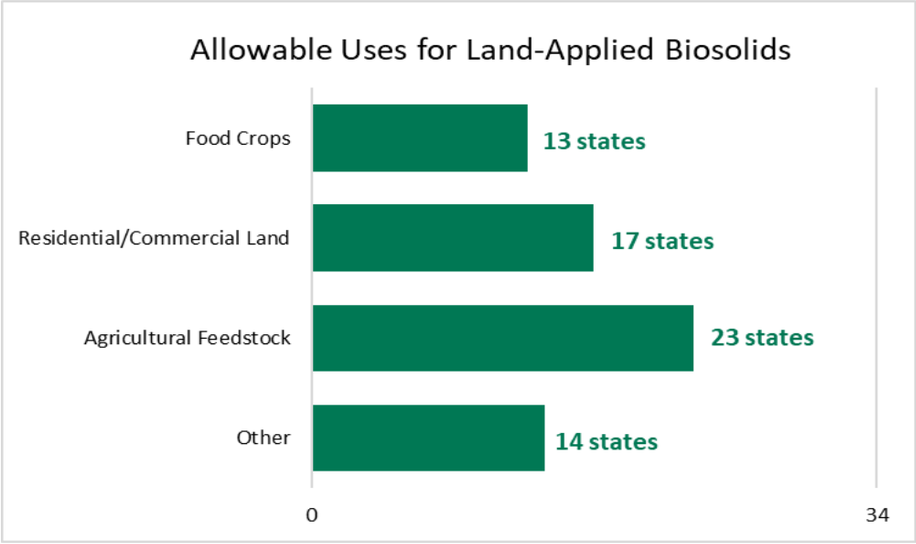
State Legislative & Regulatory Activity

States are subject to federal regulations under 40 CFR Part 503 for biosolid use and disposal, but also have the authority to make independent decisions about how to further manage biosolids while complying with the rule. 40 CFR Part 503 allows for land application on food crops (with restrictions), unless a state has a specific restriction prohibiting it. Class A biosolids, which cannot contain measurable quantities of pathogens, must meet stricter EPA guidelines for land application, allowing them to be used for not only agricultural purposes but also in public residential and commercial areas. Per **§ 503.32(b)(5)**, Class B biosolids, on the other hand, have the following access and harvest restrictions due to their detectable levels of pathogens:

- Food, feed, and fiber crops cannot be harvested for a minimum of 30 days after the last application;
- Above-ground food crops must not be harvested for a minimum of 14 months after the last application;
- Below-ground food crops must not be harvested for a minimum of 20 months after the last surface application where the material remains on the surface for four months or longer prior to incorporation, or a minimum of 38 months after the last surface application where the materials remain on the surface for less than four months prior to incorporation;
- Livestock/domestic animals are not allowed to graze for a minimum of 30 days after the last application;
- Turf must not be harvested for a minimum of one year after the last application; and
- Public access is restricted for a minimum of 30 days to a full year after application.

Maine is currently the only state with a ban on the land application of biosolids, and very few states have enacted or proposed legislation for managing PFAS in biosolids. However, a number of states have taken or are considering other types of regulatory actions. ECOS asked states to share the extent, rates, and frequencies with which they land apply biosolids; if they or any of their counties, municipalities, or other jurisdictions have taken regulatory actions; and where there have been prohibitions or restrictions on beneficial use. The regulations and management measures discussed below were not developed to mitigate PFAS migration but rather designed based on other impacts such as introducing nutrients and minimizing contact with pathogens.

Allowable uses for land applied biosolids



This question sought to gather information on how states may land apply biosolids and for what purposes. It is important to note that more states than those listed for each type in the chart above may allow for different types of land application (or states that selected "other" may also apply to land that provides food crops or feedstock, for example), and the question did not ask states about what percent of biosolids are distributed in these manners. However, the variability of the results indicates how states that responded to the survey classify their distribution of biosolids and if they have any restrictions more stringent than EPA's regulations.

Five states (Idaho, Iowa, Kansas, Nevada, and New York) said biosolids are distributed only to agricultural feedstock, but other respondents selected more than one answer, or provided comments on other types of distribution processes.

For many states, allowable uses for land applied biosolids are dependent on the class of biosolids. States reported that Class A biosolids may be marketed, sold, or given away, mostly for residential, commercial, and municipal landscaping purposes. These biosolids can also be land applied to fields to fertilize food crops and used as agricultural feedstock. A couple of states specifically commented that **Exceptional Quality** (EQ) Class A biosolids – which are of the highest quality as they meet pollutant concentrations, Class A pathogen requirements, and one of the vector attraction reduction requirements outlined in 40 CFR Part 503 – also may be distributed and marketed for certain food crops, agricultural row crops, commercial landscaping, and residential lawn and garden use. New Jersey noted that in 2020, 12 percent of its domestic sewage sludge generated was prepared as Class A biosolids and distributed as fertilizer and for topsoil blending. Colorado said that while application for food crops is generally not occurring, some of the grain crops produced from fields where biosolids are applied may end up as food crops.

States similarly reported that they distribute Class B biosolids to agriculture and feedstocks, as well as for reclamation and silviculture (for timber production). A few states like Vermont specified that this does not include food crops, per EPA and state laws. Virginia said that it land applies Class B biosolids to agricultural row crops for human and animal consumption per EPA Part 503 harvest restrictions. Michigan said this also applies Class B biosolids to silage and corn for ethanol, Arkansas to grazing and hay fields, and New Hampshire for forage crops to feed livestock. New Jersey said that in 2020, one percent of domestic sewage sludge generated was prepared as Class B biosolids and applied to agricultural farmland as fertilizer for growing animal feed.

Examples of "other" allowable distribution types and state-specific processes mentioned in the survey include compost feedstocks (Virginia, Washington), fiber crops (South Carolina, Washington), turf farms (South Carolina, Virginia), septage land application (Maine, Washington, Virginia), tree farms (Massachusetts, Minnesota), landfill daily cover (New Jersey, Virginia), and mine reclamation (Alabama, Minnesota, Virginia).[6] Minnesota said that in addition to mine reclamation, biosolids are land applied for reclamation over former decommissioned wastewater pond sites, although reclamation occurs on a very small quantity of acres in comparison to land application on agricultural fields. New Jersey noted that approximately 40 percent of its sewage sludge is beneficially used in the state as landfill alternative daily cover, and Wyoming reported that as of 2018, 55 percent of its biosolids were distributed to agriculture; 26 percent to landfill alternative daily cover; and the remainder to landfill burial, Class A EQ distribution, and reclamation (National Biosolids Data Project).

[6] This list is not exhaustive and only includes references to states that specifically listed these distribution types in their survey responses.

Maryland said that in addition to selling its Class A biosolids for use on commercial and/or residential land and land applying its Class B biosolids on agricultural and marginal land, its biosolids are also exported out of state for land application. A few states also reported issuing permits for specific brands of EQ Class A biosolids that are produced in other states and then sold to and distributed in their state for multiple purposes, such as home and garden or agricultural use.

Connecticut reported that about 95 percent of its biosolids are incinerated at the state's regional sewage sludge incinerators and, in a few instances, had been conducted pursuant to a historic Comprehensive Nutrient Management Plan submitted to its Department of Energy and Environmental Protection and agricultural application pursuant to state Department of Agriculture guidelines. To date, while regulated under its solid waste program authority, no land application for beneficial use has been authorized through a licensing process. Montana said the extent of its biosolids application is unknown.

Maine is the only state with a current ban on land application of biosolids. However, land application of septage is not banned, and there are a few exemptions in state statute **38 MRSA §1306 (7)(A)(2)** for some sludges like compost material or other agricultural product or material derived from or containing residuals generated as a result of the processing or cultivation of foods. Maine therefore commented in the survey that some septage land application sites are still active, and there may be cases of sludge derived products still in use at residential or commercial properties, as well as some exempted sludges that may still be land applied. The Maine Department of Environmental Protection (Maine DEP) has a public, statewide **mapping system** indicating licensed sludge and septage sites (does not necessarily mean there is a presence of PFAS), with locations of sampling for soil and water overlaying the map.

State approved rates and frequency for land application of biosolids

Most states reported that the amount of biosolids they land apply are based on agronomic rates, as determined by the amount of nutrients (nitrogen or phosphorus) in the biosolids and those needed by the crop grown, the region, or as recommended by EPA, land grant universities or university extensions, or other entities. These rates limit the amount of biosolids applied, ensuring that nutrient content is used efficiently and safely for the crop cultivated. 40 CFR Part 503 prohibits land application in which the nutrient application exceeds the agronomic rate for the crop or vegetation cultivated.

A number of the states provided context or a range of data for how these agronomic rates are applied and information on how state application rules may or may not limit frequency of land application:

- In Arizona, application rates and frequency are dependent on pathogen reduction, as well as the pollutant loading requirements for limited pollutants as outlined in 40 CFR Part 503. The state has strict limitations for harvesting food crops from land where biosolids do not meet the Class A pathogen reduction requirements established in its state Administrative Code **R18-9-1006**.
- In Colorado, rates are allowed based on the beneficial use to agricultural land and on the need for nitrogen for the next crop to be grown in a single cycle. Applicants must provide soil samples showing nitrogen residuals to justify the need for land application of biosolids cultivated.
- In Delaware, approved rates and frequency for land application are both site- and product-specific. For example, if the crop uptake value indicates that 100 pounds of plant-available nitrogen are needed for optimum yield for a crop, up to 100 pounds of plant-available nitrogen can be applied to the land for biosolids. Biosolids are typically applied on an annual basis, or less frequently, depending on the farm, and lawn care companies that utilize biosolids tend to use them for several feedings in a year to meet the nutrient needs of the turf.
- Florida said that due to recent rulemaking, its land application rates are derived using a rule-based formula that takes into account crop uptake, ground water table, and nearby surface waters.
- Indiana sets application rates based on the nutrient content of the biosolids and crop grown. These rates are up to 200 pounds of nitrogen application for corn crops; 100 pounds of nitrogen for soybeans, wheat, and hay; and 50 pounds of nitrogen for grass and land with no crops.
- In Iowa, the biosolids land application approval rates are based on the aerial loading rate for pollutant concentrations to be complied with 40 CFR Part 503 and the agronomic nitrogen rate to stay under the growth needs of the crops. The frequency of biosolids land application varies from one time per year to one time per month, depending on biosolids production at each city.
- In Minnesota, for agricultural lands and for tree farms, the rates are based on the nitrogen need of the crop taking into account any nitrogen credits. For reclamation purposes, the nitrogen need is a major factor, but the biosolids can also be used to help establish organic matter content to those disturbed soils where the organic soil and topsoil horizons are depleted. Any determination of rate takes into account the wastewater treatment method, application method (surface-applied or injected), and types of nitrogen available (organic and inorganic). While biosolids rules in Minnesota do not directly regulate the frequency for land application, other regulations (e.g., nitrogen needs, soil limitations, land application site slopes, harvest restrictions, ceiling (and cumulative) metal limits) impact the timing and recurrence of land application events.
- In North Carolina, land application rates for Class A and Class B sites are determined by calculating the Plant Available Nitrogen loading for the intended crop and its realistic yield expectation. For biosolids permits, crop-specific agronomic loading determines the application rate. Agronomic rate determines

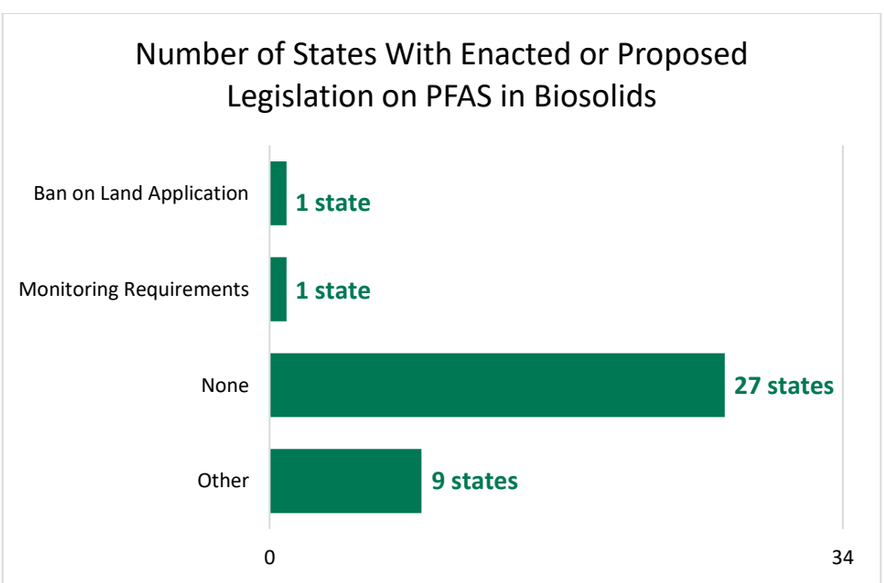
the amount of residuals applied to meet the nitrogen needs of the crop, but does not overload the soil with nutrients or other constituents that cause or contribute to a contravention of surface water or groundwater standards, limit crop growth, or adversely impact soil quality. Dedicated Class B land application sites in the state allow for application above agronomic limits as disposal is of primary concern and crops are of secondary importance.

