Date: April 1, 2024

To: Vermont Agency of Natural Resources, Department of Environmental Conservation

From: Vermont Residuals Management Working Group

RE: **Interim Strategy for Mitigating PFAS Risks Associated with Residuals Management**

The following interim strategy was developed by the Vermont Department of Environmental Conservation (DEC), in consultation with a working group comprised of regional residuals management experts from both the public and private sectors, and the Vermont Department of Health and Vermont Agency of Agriculture Food & Markets. The following strategy is intended to help Vermont mitigate risks associated with potential transfer of per and polyfluoroalkyl substances (PFAS) to the environment via the management of residual materials (biosolids, septage, paper sludge; not including food waste). Existing management options for these residual materials include landfill, incineration, or land application. The PFAS-associated risks stemming from land applied residuals include the potential for leaching to groundwater and contamination of drinking water supplies and crop uptake into food-chain crops.

BACKGROUND

***Vermont Regulations**:*

- Biosolids are sewage sludge derived from domestic wastes which have been subjected to a treatment process for the reduction of pathogens and have been demonstrated to meet the applicable requirements for contaminant concentrations, vector attraction reduction and pathogen reduction.

- Short paper fiber (SPF) is a byproduct of paper manufacturing – paper fibers that are too short to bind together in the paper making process. SPF is a source of organic matter for soil amendments and helps reduce erosion when establishing vegetation on slopes. It is also used as animal bedding.

- The State of Vermont regulates two classes of biosolids under the Vermont Solid Waste Rules: Class B and Exceptional Quality (EQ). The term Exceptional Quality is used to describe a biosolids product which meets Class A pathogen reduction requirements, the most stringent metals limits (pollutant concentrations), and vector attraction reduction standards specified in the Part 503 Rule. The distinction between EQ, Class A and Class B biosolids is based on Environmental Protection Agency pathogen reduction requirements, established in CFR 40, Part 503, where EQ and Class A biosolids are tested to demonstrate meeting lower pathogen limits and are also subject to a process to further reduce pathogens. Class B and septage land application sites require a site-specific permit, or certification, due to the greater level of pathogenic content relative to EQ biosolids. Except for pathogenic content, there is no distinction between Class B and EQ biosolids in terms of pollutant limits.

- The State of Vermont has adopted a Maximum Contaminant Level (MCL) for drinking water and a Groundwater Enforcement Standard (GWES) of 20 parts per trillion (ppt) for the sum of five

PFAS: perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluoroheptanoic acid (PFHpA), perfluorononanoic acid (PFNA), Perfluorohexane sulfonate (PFHxS).

- At the time of this interim strategy, the State of Vermont has not adopted a soil-to-groundwater leaching standard for PFAS, or a PFAS pollutant limit for soil amendments, including biosolids and short paper fiber.

- In 2020, the Vermont Solid Waste Rules were amended to include specific regulations focused on PFAS testing and improved tracking of EQ biosolids. These include:

    - Testing of PFAS for all biosolids generated in or approved for import to Vermont.

    - Testing of PFAS in soil and groundwater at all certified land application sites for Class B biosolids and stabilized septage, at minimum, annually. Testing of PFAS in Crops grown on certified land application sites at the end of each five-year permit cycle.

    - Application for approval from DEC to import EQ biosolids into Vermont. Imported biosolids must meet the more stringent pollutant and pathogen standards of either Vermont or the jurisdiction where the biosolids were generated.

    - All EQ biosolids imported to or generated in Vermont must be distributed with a label indicating that the product may contain PFAS.

Status of EQ Biosolids, Class B Biosolids/Septage Land Application in Vermont and other

- At the time of developing this interim strategy, there are:
    - Three certified active Class B land application sites, as well as four certified Class B sites that have not been, or are unlikely to be, utilized.
    - One certified and active septage land application site.
    - Eight certified facilities producing and distributing EQ biosolids in Vermont.
    - Three facilities approved to import EQ biosolids to Vermont.

- In 2022, sewage sludge produced in Vermont was managed according to Table 1:

Table 1. Vermont Sludge Management in 2022

Management Option	Amount (dry tons)		
	In-State	Out-of-State	Totals
Class B biosolids Land Application	194	0	194
EQ Biosolids Distribution	3,796	4,965	8,761
Landfill Disposal	2,699	609	3,307
Total	6,689	5,573	12,262

- Biosolids recycling has many benefits, including improving soil health, increasing soil carbon