- In South Carolina, application rates and frequency are determined by recommended agronomic rates published by land grant universities; annual pollutant loading rates (metals) required by 40 CFR Part 503; hydraulic loading rates if the sludge is below 2000 micrograms per liter of total suspended solids; soil types and depth to groundwater; and soil testing and nutrient balances.
- In Vermont, application rates for biosolids are based on the crop nutrient demand, typically nitrogen-based. However, the state also has a Vermont Phosphorus-Index (P-Index) intended to reduce phosphorus loss from soil or soil amendments to surface waters, with the caveat that septage application rates are usually only nitrogen-based.
- In Virginia, Class B biosolids must be land applied in accordance with the **Virginia Nutrient Management Standards and Criteria**, which include limitations based on agronomic rates of nitrogen and phosphorous, depending on the soil phosphorous levels. Some Class A biosolids meeting the EQ criteria require a nutrient management plan while others do not.
- Washington utilizes fertilizer recommendation guidelines (nutrient guidelines provided by local universities), which provide information about how much nitrogen-specific crops =can be expected to take up, along with how much is already available in the soil. The state then uses the Cogger-Sullivan Worksheet for calculating biosolids agricultural rates.

Arkansas, New Jersey, Vermont, and Virginia have rates that are typically nitrogen-based but may consider phosphorus in certain instances. For example, in New Jersey, Class A biosolid land application is based upon approved product literature, but land application rates for Class B biosolids are determined by an approved Nutrient Management Plan that uses a phosphorus index to evaluate if phosphorus or nitrogen is the limiting nutrient when calculating the agronomic rate. Maryland and Virginia also base their rates and frequencies on Nutrient Management Plans. Other states said they are based on EPA and/or state regulations. For example, Georgia, Idaho, and Iowa specified that they comply with 40 CFR Part 503, and Tennessee uses guidance from the University of Tennessee Extension to provide the amount of nitrogen needed based on crop yields. New Hampshire's biosolids management was established by the state's administrative code, chapter Env-Wq 800. For Class B biosolids, Env-Wq 800 requires the permittee to follow university extension best management practices involving soil testing and land application calculations based on nutrient demand (nitrogen or phosphorus), and must be done to inform the public that the permitted site will receive biosolids. Class A biosolids do not have to follow the practices, but the state encourages soil sampling. If there are issues with a site and no soil test was conducted, the user of biosolids did not follow state definitions and disposed of them rather than recycle.

Several states noted that the approved frequency rates are unknown, not applicable, or do not exist. For example, Connecticut has no beneficial use determinations licenses approved by the environmental agency; in Maine, land application is prohibited; Massachusetts regulations pertaining to the land application of biosolids do not include rate or frequency limitations according to crops, and Wyoming's program authority does not include biosolids (the permitting of biosolids facilities and land application is regulated by EPA; in cases where EPA does not issue a permit under 40 CFR Part 503, Wyoming issues a permit under Chapters 3 and 11 of its state Water Quality Rules, which requires applications to comply with requirements of federal regulations).

Legislation enacted or proposed with respect to biosolids



Maine is currently the only state with a ban on biosolids land application. The state legislature has banned all land application of sludge or sludge-derived products on land within its borders with the exception of a few specific types of sludges identified in statute (e.g., those that are less likely to contain PFAS). Maine has not yet banned the land application of septage but is exploring options regarding what would be needed to do so (e.g., infrastructure). Maine DEP **reported** this to the state legislature in January 2023, and is currently sampling soil and groundwater statewide where biosolids application was licensed. Maine is also conducting WWTP effluent sampling statewide, as well as sampling for leachate at landfills.

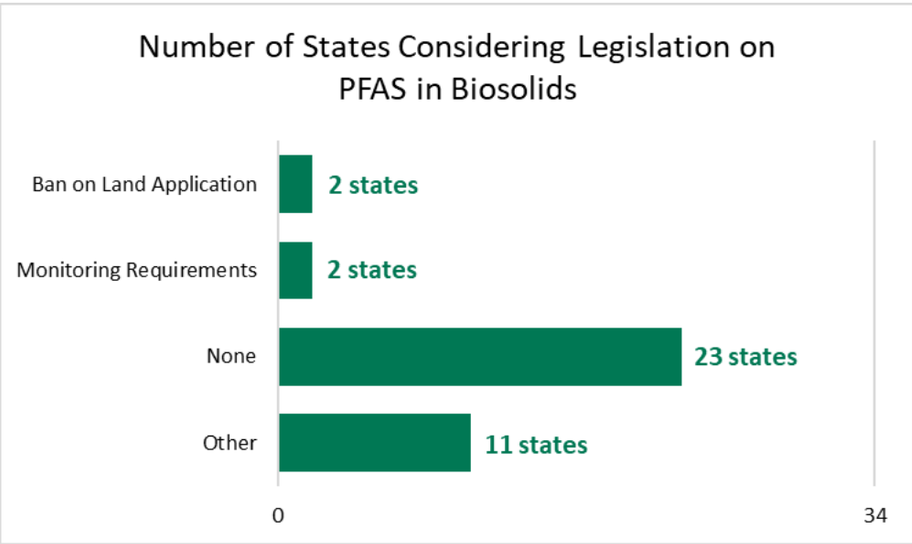
New Hampshire is the only state that reported having requirements for facilities to monitor PFAS in biosolids. Since 2019, New Hampshire has required all Sludge Quality Certificate (SQC) biosolids (Classes A or B) to be monitored, with the goal of reducing the concentration of emerging contaminants in biosolids. Recently, the state revised the SQC requirements to include PFAS monitoring, specifically, and will revise its Administrative Code **Env-Wq 800** to reflect these requirements once draft Method 1633 is multi-lab validated. The state also plans to issue a soil standard into rule by November 2023 and will then back calculate a sludge standard to implement into Env-Wq 800.

Massachusetts and Michigan do not have legislation on monitoring but have related requirements. The Massachusetts Department of Environmental Protection (MassDEP) since 2019 has required that residuals approved for land application in (including biosolids and sludges from the processing of water treatment solids, paper sludge, and industrial sludge) monitor for PFAS on a quarterly basis. Michigan since 2021 has had monitoring requirements of PFAS in biosolids for all land-applied biosolids and since 2017 has prohibited application of biosolids deemed to be industrially impacted.

No states reported having a ban on landfilling, and 27 states have no enacted or proposed legislation with impacts on PFAS in biosolids. Several of these states provided some context to their responses:

- No ban exists in Connecticut, but biosolids in the state are – and have primarily been – managed with incineration at sewage sludge incinerators.
- Maryland has the authority to require monitoring for constituents needed to determine the quality of the biosolids. Currently, the Maryland Department of Environment (MDE) is collecting PFAS sampling information for biosolids from selected treatment plants throughout the state. This initial data collection effort is being conducted on a voluntary basis, and results will inform the next steps in terms of any additional sampling or other actions.
- The New Mexico Environment Department's Ground Water Quality Bureau has monitoring requirements related to water that was contaminated from a specific point source. However, the state's 401 certifications for NPDES permits do not include any PFAS monitoring requirements since New Mexico does not have any water quality standards for PFAS in surface waters of biosolids. The state is waiting for the EPA Center of Excellence in EPA Region 7 to implement federal requirements before requiring its own biosolid requirements.
- The South Carolina Department of Health and Environmental Control (SCDHEC) is currently requesting that producers of municipal, domestic, and industrial sludge sample for PFAS constituents in permit applications for land application of sludge. However, this is voluntary.

Legislation being considered on biosolids as it relates to PFAS

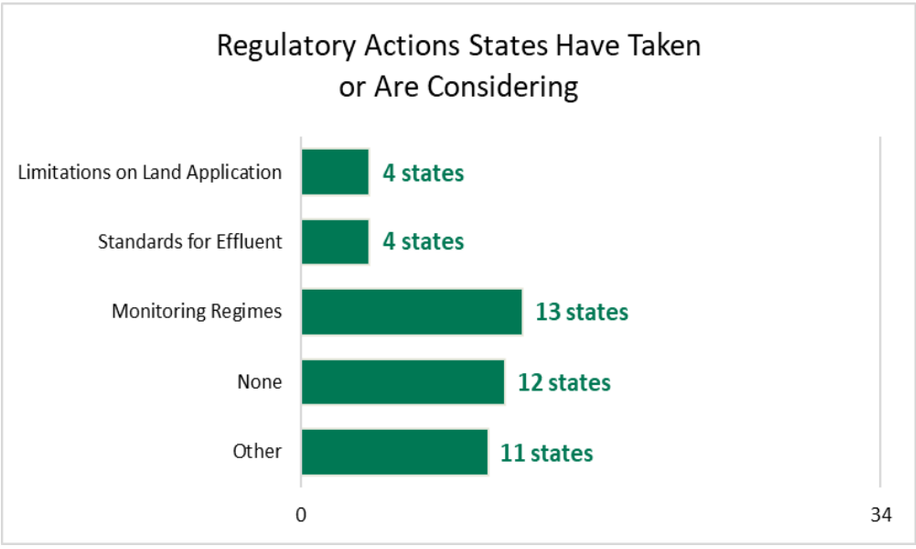


The Vermont legislature has considered a ban on land application. The Maine legislature may also consider a ban on septage application, and the state anticipates additional PFAS legislation to be introduced to the legislature in 2023. Nevada and North Carolina are considering monitoring requirements. No states are considering a ban on landfilling. Twenty-three states are not considering any legislation on PFAS in biosolids, and 11 states selected "other," with the following comments:

- Several states are assessing the issue of PFAS in biosolids and will consider limitations or bans. Delaware is reviewing currently available risk-based information and will review new risk-based information as it is generated, ultimately utilizing this information for future actions and/or legislation; Florida is working with various agencies and universities in the state to assess PFAS in biosolids; Massachusetts is monitoring and is considering limitations on biosolids land application; Maryland is gathering some initial information that will inform the need for future actions; and North Carolina has developed an investigative sampling plan, the findings of which will serve as the basis for future actions and/or legislation. Idaho said that with PFAS in the media and its unprecedented population growth from out of state, it will only be a matter of time before people start bringing this issue to the forefront for potential legislation.
- A couple of states like Vermont and Washington noted that they see bills focused on land application or anticipate at least one bill from the state legislature in 2023 focused on biosolids.
- New Jersey reported that a bill has been introduced in the 2022-2023 legislative session entitled the "Protecting Against Forever Chemicals Act." The intent of the bill is to begin prohibiting the sale and distribution of products containing added PFAS within the state and to increase transparency with consumers of products that contain PFAS. In addition, the bill would require the New Jersey Department of Environmental Protection (NJ DEP) to establish a source reduction program to reduce the presence of PFAS in the state's air, water, and soil by encouraging the proper management of materials that contain PFAS and the use of safer alternatives. The bill would also require the NJ DEP to conduct PFAS-related research and comprehensive monitoring and testing of the presence and impact of PFAS on environmental media within the state, including air, water, biota, and soil. Specific legislation regarding biosolids may be possible in the future.
- New Hampshire said that its legislature is comfortable with the New Hampshire Department of Environmental Services (NHDES) revising the SQC to monitor for PFAS. The state will back calculate and implement a sludge standard once its soil standard issued later this year.

Indiana, Iowa, Minnesota, and Utah said they are either following EPA's lead or waiting for EPA to complete its biosolids risk assessment study, implement new regulations, establish a national standard, and/or publish recommendations before enacting any potential PFAS limits.

Regulatory actions taken or being considered on biosolids



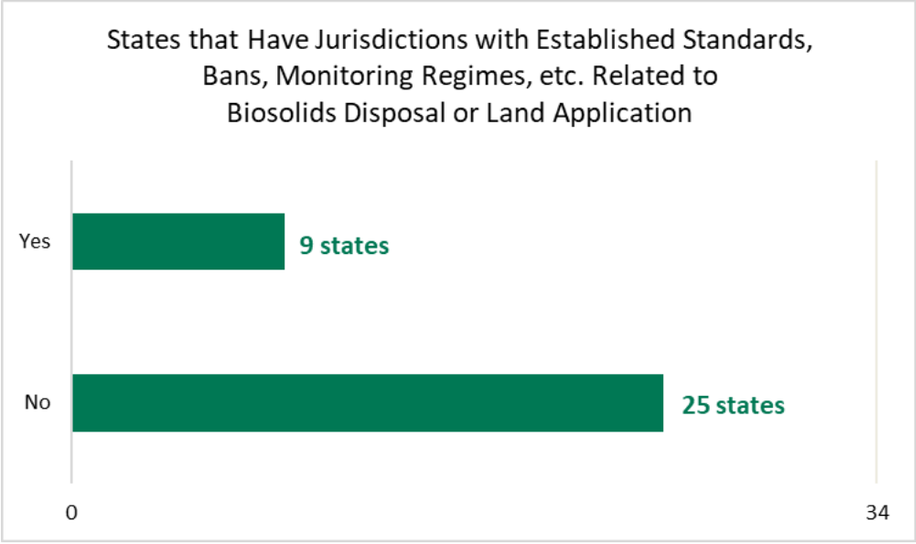
A number of states are considering limitations on land application, standards for effluent, monitoring regimes, and/or other regulatory actions on biosolids. These include:

- Actions and regulations governed by 40 CFR Part 503 (e.g., biosolids land application, pretreatment, etc.) (Alabama, Arkansas, Iowa).
- Active monitoring regimes driven by state regulations, including those for source identification and reduction work.
    - Colorado is in the process of implementing monitoring and reporting on source identification and control using existing regulatory authority.
    - Maine initiated in October 2022 a statewide effluent monitoring program for 100 POTWs and 20 non-POTWs. Facilities are required to take samples generally once per month for 10 months.
    - Minnesota is working on monitoring influent at approximately 90 wastewater treatment facilities for PFAS to help guide where source identification and reduction work should begin.
    - New Hampshire requires monitoring for PFAS of all SQC biosolids and will require draft Method 1633 to be used for sampling once validated. However, once soil standards are developed, the state said there will be limitations, as it will restrict where one can land apply biosolids.
    - New Jersey has begun PFAS monitoring on some dischargers.

  - Vermont in 2020 updated its Solid Waste Rules to require PFAS monitoring in biosolids produced in or imported to the state, as well as soils, groundwater and crops at land application sites.
- Authority or requirements to monitor (or voluntary monitoring regimes, as previously described) (Maryland, Massachusetts, South Carolina).

Connecticut noted that any land application would need to be authorized using the statutory framework for beneficial use determination or through a solid waste licensing process, which includes a technical review and determination prior to land application of biosolids. Delaware, Idaho, New York, and Virginia are waiting for EPA to establish more risk-based information, biosolids standards, and/or other federal rulemakings. Maine plans to adopt EPA ambient water quality criteria once promulgated by EPA. Effluent discharge limits will then be required as needed, per **state law**. Montana and Virginia said they have conducted some monitoring of rivers or may require some monitoring on a case-by-case basis dependent upon information from potential sources or generators and wastewater testing, respectively, but that they have not taken any regulatory action. A few states said they will consider a wide variety of other actions in the future.

Counties, municipalities, and other jurisdictions that have established standards, bans, monitoring regimes, etc. related to biosolids management



*One state did not reply to this question. It is assumed that the state does not have standards, bans, etc., and it was therefore included in the "no" count.

Nine states (Arizona, Colorado, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, Tennessee, and Texas) reported that they have counties, municipalities, or other jurisdictions that have established their own standards, bans, monitoring regimes, or other regulations related to biosolids disposal or land application. In Arizona, Pima County Wastewater conducted a **study** that showed no transport of PFAS from biosolids past a six-foot depth. Colorado said three of its counties have implemented their own permitting process for biosolids land application sites, Tennessee has one county (Polk) that enacted a ban on biosolids usage, and North Carolina has one county (New Hanover) that has voluntarily stopped land applying Class B biosolids and contracted removal and alternative disposal (the state noted at least one municipal operator is taking the residuals to a lined landfill). In Minnesota, several townships have long-standing biosolids land application bans (in effect since the late 1990s or early 2000s), and some of these townships also ban other land application activities like land application of industrial byproducts. One county from 2018-2020 conducted sampling of water supply wells located near biosolids land application sites for a variety of parameters, including PFAS. MassDEP said that it is aware that some communities have banned the land application of biosolids, but the agency does not officially collect that information. Michigan similarly reported that some local municipalities have enacted bans on biosolids (unrelated to PFAS), but that they are not yet determined to be enforceable as they contradict legislation already established protecting the rights of farmers. New Hampshire has towns that have been establishing their own ordinances on biosolids land application for a while, dating back to before the state discovered PFAS in biosolids.

While it does not have jurisdictions with a ban because there is a statewide program underway, Maine commented that its town of Trenton received a grant using federal funding under the American Rescue Plan Act of 2021 to conduct testing for private groundwater wells for town residents, and from those results it may be looking at some locations impacted by biosolids application. Virginia also commented that the state employs the "**Dillon rule**" with respect to local authority over actions regulated by the Commonwealth. For biosolids, the Virginia General Assembly has granted local governments the authority to enact local ordinances for biosolids testing and monitoring only to the extent required by the Virginia Department of Environmental Quality (Virginia DEQ) permits, and for limitations on long-term storage of biosolids.

Prohibitions or restrictions on biosolids beneficial use based on PFAS concentrations

Maine and Michigan are the only states that responded to the survey that have any prohibitions or restrictions on biosolids beneficial use based on PFAS concentrations. Prior to Maine's ban on land application of sludge or sludge-derived products, the state used its beneficial use screening standards as a guide for acceptable PFAS levels to be placed in soil. These screening levels accounted for use of loading calculations to determine volume and frequency of land application. For other non-sludge derived materials that are not banned, but contain PFAS, the screening standards will still apply. In Michigan, all WWTPs are required to sample for PFAS prior to land application. If PFOS is above 125 parts per billion (ppb), land application is prohibited. If PFOS is above 50 ppb, but less than 125 ppb, the application rate must be lowered to 1.5 dry tons or less (about 50 percent of the typical rate for injection of liquid biosolids Michigan).

Thirty-two states do not have prohibitions, although New Hampshire said it plans to notify permit holders about its new soil standards for PFAS, and will require permit holders for Class B biosolids to sample soil. The state will then prohibit distribution of Class A biosolids if the soil levels are at or above the forthcoming standard.

Key challenges surrounding biosolids management

States were asked to list some of the key challenges they face, now or in the future, with new regulations related to biosolids management. States acknowledged that challenges exist with all three primary management options for wastewater treatment facility sludge.

The following list of challenges is ordered by the number of states that referenced the challenge in the survey, beginning with the challenges most referenced.

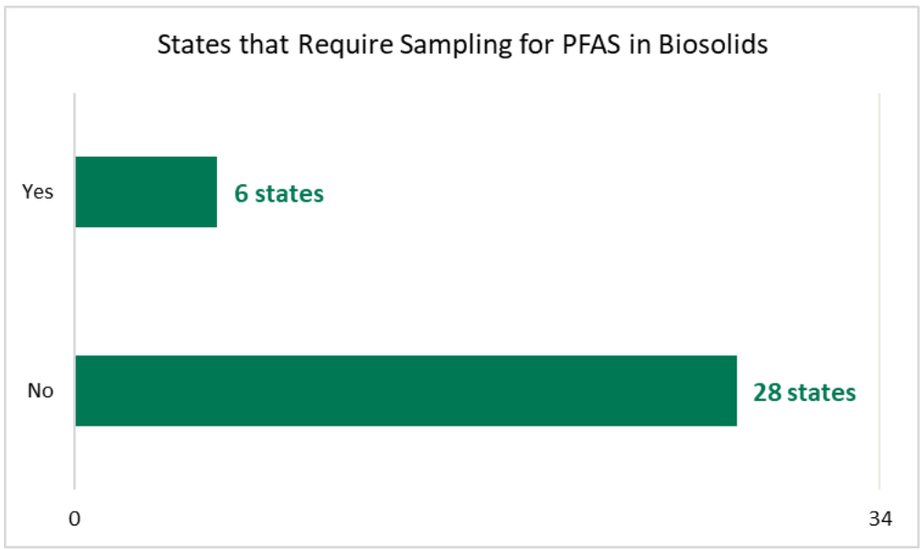
- Limited disposal options and disposal capacity (e.g., landfill limitations, landfilling is easier and less expensive but too much is being landfilled, landfills do not want sludge due to moisture and PFAS content, etc.);
- Cost (of destruction and disposal, of wastewater treatment for PFAS contained in landfill leachate, of hauling and of tipping fees for municipalities looking to offload sludge, of management if land application is no longer an option for WWTPs [especially small facilities], of implementing testing and treatment technology, etc.);
- Interstate challenges in terms of exporting biosolids (and those facilities reaching capacity or fluctuating willingness (with price of fuel and commercial fertilizer) to accept them), and potential impacts of bans or regulations in other states affecting disposal options and price;
- Land application areas are decreasing and there are limitations of end users (e.g., commercial agriculture on the downswing in one state so less farmers willing to use the material);
- Lack of federal standards for land application and outdated regulations;
- Lack of science for fate and transport (e.g., food chain uptake) and for environmental and health impacts to communities where biosolids are handled;
- Lack of technologies for treatment and destruction, and ensuring that alternative disposal options would better capture and destroy PFAS compounds. (For example, if biosolids are incinerated, were all of the PFAS compounds destroyed? Or do they become airborne? If landfilled, does the PFAS partition to the leachate and does that leachate get treated for PFAS? How?);
- Public concerns and odor complaints;
- Complexity of PFAS source identification;
- Lack of definitive assessment for risk and liability, and accepted beneficial value of, biosolids land application; and
- Industry pushback.

Sampling, Monitoring, & Pretreatment

This section outlines state efforts to identify, monitor for, and take steps to mitigate the presence of PFAS in biosolids. States were asked to identify sampling, source assessment, and source control requirements; provide information about various monitoring that may have occurred; and discuss pretreatment policies in regards to PFAS in biosolids.

EPA has a pretreatment program under the CWA to help stop chemicals from entering the treatment system (and subsequently, biosolids), and its PFAS Strategic Roadmap calls on the agency to "require pretreatment programs to include source control and best management practices to protect wastewater treatment plant discharges and biosolids applications."[7] Presently, however, most states do not have formal pretreatment standards, and these programs mostly target industrial sources of PFAS, rather than domestic ones. As such, there is an increased emphasis on source control, though it is not required in many states or by EPA.

Sampling requirements for PFAS in biosolids



Six states (Colorado, Maine, Massachusetts, Michigan, New Hampshire, and Vermont) that responded to the survey require sampling for PFAS in biosolids:

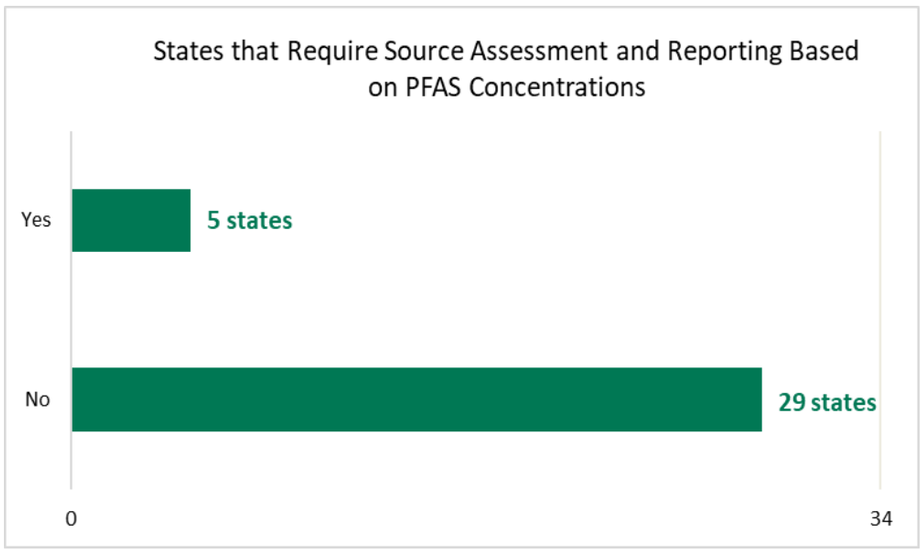
- Colorado: Beginning in 2023, the state will require sampling of biosolids between monthly and annually depending on the amount of biosolids generated. All preparers of biosolids who generate 30 dry tons or greater of biosolids per year, if any of their biosolids are beneficially used, are required to sample and test their biosolids for PFAS and report the results.
- Maine: Beginning in 2019 and before the state's sludge ban, generators of sludge or sludge-derived products were required to sample for PFAS prior to approval for land application. The state would then run loading calculations and compare them to soil screening levels for Beneficial Use to determine if it would safe for land application. Now that there is a ban in place, this is not required for sludge.
- Massachusetts: The state requires that facilities approved for the land application of biosolids test quarterly for PFAS and submit results to MassDEP. Regarding the testing of sludge from WWTPs, as National Pollutant Discharge Elimination System (NPDES) permits are renewed, PFAS testing is added to include testing of sludge. The state's Residuals Program conducts PFAS testing quarterly, and the frequency of sludge testing according to NPDES permits depends on the size of the facility (two or four times per year). Sampling is required by the facility holding the approval to land apply or the facility holding the NPDES permit.
- Michigan: Sampling is applicable to all WWTPs that land apply in the state through modification of all Residual Management Programs for treatment plants with NPDES, groundwater, and general land application permits. An isotope dilution method is recommended. For all NPDES Majors, all WWTPs with an Industrial Pretreatment Program (IPP), and all municipalities with a 2218 Groundwater Permit, sampling is conducted once per calendar year, prior to land application. For all other permittees (NPDES minor, non-IPP, all other groundwater permittees), sampling is conducted upon permit reissuance, prior to the initial land application in the permit cycle. If the permit is extended, sampling is conducted at a minimum of once every five years.
- New Hampshire: Sampling is currently required once per year. That schedule will change when the state imposes the standard into their rules, which New Hampshire will evaluate if it increases this frequency to match sampling frequencies of NPDES permits of once per quarter. The state will

[7] Document: **PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024**, EPA

evaluate if the frequency is worthwhile depending on whether or not it sees the same number per quarter.
- Vermont: In 2020, the state updated its Solid Waste Rules to require that certification holders perform annual (at minimum) PFAS monitoring in biosolids produced in (or generators of imported biosolids to) Vermont, as well as in soils, groundwater, and crops at land application sites.

The other 28 states that responded to the survey do not require sampling. Maryland noted that while sampling is not required, it has initiated a voluntary sampling pilot for a sample of WWTPs and will use the data to evaluate future sampling needs. Minnesota also clarified that it has asked about 90 municipal WWTPs to voluntarily monitor for influent PFAS, and biosolids analysis for PFAS will likely be a part of future phases of the state's PFAS monitoring plan. New Jersey is considering PFAS monitoring requirements on domestic and industrial treatment works that generate sludge.

Source assessment and reporting requirements based on PFAS concentrations



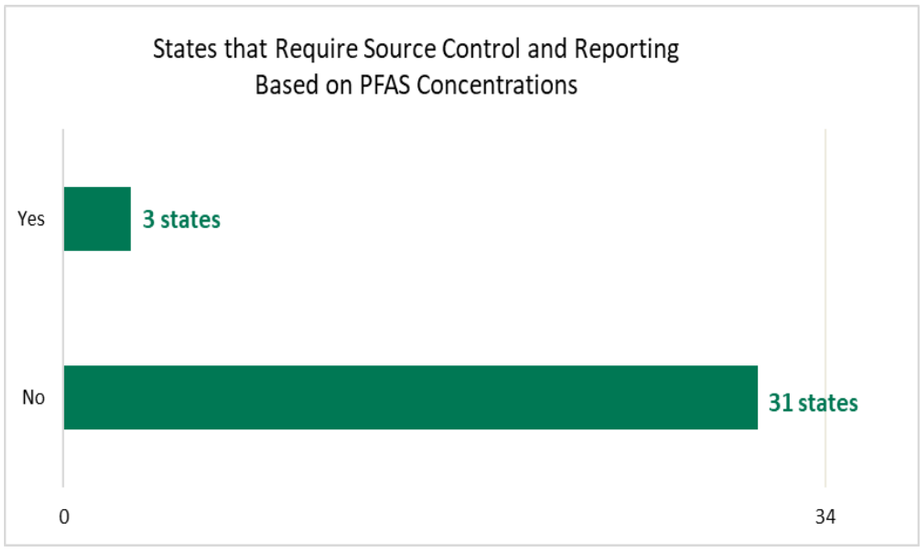
Five states require source assessment and reporting based on PFAS concentrations:

- Colorado has authority through duty to provide information in its domestic wastewater treatment works' (DWWTWs) NPDES permits. The trigger level for source assessment and reporting is if biosolids PFOS level is 50 micrograms per kilogram (µg/kg) or greater.
- Florida uses 70 parts per trillion (ppt) for fire training facilities under its provisional cleanup target rules.
- Maine is required to assess soil and groundwater contamination stemming from licensed land application of sludge and septage. There are no trigger levels for doing the sampling except that there is a tiered system Maine has developed to prioritize licensed land application sites; the sampling takes place based on a Sampling and Analysis Plan approved by Maine DEP. Maine DEP has been reporting this information to the public via its website and a **report** to the legislature on this investigation was released on January 15, 2023. The agency also provides water treatment systems where residential wells exceed the state's interim drinking water standard. Maine's Drinking Water Program, based out of the state's Department of Health and Human Services, is required to assess public water systems across the state at schools and daycare facilities for PFAS, information for which is reported on that agency's website. The trigger level is the state's interim drinking standard of 20 ppt for the sum of six PFAS. The Drinking Water Program is not required to assess sources, so when the program finds contaminated public water systems at schools or daycares, Maine DEP may be asked to use its discretion to determine whether to further assess possible sources. Schools are required to treat their own systems, but where PFAS are detected at high levels, surrounding receptors (residential wells) may be impacted. In those cases, DEP evaluates the potential sources, proximity, and other factors to determine if a step-out assessment is necessary.
- Michigan's WWTPs are broken up into tiers based on PFOS results. PFOS above 20 ppb initiates additional recommendations (e.g., sample effluent for PFAS, begin source identification if not already doing so through the IPP PFAS Initiative for WWTP Effluent). PFOS above 50 ppb requires WWTPs to sample WWTP effluent within 60 days (if effluent monitoring is not already being conducted through the IPP PFAS Initiative), and begin source identification. This requires an Interim Report, due six months after the biosolids sample is submitted, and a Summary Report, due four months after the Interim Report. The reports provide the state with all data for source monitoring, collection system sampling, and any other monitoring completed for PFAS source identification. These requirements are contained in the Land Application of Biosolids Containing PFAS Interim Strategy, which is a part of the WWTP's Residuals Management Plan required in their permit.
- New Hampshire requires all SQC holders to submit a write up in their annual report describing what they did to help reduce the PFAS concentrations present in their biosolids through source pollution prevention. The state has also been conducting sewer collection system wastewater and analyzing it

using terminal PFAS compound analysis and total oxidizable precursor assay analysis. New Hampshire discovered new data indicating that residents are potentially discharging more PFAS than industry, and needs more data to verify and analyze these findings further.

Twenty-nine states do not require source assessment and reporting based on PFAS concentrations. Connecticut did, however, share its **guidance**, and Minnesota noted that while it does not at this time, the PFAS Monitoring Plan is meant to help inform and prioritize source identification and reduction efforts.

Source control and reporting requirements based on PFAS concentrations

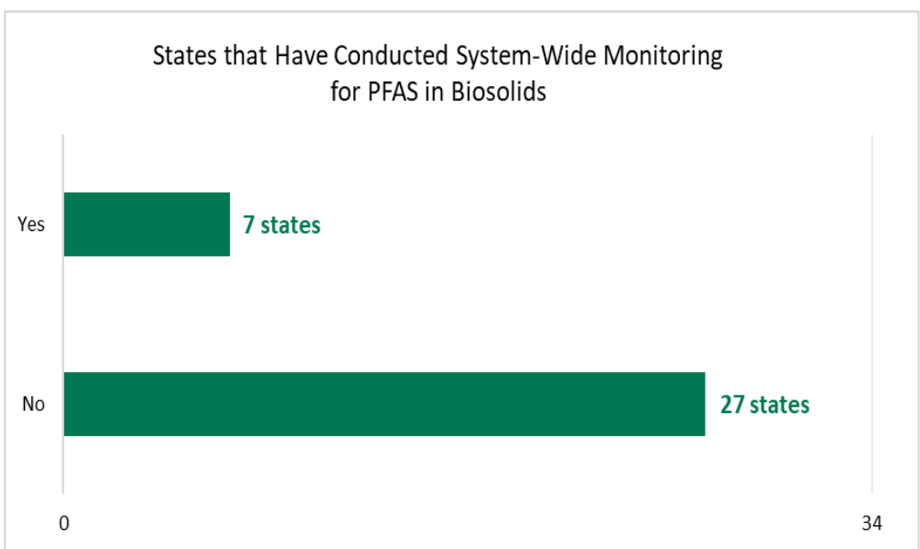


*Two states did not respond to this question. It is assumed that the states do not have these requirements, and they were therefore included in the "no" count.

Three states require source control and reporting based on PFAS concentrations. Michigan and New Hampshire referenced their responses from the previous question, and Colorado said it requires reporting on source controls but does not currently require specific source control actions. As noted previously, the state's trigger is a biosolids PFOS level of 50 µg/kg or greater.

Thirty-one survey respondents do not require source control and reporting. Maine said source control and reporting is not required for any specific industry or operation at this time, but the state passed a law in 2021 requiring manufacturers of products with intentionally-added PFAS that are sold or distributed in Maine to report the type and quantity of PFAS in their products starting January 2023. Maine will review this information and determine by 2030 which products to ban or to exempt from ban. Massachusetts reported that while it does not require this either, the state for several years has had a pretreatment partnership with the state's Office of Technical Assistance (OTA), a non-regulatory agency that provides free, confidential, onsite technical assistance to Massachusetts manufacturers, businesses, and institutions. This partnership has focused on PFAS, and MassDEP hopes that PFAS data it is gathering from industries (based on NPDES permit requirements) will help with this work.

System-wide monitoring for PFAS in biosolids



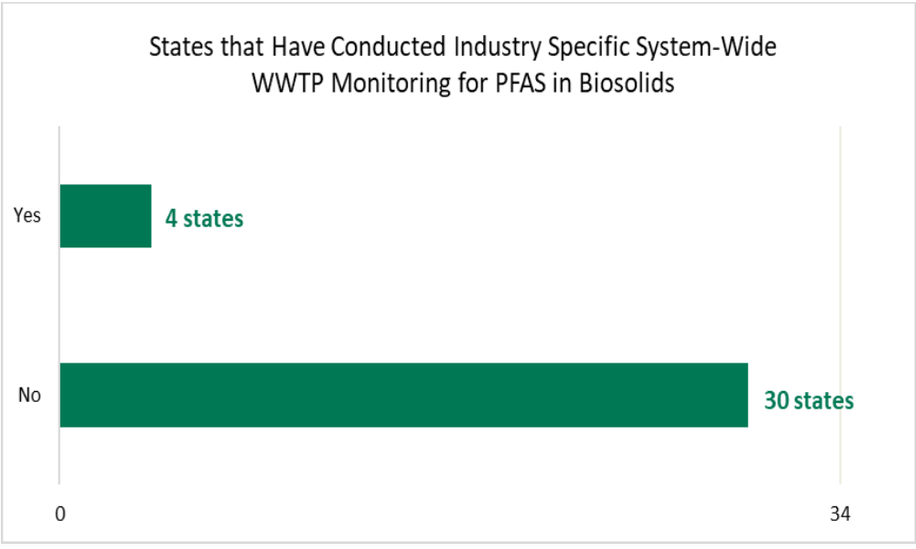
Seven states have conducted system-wide monitoring for PFAS in biosolids. "System-wide" encompasses the full spectrum of biosolids treatment and management practices, and can include assessment of wastewater

influent and effluent at WWTPs, as well as of the sludge and land for which it may be applied. These states shared the following specifics on their monitoring programs:

- Arizona: The Arizona Department of Environmental Quality (Arizona DEQ) has performed a one-time voluntary screening of PFAS in biosolids: one screening of 25 wastewater treatment plants receiving commercial and domestic water in June 2022.
- Massachusetts: As described above, MassDEP has since 2019 required that residuals approved for land application (including biosolids and sludges from the processing of water treatment solids, paper sludge, and industrial sludge) be regularly monitored for PFAS. Since October 2020, this testing has been required to occur quarterly. As for the testing of sludge from WWTPs, as NPDES permits are renewed, PFAS testing is being added to include testing of sludge. At this time, the state only has data from a few WWTPs.
- Michigan: The Michigan Department of Environment, Great Lakes, and Energy (EGLE) conducted a limited Statewide Study in 2018 on sampled influent, effluent, and final solids, and a follow-up study in 2021. As of July 2021, WWTPs in the state are required to sample prior to land application.
- Minnesota: In 2007, the state conducted a one-time test of biosolids at approximately 20 municipal WWTPs.
- New Hampshire: The state has been monitoring the SQC biosolids on an annual basis since 2017 and has required it since 2019. This involves WWTP biosolids, papermill short paper fiber, and drinking water treatment hyrosolids[8], as well as any batch-manufactured topsoil using biosolids.
- North Dakota: The state has conducted one sampling event for 50 percent of its land application facilities.
- Vermont: System-wide monitoring began in 2020 for biosolids (not sludge).

Twenty-seven states have not conducted system-wide monitoring for PFAS in biosolids. A few of these states, however, said preliminary studies or investigations are underway. This includes North Carolina, Delaware (a study of 5 POTWs will begin in the next month; biosolids will be sampled quarterly for a year and additional sampling will likely come after), and Connecticut (nearing completion of a PFAS study at a subset of its POTW; sewage sludge and scrubber water was included as sample locations at POTWs with sewage sludge incinerators). Maine is also conducting a statewide investigation of soil and groundwater potentially impacted by land application of sludge by licensed generators of sludge. The state is conducting sampling as a one-time event unless a need for repeat samples is warranted, and sampling is conducted where biosolids were applied and potentially integrated into the environment (not at the source or where biosolids are generated).

Industry specific system-wide WWTP monitoring for PFAS in biosolids



* One state did not reply to this question. It is assumed that the state does not have system-wide WWTP monitoring, and it was therefore included in the "no" count.

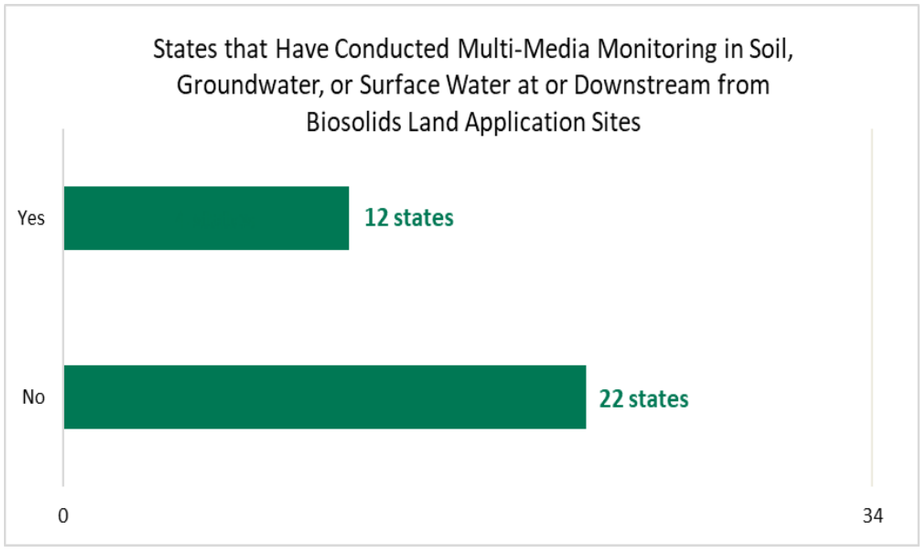
Four states (Connecticut, Michigan, Nevada, and New Hampshire) have conducted industry specific system-wide WWTP monitoring for PFAS in biosolids. Industries could include chrome platers, facilities with aqueous film-forming foam (AFFF) contamination, leather tanneries, landfills, paper mills, etc., depending on the amount of effluent and whether the state regulates wastewater or surface water discharges, among other policies. Connecticut is beginning to include PFAS monitoring for regulated wastewater discharges through its pretreatment and NPDES programs, and although sampling has not yet started, Nevada is establishing a monitoring program. In Michigan, from 2018 to 2021, WWTPs were required to sample biosolids if effluent for PFOS were greater than 50 ppt. Those treatment plants were typically sampling effluent due to

[8] Per a 2022 New Hampshire Department of Environmental Services **Fact Sheet**, hydrosolids are residuals derived from the drinking water treatment process that can be used as a soil amendment for topsoil blending.

requirements under the IPP PFAS Initiative. Facilities with effluent above 50 ppt typically had industrial sources to WWTP such as chrome platers, AFFF contamination, leather tanneries, landfills, and paper mills. Since 2021, all WWTPs have been required to sample biosolids for PFAS. In New Hampshire, influent and effluent from every WWTP has been sampled for PFAS. The state releases EPA NPDES permits to require PFAS monitoring in the influent, effluent, sludge, and upstream IPP holders, and the state is also sampling collection systems as described above.

Thirty states have not conducted this monitoring. Massachusetts said that for most of its POTWs, it would be very difficult to perform industry specific testing since several industries might discharge to a plant. However, the NPDES permit requires industries producing effluent to test. The state said that theoretically in the future, someone could link PFAS in WWTP sludge with the types of industries, although that data is not yet available. Virginia DEQ has conducted a survey of facilities with surface water discharges to determine what PFAS monitoring data facilities had conducted, and asked questions related to PFAS monitoring in biosolids. Nearly all sources in the state responded that they do not monitor for PFAS in biosolids.

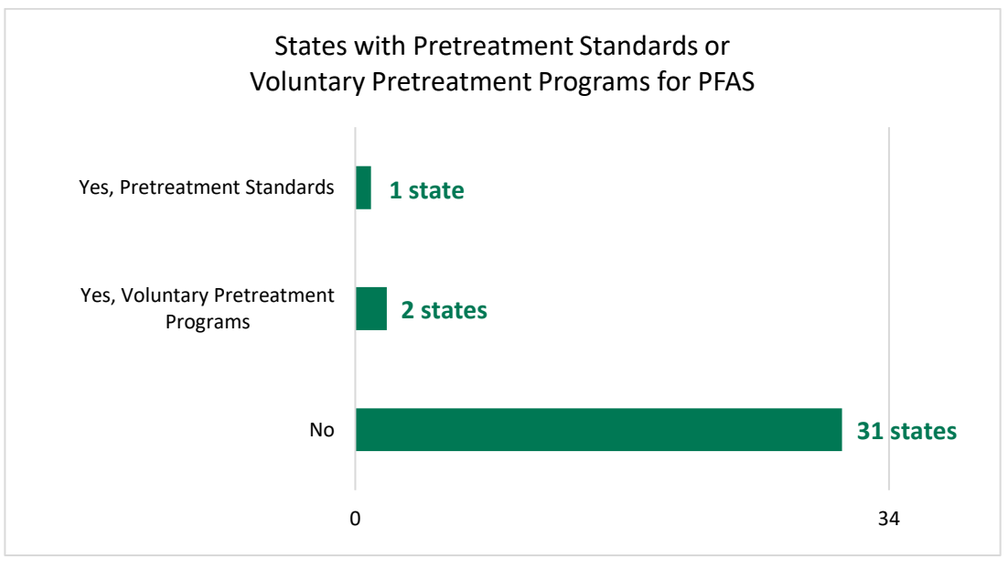
Multi-media monitoring in soil, groundwater, or surface water at or downstream from biosolids land application sites



* One state did not reply to this question. It is assumed that the state does not have monitoring, and it was therefore included in the "no" count.

Twelve states (Florida, Georgia, Iowa, Kansas, Maine, Michigan, Nevada, New Hampshire, New Jersey, South Carolina, Tennessee, and Vermont) have conducted multi-media monitoring in soil, groundwater, or surface water at or downstream from biosolids land application sites. Michigan referenced its statewide wastewater treatment plant and biosolids PFAS **study** in its comments, noting that it completed multi-media monitoring at various biosolids land application sites. The state said individual field reports can be found on its Biosolids PFAS-related information and links **webpage**. No other states provided additional information for this question.

Pretreatment standards or voluntary pretreatment programs for PFAS



*One state did not reply to this question. It is assumed that the state does not have pretreatment standards or programs, and it was therefore included in the "no" count.

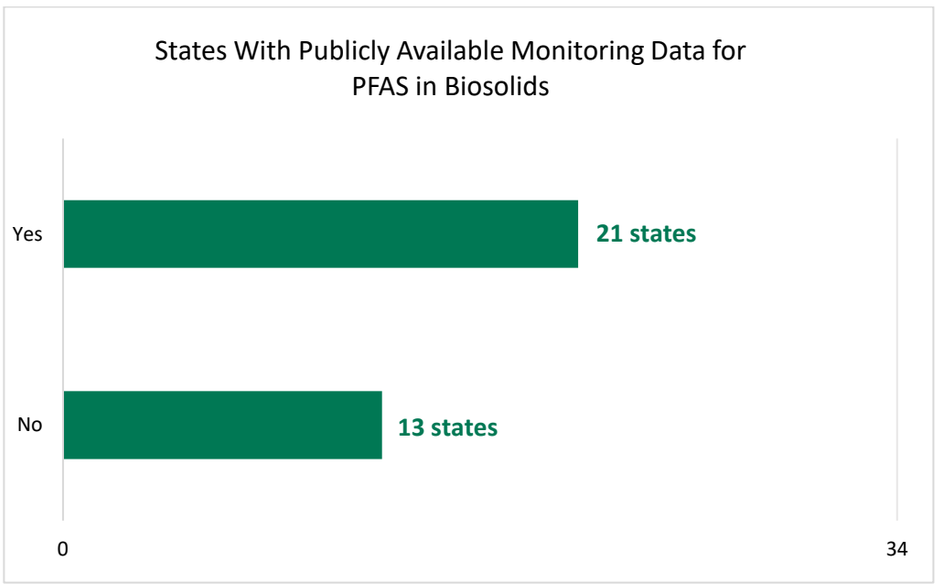
Michigan is the only state that said it has pretreatment standards for PFAS. The state has water quality values for PFOS, PFOA, and more recently perfluorobutanesulfonic acid (PFBS). These values have been used as screening levels by integrated WWTPs with IPPs for industries discharging PFOS. WWTPs are now developing local limits as appropriate (primarily for PFOS) either voluntarily or to meet required NPDES permit schedules.

Arizona and North Carolina have voluntary pretreatment programs. In Arizona, pretreatment standards are voluntary and left to the discretion of the permittee. The North Carolina Department of Environmental Quality (NC DEQ) said it is exploring ways to include PFAS sampling and best management practices in new and existing significant industrial user permits for industries known to discharge PFAS (mostly EPA targeted industry).

Thirty states responded that they do not have either pretreatment standards nor voluntary pretreatment programs, with a few caveats:

- Colorado has specific NPDES individual permits requiring DWWTWs to conduct and report on source assessment and control. The state has done various groundwater and surface water testing throughout our state but has not assessed whether the locations were at or downstream of sites where biosolids were applied.
- Minnesota has developed a media-wide PFAS Monitoring Plan that includes municipal wastewater treatment facilities. The Minnesota Pollution Control Agency (MPCA) selected WWTPs with identified significant industrial users to begin understanding PFAS impacts coming into the treatment plants. The voluntary monitoring will be completed in 2023 and 2024 to help determine influent concentrations of PFAS as well as help identify potential sources of PFAS entering municipal wastewater treatment systems. There will also be a focused effort to develop a PFAS pollutant management plan for source reduction at these facilities.
- If Maine's effluent sampling results identified earlier indicate opportunities for PFAS reduction via pretreatment, the state will pursue that in partnership with the POTW.
- Massachusetts hopes that through its partnership with OTA, PFAS data gathered from industries (based on NPDES permit requirements) will help with this work.
- Idaho responded that it is interested in having its approved programs screen for PFAS to get a baseline for the state, though it is unsure if the program would receive approval.
- New Hampshire said it is not a delegated state, so this will be determined by EPA through the NPDES permit program.
- Wyoming said that EPA Region 8 implements the pretreatment program in the state, and Tennessee clarified that its Department of Environmental Control (TDEC) does not work directly with the pretreatment program but could gather more information if necessary.

Availability of or plan to make publicly available monitoring data for PFAS in biosolids



Twenty-one of the state respondents currently, or have a plan to, make monitoring data publicly available for PFAS in biosolids.

States with currently available data provided the following links and details as to how it can be accessed:

- Alabama: All available data is accessible through ADEM's **eFile system**.
- Maine: All sampling data from the state groundwater and soil investigation, from ongoing monitoring of filtration systems installed at impacted private residential wells, and from the state's Drinking Water Program's sampling of schools and daycare facilities operating on public water systems is available on Maine DEP's **website**. While the school and daycare data are not related to PFAS in

biosolids directly, the state said many of the systems are impacted as a result of the wide breadth of land application of biosolids in Maine since the late 1970s.
- Massachusetts: All available data is accessible through the state's **Data Portal**.
- Michigan: All data is submitted through **MiEnviro Portal** and is accessible to the public by searching for the specific WWTP by name.
- Minnesota: Results from the state's 2007 testing are available on MPCA's PFAS studies and reports **webpage**. Table A11 and Figure A3 of the **Perfluorochemicals (PFCs) in Minnesota's Ambient Environment: 2008 Progress Report** summarizes the results
- North Dakota: Data are available in the statewide PFAS studies available on the North Dakota Department of Environmental Quality's (ND DEQ) **PFAS webpage**.
- South Carolina: Public Drinking Water systems data and ambient surface water sampling is available on the agency's Bureau of Water **webpage**.
- Tennessee: All monitoring reports can be accessed on TDEC's Division of Water Resources **Data Viewer tool**.
- Vermont: Data is available on the state's **Waste Water Inventory Database**, **Natural Resources Atlas**, or by request.

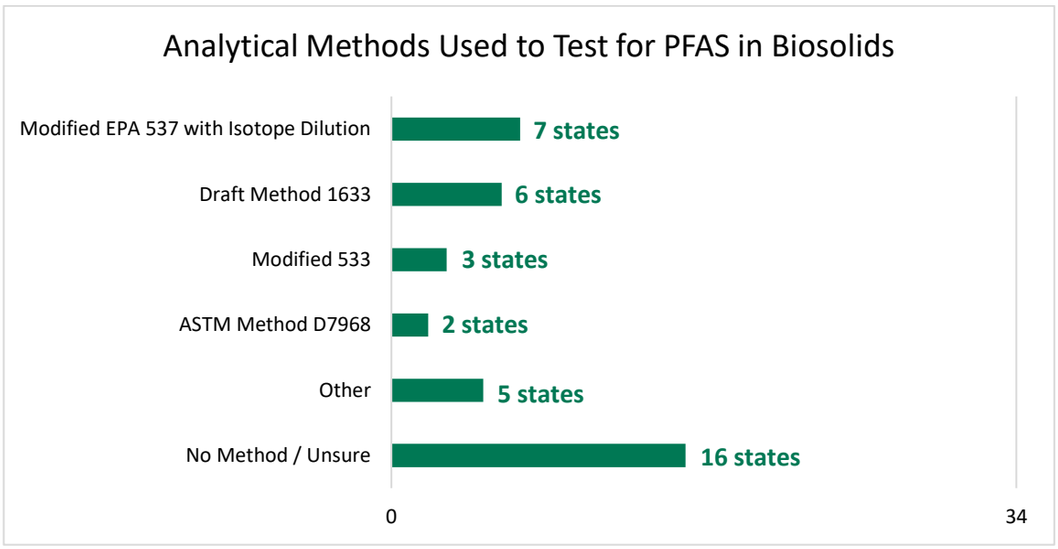
States with data that have a plan to make monitoring data publicly available for PFAS in biosolids provided the following context:

- Arizona: PFAS screening results from samples collected in June 2022 will soon be made publicly available on a mapping database.
- Colorado: Data will be posted online in 2023.
- Connecticut: Data will be available to the public once the state's POTW PFAS study report is finalized.
- Delaware: The state is in the preliminary stages for how it will share data.
- Georgia: Georgia will utilize EPA's PFAS website and interactive StoryMaps for sharing any state-collected PFAS data for biosolids. The website currently focuses on PFAS in ambient surface water and finished drinking water.
- Maryland: Biosolids data collection is in initial stages, but it is anticipated that monitoring data will be publicly available.
- Nevada: The state is in the preliminary planning stages for how it will share data.
- New Hampshire: NHDES is working on a Wastewater One Stop Database. Although the database is not yet public, PFAS data are available through a 91-A information request.
- New Jersey: A method for sharing data is under development.
- North Carolina: Monitoring data will be collected and made publicly available at a later date.
- Utah: State data is publicly available once validated.
- Virginia: All future data that may be collected would be public information pursuant to Freedom of Information statute.

Testing & Research

Given the wide range of analytical methods to test for different PFAS, ECOS asked states to discuss what methods they use to test for PFAS in biosolids, and how that method(s) may differ from those used to test for PFAS in other media like soil, groundwater, and surface water. Many states referenced draft Method 1633, which is undergoing multi-laboratory validation to analyze 40 PFAS in wastewater, surface water, groundwater, soil, biosolids, sediment, landfill leachate, and fish tissue, as one they currently use or plan to use once validation is completed. Draft method 1633 is also the method EPA recommends states use in its December 2022 NPDES **memorandum**. This section of the survey also asked states some open-ended questions about impediments to monitoring and research gaps.

Analytical method(s) used to test for PFAS in biosolids

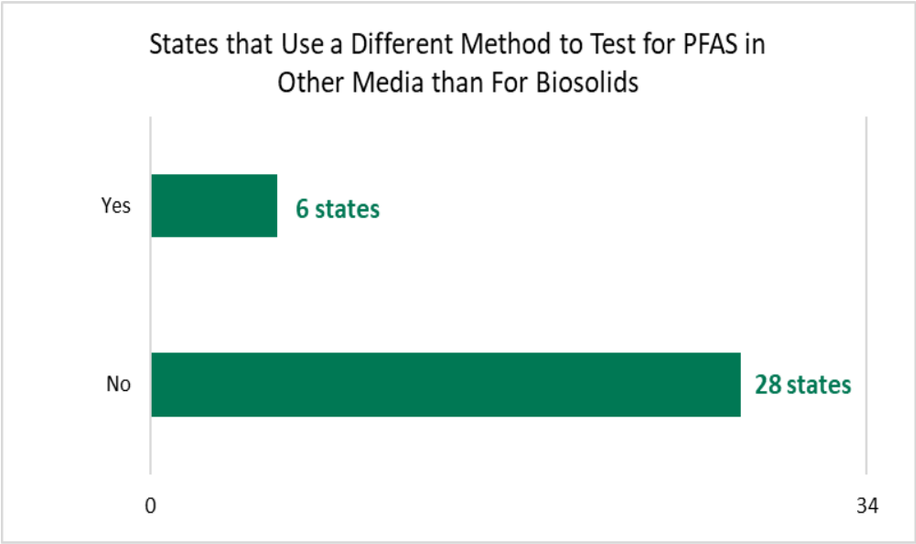


The majority of state respondents that test for PFAS in biosolids use either Modified EPA Method 537 (or a state modification to 537), to include isotope dilution (Connecticut, Delaware, Maine, Maryland, Michigan, North Carolina, and Vermont), or draft Method 1633 (Arizona, Colorado, Kansas, New Jersey, South Carolina, and West Virginia). Seven states (Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, and Washington) said that draft Method 1633 is projected to be the method of choice once multi-laboratory validated, and that they will switch from other methods to that method when complete. Kansas, Maryland, and Massachusetts use modifications to Method 533, and Massachusetts and Michigan have approved use of ASTM Method D7968. Massachusetts specified that for residuals and NPDES facilities that are currently required to test for PFAS, laboratories are expected to extract residual samples according to ASTM Method D7968 (modified by the laboratory as necessary), with subsequent extract PFAS analysis according to EPA Method 533 (also modified as necessary). The state's residuals program and NPDES permits will require Method 1633 once multi-laboratory validated.

In addition to the other methods listed, states said they use a few other method types like liquid chromatography-mass spectrometry (LCMSMS) (with isotope dilution) (New Hampshire) or Minnesota State Approved Method ID36 (North Dakota). New Jersey requires testing to be conducted at state labs certified for a Solid and Chemical Material (SCM) user-defined method that can quantify the required PFAS. Its labs are encouraged to use draft Method 1633 for now, but other user-defined method options such as laboratory-specific standard operating procedures (SOPs) are also considered for certification. Michigan said that when a final PFAS analytical method for wastewater is published in 40 CFR Part 136, this method will be required for sampling conducted under the CWA, including NPDES permits. Minnesota is not currently testing biosolids samples and is following the progression of (and once multi-laboratory validated, plans to use) draft Method 1633, but will also consider Method 8327 if EPA is comfortable with it. The state said achievable reporting limits will be an important factor in consideration of what method(s) will be acceptable. New York said it is testing using EPA's latest methods of choice.

The other 16 states (Alabama, Arkansas, Florida, Georgia, Idaho, Indiana, Iowa, Minnesota, Montana, Nevada, New Mexico, Tennessee, Texas, Utah, Washington, and Wyoming) said they do not have a specific method for use in testing PFAS in biosolids, that they do not test for PFAS in biosolids, or that they are unsure. New Mexico clarified that while it does not have a specific method for testing PFAS in biosolids, it follows EPA's guidance on PFAS analytical methods.

Use of a different method for PFAS testing in biosolids than in other media like soil, groundwater, and surface water

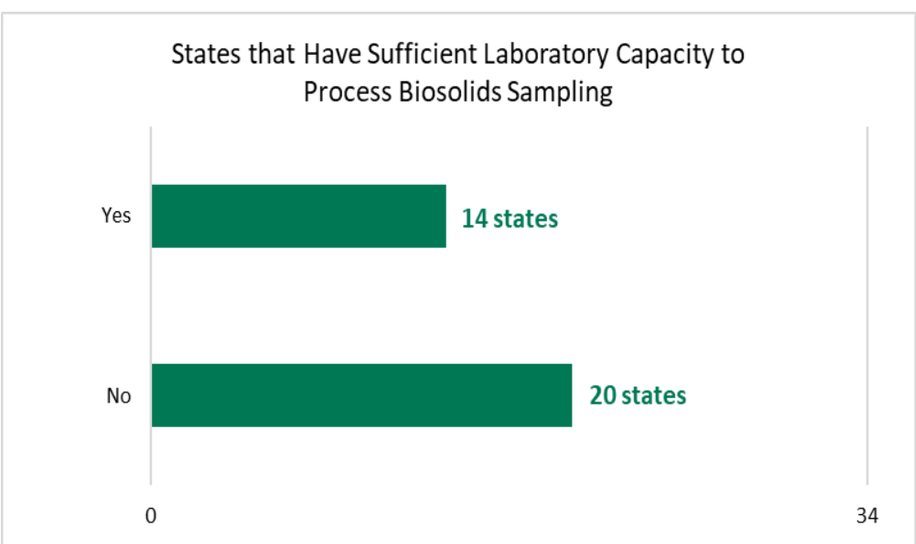


*Eight states did not reply to this question. It is assumed they do not use a different method or do not have a method for testing for PFAS in biosolids, and they were therefore included in the "no" count.

Six states use a different method to test for PFAS in other media like soil, groundwater, and surface water than they do to test for PFAS in biosolids. Arizona, Colorado, Kansas, and New Jersey use draft Method 1633 to test for biosolids; however, for example, Colorado uses modified Methods 537 and 537.1, as well as draft Method 1633, to test PFAS in other media, and Arizona does not currently but may in the future use draft Method 1633 to test PFAS in surface water, groundwater, and soil. Until draft Method 1633 is multi-laboratory validated, Michigan uses a modified Method 537 or ASTM Method D7968 for testing PFAS in biosolids. However, for wastewater, the state recommends that PFAS samples be analyzed using a those methods, draft Method 1633, or EPA Method 8327. Nevada is still in the preliminary stages of testing for PFAS in biosolids so it relies on other approved EPA methods for testing PFAS in other media.

The same methods are used for testing PFAS in biosolids and PFAS in other media in 28 states. A few states noted that the methods used to date are similar for all matrices based on the same extraction techniques and instrumentation or upon review of laboratory SOPs. Minnesota also said that given the lack of promulgated or published EPA methods for PFAS in non-drinking water matrices, the state refers to a lab accreditation program to provide accreditation against a guidance document rather than an EPA published method for those matrices. As a result, labs measuring non-potable water matrices have been using their own methods (e.g., modified 537.1 methods) and the state accreditation program ensures that labs using "modified" methods meet the state's data quality objectives. When draft Method 1633 is finalized, the accreditation program will switch to using that method rather than the guidance document approach. As much of Minnesota's non-potable analysis has been contracted to an outside lab that developed the draft Method 1633 (they also call it "modified 537.1), much of the data the state has analyzed has effectively used the draft method it will accredit.

State labs with sufficient laboratory capacity to process biosolids samples



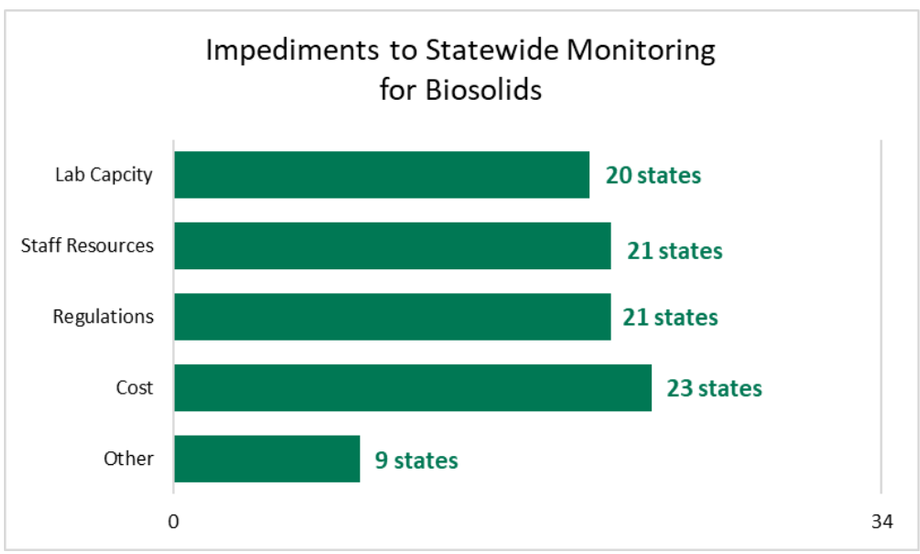
*Seven states did not reply to this question. It is assumed they do not have sufficient lab capacity or do not process biosolids at all, and they were therefore included in the "no" count.

Fourteen states (Arizona, Colorado, Delaware, Iowa, Massachusetts, Michigan, Minnesota, Nevada, New Hampshire, New York, North Carolina, Tennessee, Texas, and Vermont) said that the labs that they use have sufficient capacity to process biosolids samples. They know this either because their labs (e.g., state-owned labs or labs they contract with in or out of state) have the capacity based on samples they run for PFAS in other media or because they are already processing biosolids samples.

Some states did acknowledge, though, that labs are getting busier and that as more WWTPs are required to test (according to their NPDES permit schedules), as new methods (e.g., draft Method 1633) are validated and approved, or as more samples are processed due to regulations, sufficient capacity will be reduced. They acknowledged that as requirements for testing increase, more labs will need to establish in-house PFAS capabilities to decrease the current hold time for results.

States that said they do not have sufficient capacity noted that some factors are cost, availability of labs, and slow turnaround time. For example, Alabama contracts PFAS sampling with private laboratories, which increases costs and limits availability for adequate biosolids testing, and while New Jersey has five labs certified to analyze PFAS in biosolids, there are hundreds of residuals-generating facilities in the state so the currently certified labs do not have the capacity to process the number of incoming samples. Kansas and Maine acknowledged the considerable time it takes to process proper analysis for wastewater influent and biosolids. Maine said the process is slow due to samples from multiple states and samples for PFAS in other media like fish tissue, crops, vegetation, etc. that also need processing. The Maine legislature in 2022 provided $3.2 million for private labs to consider conducting PFAS analysis work in Maine itself. Maine has awarded two contracts to two different entities qualified to conduct PFAS analysis in the state, but it will likely be a few years before any new lab capacity is up and running. Virginia said there are limited labs that are available and equipped to test for PFAS in the state, which is a consideration in the development of any future monitoring requirements. New Mexico reported that the state's Department of Health lab probably does not have the capacity to sample PFAS, so the limited in-state analytical capabilities, costs associated with contracting out the analysis, hold times, and costs associated with sample preservation and shipping would all be challenges for the state.

Biggest impediments to statewide monitoring for biosolids



The biggest impediments to statewide monitoring for PFAS in biosolids include cost, regulations, staff resources, and lab capacity. Most states selected at least two of these options when completing the survey. Each of these impediments can be broken down further:

Cost

Cost-prohibitive challenges of statewide monitoring for biosolids include the cost of equipment; collecting, analyzing, and interpreting the samples; shipping samples to commercial labs; and other challenges. A couple of states noted that shipping costs are especially difficult on smaller facilities, as is the cost to address contamination once it is found. There are additional costs to non-state entities like WWTPs that do not have adequate funding for potential source investigations (such as influent, effluent, and collection system sampling), or to biosolids permittees who do not have funding for regular testing. Some states do not have the political backing, and therefore funding, to support statewide monitoring, and may not be able to dedicate resources to PFAS issues like biosolids until they are mandated at the federal level.

Staff Resources

Most state environmental agencies do not have the funding or position allocation to fill staffing positions required for robust PFAS efforts like statewide sampling for biosolids. States also noted that there are knowledge gaps in terms of the general understanding of biosolids and PFAS, as well as methodology

considerations for developing studies (e.g., how PFAS partitions, plan operation considerations [hydraulic versus solids retention times], biosolids treatment approaches, and land application considerations).

Lab Capacity

While 15 states indicated that they have sufficient laboratory capacity to process biosolids samples, many states still acknowledged that method technique limitations are a prohibitive factor. Some states said that it is challenging to support statewide or targeted biosolids monitoring since EPA has not yet finalized its multi-laboratory validation of draft Method 1633. Massachusetts acknowledged that it is difficult to perform adequate long-term quality analysis and quality control (QAQC) on PFAS data in residuals and wastewater, but also expensive to contract it. This could be solved with swift finalization of draft Method 1633, as there will no longer be a need for independent QAQC of PFAS data in the state.

Other states mentioned various challenges around analytical reporting limits and said that without federal regulatory requirements on biosolids, there is little guidance on how to interpret the data gathered from this sampling or how to translate the data into a specific action. States need standards and risk-based values to assess the results against and to understand how the data will be used. States also need EPA to develop biosolids land application criteria for PFAS. This will help generate more certainty among permitted facilities (who prefer multi-laboratory validated methods rather than "state-accepted" methods) and among the general public about what the analytical data means, and will help states make better regulatory decisions based on the collected data.

Other

A couple of states noted that they have challenges with industry pushback and access issues, as not all landowners or homeowners want their soil or groundwater tested.

Pressing research gaps

States were asked about the most pressing research gaps related to various aspects of PFAS and biosolids, including removing PFAS from POTW effluent, migration, plant uptake, human and ecological risks, and other areas.

Removing PFAS from POTW effluent

Most state responses centered around monitoring and treatment technologies, and disposal options. These include:

- Lack of cost-effective technologies that can be applied to individual PFAS or an entire suite of PFAS, as well as to PFAS found in "low" concentrations;
- Difficulty determining which technologies are most effective, in terms of capacity and feasibility, for removing PFAS within the WWTP and at a full plant implementation scale, with an emphasis on concentrating and then disposing of the chemicals so they do not migrate to surface water. What treatment system residues are created and how can they be disposed of? It is important to look at this gap with a life cycle perspective; for example, if reverse osmosis is recommended, how will the resultant sludge be handled?;
- Lack of disposal options, especially given the large volume of effluent and that most effluent is below some state drinking water MCLs; and
- Need for more affordable treatment for continuous processing of PFAS-contaminated materials.

States said that this specific aspect is a challenge in terms of cost and availability in general. A couple of states also discussed the cost-benefit issue when evaluating source reductions and actual influent levels, and of pretreating a known PFAS-rich source of influent rather than treating effluent from a WWTP. One state also mentioned that it would be helpful to have more research on characterizing potential legacy PFAS in the POTW.

Migration

States would like more research on environmental fate and transport parameters for various PFAS in soil, sediment, and groundwater, especially. States would like assistance with modeling to gain a clearer understanding of how PFAS leach from soil to groundwater and surface water, and are taken up by crops, plants, wildlife, and fish, as well as what site conditions affect this migration. States also noted that more research on the detection and transformation of oxidizable precursors and how they change in a WWTP would be helpful, as well as on how migration is associated with human health and ecological risks. Source reduction, and limiting industry production of PFAS, will help avoid some of the migration concerns.

Plant Uptake

There are still many unknowns on how crops and other plants take up PFAS when biosolids are land applied or by surface and groundwater interfaces. States would like more research on:

- What is the impact of PFAS and biosolids to crops (including feed crops, gardening crops, roots, leaves, fruits and vegetables, etc.), and are certain crops more or less likely to uptake?
- What conditions affect uptake (e.g., PFAS concentration in biosolids, plant type, etc.)? This includes questions about direct plant uptake, as well as uptake from plants used as grain and animal feed. Can uptake be controlled by restricting plant type?
- How do PFAS partition for in-ground vs. above-ground plants, and how does this change over time if it is dependent on chain length?
- How does PFAS bioaccumulate in crops grown on land application sites, and what is the relationship between land application and plant uptake?

States said they would like more research on how to quantify risks for the land application of biosolids or effluent on future crop production, and acknowledged that it would be most helpful for EPA to develop a standardized rate and land application criteria.

Human Health and Ecological Risks

This aspect was specifically listed as a significant or top concern for a couple of the states that responded to the survey. This category includes more research on exposure pathways and risks, and an emphasis on risk communication.

In terms of exposure pathways, what are all of the exposure pathways (e.g., ingestion of drinking water from groundwater and/or surface water sources, ingestion of recreationally-caught fish and/or hunted game, etc.), what is the primary mechanism for exposure (e.g., water, plants, fish, hunted game, direct contact, etc.), and what exposures do the public face?

As for risks, states want to know:

- What is the relative risk to humans from consumption of crops grown with biosolids that were contaminated with PFAS?
- What are the exposure risks downstream of sites and within the food chain?
- What site conditions make risk so great as to require remediation and/or use restrictions?

These gaps include questions about perceived versus real risks, and point to the need to better understand how the PFAS levels in biosolids, soil conditions, and depth to groundwater and crop selection factor into human and ecological risk. As risk communication is a top concern for most state environmental agencies, many emphasized the need for better messaging on what health impacts from PFAS in biosolids are likely over the short and long term. One state noted that information for clinicians would also be helpful.

States said it would be helpful to have more research on currently-used PFAS to be able to better quantify the human health and ecological risks associated with them, as well as assistance in understanding certain second and third generation PFAS and the risks those may pose. States would like for EPA to develop national standards for PFAS in soil, groundwater, and sediments.

Other Gaps

Many of the other gaps that states detailed in their survey responses included general information and questions various aspects of PFAS and biosolids. Below are a few of the specific areas that states requested more research on:

Destruction, Disposal, and Treatment

- Access to short-term and affordable solutions;
- Available capacity of or operating conditions for other disposal methods to manage biosolids;
- Overall costs for removal of PFAS from the environment; and
- Options for remediation when PFAS levels in the soil at a site are determined to be of high risk.

Fate and Transport, Bioaccumulation

- How to distinguish biosolids-specific PFAS (e.g., transformation and oxidation products) apart from other PFAS sources in areas where biosolids are or have previously been land-applied; and
- Ability to conduct fingerprinting and track industrial sources of PFAS.

Wastewater Impacts

- Determining what PFAS and at what levels those PFAS in wastewater pose threats to human health and water quality; and
- Identifying what PFAS levels in wastewater might be expected to come from a “typical” residential house and how to determine where those PFAS originate.

Impacts to Other Species and Crops

- Analyzing PFAS risks to reptiles (which have been noted in parts of the country) and birds (which appear to be more sensitive to PFAS exposure than many types of aquatic life); and
- Determining uptake of FPAS to wild rice or other plants which are harvested from non-cultivated populations.

Other

- Research on whether the benefits of land application outweigh the concerns of PFAS exposure;
- Research on the PFOS levels that may originate from the refinishing of commercial floors; and
- Alternatives for biosolids management if land application is restricted or banned.

Risk Communication

Many states emphasized that risk communication is the most pressing issue surrounding PFAS in biosolids. States need to be able to communicate to farmers, constituents, legislators, and others about what to do in the event of a PFAS contamination event resulting from land applying biosolids or other biosolids management. These messages need to be clear and consistent among states, federal partners, and the media. ECOS has flagged this top priority to EPA and looks forward to addressing some of the questions and gaps identified below.

Key questions and risk communication gaps related to PFAS in biosolids that states need help addressing

States shared some of the key questions and risk communication gaps related to PFAS in biosolids.

Questions

- Who is impacted? How to determine if land or crops have been impacted? What to do if you have confirmed PFAS contamination? What, if any, concentration levels are safe?
- How much PFAS is ending up in biosolids, and what are the main sources (residential vs industrial)?
- What risks are associated with various uses of biosolid-derived products, and what is the leaching potential from biosolids to groundwater from various land application practices?
- How does PFAS move from biosolids to plants, soil, groundwater, and drinking water?
- What are realistic pathways for all foods, hunting game, fishing, etc.?
- What are PFAS levels in: animal feed crops, biosolids, groundwater, runoff, etc.?
- What is the relative risk to human health and environment (of biosolids, water treatment residuals, domestic septage wastes, etc.)?
- How do states effectively explain what likely health impacts are – what is the real threat? Most people have been around since PFAS have been in the environment, and we need to better explain chronic vs. acute, as well as effectively point out how people might be exposed to PFAS beyond water (e.g., how do we address concerns since soils are not regulated?).
- How can we understand risks from historically applied industrially-impacted biosolids vs. PFAS in low levels of biosolids today?
- Can we continue to use biosolids as a fertilizer and soil amendment? Is applying biosolids safe for crops?
- Are there any regulatory structures for land application that are adequately protective of groundwater?
- If a state determines that biosolids can no longer be land applied due to PFAS, how does it determine the impact on existing alternative disposal locations and whether there are possibilities for new such facilities?
- How do states' classifications of "biosolids" differ?
- How do states deal with the inconsistency among state and federal standards?

Risk Communication Gaps

- Communication targeted at residents and users of biosolids on the current understanding of risk (actual and perceived).
- Communication to farmers, landowners, and residents on the risks/impacts of applying fertilizers with biosolids, and about contamination in general.
- Communication of the challenges of managing biosolids, understanding that landfills and incineration create their own potential exposures/contamination.
- Gap between states and public about safety of private drinking water wells and the safety of crops where land application of PFAS materials have occurred.
- Help the public understand PFAS levels in biosolids and its relative abundance to the PFAS level in soil background. What kind of PFAS level in biosolids is impactful?
- Help the public better understand how linked biosolids are to the CWA (e.g., Section 405d). Biosolids are integral (and not just about money and industry) and there is only so much room in landfills.

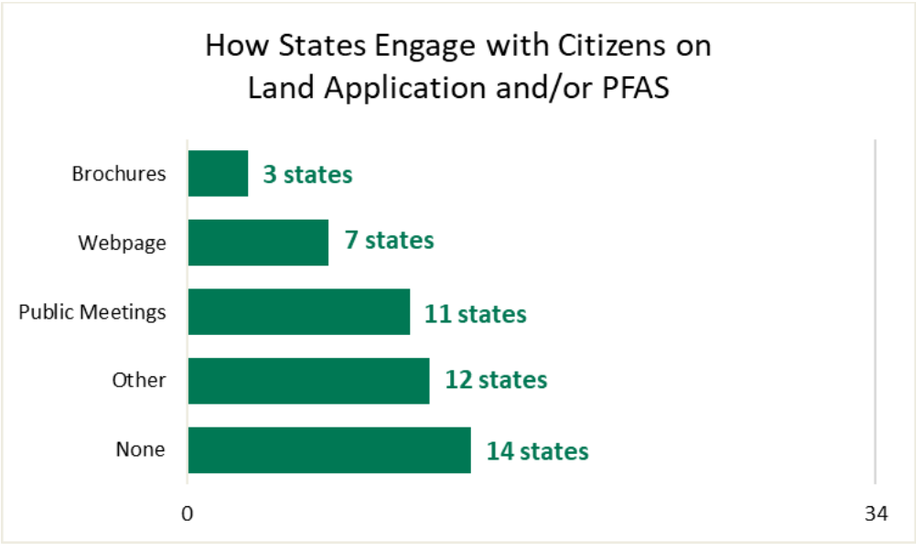
Educate people to pay attention more to what is going down the drain or toilet, which in turn helps clean up wastewater streams and biosolids.

- Since PFAS can be found at detectable levels almost everywhere in the environment, it is important to develop communication that considers the anthropogenic background levels and is able to communicate when land application contributes to increased risk. EPA's risk assessment will help put risk into context for land application, but it is also important to communicate that wastewater is a representation of societal choices and how can the public understand how they can help the wastewater plants reduce PFAS coming into wastewater facilities and thereby reduce PFAS discharged to the environment. Coordinated messaging on this topic may help reduce discharges to the environment and slowly start to change consumer purchasing decisions.

Challenges

- A few states acknowledged that communications will be easier once EPA establishes standards and finalizes risk assessments.
- States would like discussions of PFAS sources into WWTPs, in addition to discussions about treatment once PFAS reaches the plant.
- States need to get out in front of public opinion, but no data to demonstrate that it's not an issue, or if it is an issue, how they are handling it.
- States need technical assistance to track the fate and transport of biosolids that have been land applied, determine the efficacy of pollution prevention options/source reduction, determine the appropriate level or determining factor for industrial impacted biosolids.
- There is conflicting information regarding uptake of PFAS in biosolids through food crops.
- States need recommended interim measures in lieu of definitive data in the near-term.

State engagement with citizens related to land application and/or PFAS



States said they engage with citizens on land application and PFAS in biosolids in a number of ways, including brochures, webpages, and public meetings.

Connecticut, Maine, Massachusetts, Michigan, New Hampshire, South Carolina, and Virginia said that they have, or are developing, webpages or documents specifically related to PFAS in biosolids, and Connecticut, New Hampshire, and South Carolina utilize brochures and/or factsheets. A few of the states provided links to their webpages or fact sheets:

- Connecticut's biosolids **fact sheet** and PFAS **action plan**;
- Massachusetts' biosolids PFAS resources **webpage**;
- Michigan's biosolids **webpage**; and
- Virginia's **webpage**.

A list of all state PFAS webpages can be found on **ECOS' PFAS webpage**.

Eleven states (Colorado, Kansas, Maine, Maryland, Massachusetts, New Hampshire, Tennessee, Texas, Vermont, Virginia, and Washington) have held public or stakeholder meetings, including the following:

- Colorado hosted stakeholder meetings on developing current strategy for monitoring and reporting on source identification and controls. Additional information on monitoring results will be posted online in 2023.
- Massachusetts held a remote stakeholder meeting in September 2020 and expects to hold another in the near future.

- Maryland said it holds public meetings for new land application applications for biosolids on request. PFAS has been raised as an issue during at least one of these meetings.
- The Michigan PFAS Action Response Team (MPART) has a Citizens Advisory Workgroup that meets monthly to discuss ongoing citizen concerns, and Michigan has quarterly meetings with the Michigan Environmental Council, which often works with organizations like Sierra Club and others. Michigan also holds stakeholder meetings with agricultural industries, WWTPs, etc., beyond coordination of EGLE's Water Resources Division, which regulates biosolids, MPART, and its state agriculture and health agencies.
- New Hampshire created the Northeast Biosolids Improvement Program that works on industry outreach regarding the impact of PFAS on wastewater and sludge. The Program meets regularly to discuss the latest news in PFAS biosolids information sharing.
- Virginia held an informational webinar to discuss findings from sampling at the Newport News Waterworks, which showed elevated levels of PFAS in the Chickahominy River watershed. The webinar covered Virginia's response to date, health impacts, and future sampling plans, as well as a general overview of PFAS. Virginia DEQ generated a **Q&A document** after the webinar, and has also responded to PFAS questions during biosolids permit public meetings.
- Washington has presented at local community meetings about PFAS and biosolids.

Other examples of state coordination with the public on PFAS and biosolids include:

- Alabama directly engages with citizens via on-going implementation (registrations, inspections, complaint investigations, enforcement, etc.) of its Department of Environmental Management's beneficial use (land application) regulations.
- In Iowa, there has been some outreach to the Iowa Environment Association communicating PFAS research in biosolids, and the state is coordinating with Iowa State University Civil Engineering professor for sharing PFAS baseline knowledge at the upcoming state annual biosolids conference.
- Maine agencies and nonprofit organizations are very involved in working with communities via speaking at events and trying to educate the general public.
- Vermont holds direct one on one conversations with biosolids managers and farmers.

Several states also identified other examples of outreach or detailed how they plan to begin outreach on PFAS in biosolids.

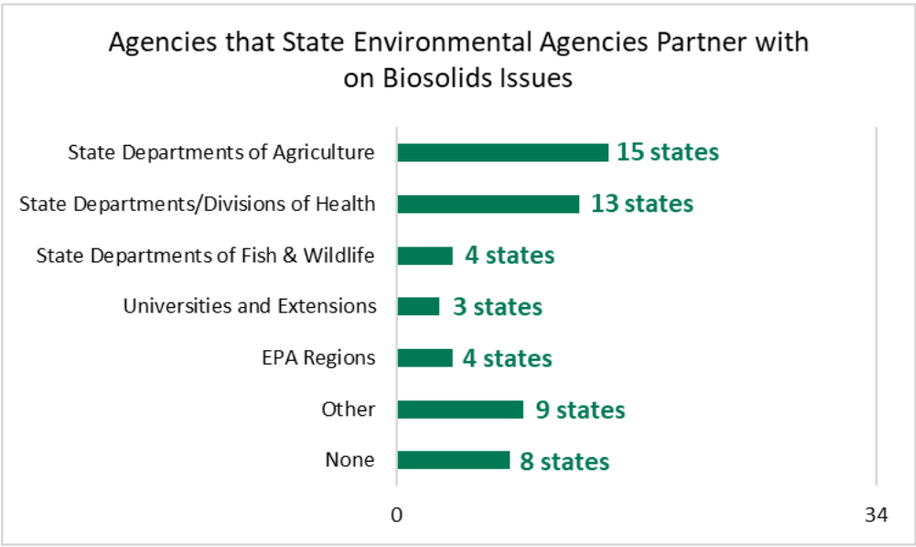
- Maine has two public email accounts that are monitored every day; one focuses on all matters PFAS except products and the other focuses on PFAS in products. In addition, the Maine government is inundated with media inquiries. The media presence on PFAS in Maine is pervasive and so it serves as a mechanism for public education.
- Minnesota developed a webpage which aims to answer basic questions and to educate the general public about PFAS. MPCA is actively discussing the need for additional types of citizen engagement related to the PFAS and the land application of biosolids.
- New Hampshire was recently featured in an **NPR article** on PFAS in biosolids.
- Washington answered many questions from the public, organizations, and industry alike in a 2021 Response to Comments for a draft statewide biosolids general permit. It also responded in kind to a number of public inquiries about PFAS and biosolids.

Fourteen states said they have not yet engaged with citizens in these forums on biosolids.

Partnerships & Moving Forward

ECOS asked the state environmental agencies that responded to the survey to identify what other agencies within the states (and entities broadly) they coordinate with on biosolids issues, as well as to list ways in which they can be better supported on challenges related to PFAS in biosolids in the future.

Agency coordination within states on biosolids issues



State environmental agencies actively work across their programs, divisions, and/or bureaus to accomplish a variety of PFAS tasks. Specific to biosolids, these agencies also work with other partners within their states on PFAS issues.

- Fifteen state environmental agencies (Alabama, Colorado, Connecticut, Kansas, Maine, Maryland, Massachusetts, Michigan[9], Minnesota, New Hampshire, Tennessee, Vermont, Virginia, West Virginia, and Wyoming) coordinate with their state departments of agriculture.
- Thirteen state environmental agencies (Alabama, Arkansas, Delaware, Florida, Iowa, Maine, Massachusetts, Michigan, Minnesota, New York, Virginia, Washington, and Wyoming) coordinate with their state departments or divisions of health.
- Four states (Maine, Massachusetts, Michigan, and Virginia) coordinate with their state department of fish and wildlife.
- Three states (Michigan, North Dakota, and Tennessee) work with universities or extensions in their state.
- Four states (Colorado, Indiana, and Wyoming) work directly with their EPA regions. Montana noted that EPA handles all biosolids actions in the state, Washington coordinates with EPA's Office of Research and Development, Michigan participates in the EPA Region 5 and Great Lakes States PFAS and Biosolids Pretreatment Subgroup, and North Carolina said it intends to collaborate with EPA on a subset of its biosolids sampling initiative.

Nine states specifically commented on what "other" entities with which they coordinate on biosolids issues, including Arkansas and Minnesota with their state divisions of natural resources; Virginia with its state Department of Conservation and Recreation; Maine with its state Centers for Disease Control, Alabama with surface mining agencies; Connecticut with an agricultural experiment station, Massachusetts with its state OTA; Utah with POTWs and a state lab; and Arizona with county wastewater departments and municipalities.

Eight states (Georgia, Idaho, Indiana, Nevada, New Jersey, North Carolina, South Carolina, and Texas) said that they do not have state agencies external to the environmental agency that they routinely coordinate with on PFAS in biosolids. However, Indiana said that Region 5 state biosolids and pretreatment coordinators meet regularly.

Thoughts on how ECOS, EPA, and others can support states on dealing with the multifaceted challenges of PFAS in biosolids

States shared the following thoughts on how they can be better supported to deal with PFAS in biosolids. Most of the comments are directly targeted at EPA in terms of how the agency can facilitate regulations, research, and risk communication.

Regulations and Guidance

- Develop national standards (which provide consistency related to interstate management of PFAS) and development of biosolids land application criteria;
- Establish guidance on use of biosolids in fertilizers;

[9] Michigan's biosolids program is regulated by EGLE. However, PFAS staff from various state agencies coordinate regulatory through **MPART**, which is comprised of seven state agencies (EGLE, Department of Health and Human Services, Department of Agriculture and Rural Development, Department of Natural Resources [includes fish and wildlife], Department of Transportation, Department of Licensing and Regulatory Affairs, and Department of Military and Veterans Affairs) to ensure coordination in implementing a response to PFAS.

- Complete (swiftly) the EPA risk assessment and establish communication about current understanding of risk to avoid multiple, different state criteria;
- Assist states with implementing federal risk-based PFAS standards, and with finances and logistics in finding alternative treatment or disposal options once standards are developed;
- Share information on whether the PFOA and PFOS designation under hazardous waste will impact the current biosolids land application regulations;
- Establish applicable PFAS limits in biosolids disposal regulations;
- Consider legislation that would ban non-essential uses of PFAS;
- Develop effluent limitation guidelines for PFAS and consider an abbreviated effective date; and
- Establish guidance on developing and implementing state programs, especially for those that mirror 40 CFR Part 503.

Research and Development

- Continue rapid dissemination of and updates to EPA research findings, technical studies, and the state of the science;
- Focus on environmental fate and transport data to better understand PFAS transport to the environment/biota via leaching potential from biosolids to soil to groundwater and crop uptake;
- Conduct more sampling and research related to biosolids and fields where biosolids application has taken place;
- Provide recommendations regarding what states should look for relative to evaluation of monitoring results;
- Hone in on source reduction challenges, including:
    - Developing regulatory tools to eliminate the sources of PFAS from entering the waste stream,
    - Placing a national emphasis on source reduction and product substitution as a critical component of reducing PFAS releases to the environment (source identification tools and strategies should be targeted for the general public as well as for the wastewater industry),
    - Emphasizing pretreatment,
    - Creating a central database to compare levels of PFAS compounds in various matrices and the combinations which may identify the source, and
    - Developing some regulatory tools to eliminate the sources of PFAS from entering the waste stream;
- Approve methods for measuring PFAS in biosolids;
    - Provide multi-laboratory validated sampling methods (e.g., complete the multi-laboratory validation of draft Method 1633), and science-based action levels or regulatory limit with which to compare samples, that states can use to begin monitoring PFAS in biosolids, and
- Establish treatment technologies and disposal options (and evaluate all options given their various challenges). Need additional information on:
    - What to do with PFAS-contaminated soils, sludges, agricultural waste products, etc.,
    - The cost and benefits of land application of biosolids versus disposal through incineration and/or landfilling (this should include cost of WWTPs to upgrade in order to landfill or incinerate, capacity concerns, and environmental impacts), and
    - What treatment system(s) will remove PFAS from biosolids so they can be beneficially reused? What are alternative disposal options to landfills for PFAS wastes?

Funding

- Enhance lab capacity and better lab equipment;
- Provide states with financial resources to ensure that they have enough staff to properly address PFAS work and PFAS concerns;
- Provide funding to wastewater treatment facilities to test for PFAS, conduct source identification and reduction work, for any potential upgrades needed, and for increased costs to manage biosolids if land application is not feasible; and
- Provide grants to support monitoring.

Risk Communication

- Expeditiously provide public-facing information and talking points to help counter negative and alarmist press regarding PFAS. Put the problem in perspective and talk about the problem on a national level, not just in one state or location. Take people out of panic mode while working towards a solution, and communicate to the public how they can be a part of the solution to helping wastewater facilities decrease the amount of PFAS they receive and subsequently discharge to the environment, etc.;
- Communicate about science of PFAS and its human health impact that is related to beneficial use of biosolids land application;
- Educate the public on how important the CWA is and how its function relates to wastewater and biosolids. Source reduction does not just happen at the industrial and permit holder level, but also at residences; and

- Create a fact sheet that highlights exposure pathways with respect to relative risk of exposure to PFAS from biosolids. Show that people are much more likely to be exposed to PFAS via food wrappers and consumer goods with which they come into contact on a daily basis, than via land application of biosolids. Biosolids are a reflection of the community that produces them. If we want to see cleaner biosolids, we need to ban manufacturers from producing PFAS and other toxic chemicals in the first place. Prevention is the answer.

Coordination

- Engage POTWS, industries, and states simultaneously;
- Develop a list of resources such as existing knowledge/research in this area, current industry and academic experts, as well as possible collaborators (e.g., NEBRA, the Water Environment Federation, the Solid Waste Association of North America, etc.);
- Form a "biosolids advisory" group with states as key members;
- Develop clear guidance for states, POTWs, and landowners;
- Publish a viable list of certified laboratories that can test PFAS in biosolids with approved methods; and
- Keep sharing information from other states.

Conclusion

This survey was not conducted to offer a state-by-state comparison but rather to share how states are addressing the issue of PFAS in biosolids and where there are opportunities for coordination, especially since these challenges tend to have cross-state implications. Given the wide range of state regulations, policies, initiatives, and research needs on PFAS in biosolids, there are a number of ways for states, federal partners, and other stakeholders to coordinate on these efforts. In the immediate term, ECOS is sharing this report with its partners at EPA so that they are aware of the ways in which states can be supported on this work. In the near-term, ECOS hopes to build upon its partnership with EPA, NASDA, and USDA to form a working group that can focus on effective risk communication and build confidence among the environmental and agricultural communities. Once EPA completes its biosolids risk assessment in 2024, states will be eager to identify ways to better and more cooperatively mitigate the risks associated with PFAS in biosolids. States do not currently recommend a nationwide ban on land application or any other such universal restrictions, especially without further research. However, ECOS hopes that with supportive partnerships and proper messaging, states can begin to more effectively and consistently manage PFAS in biosolids.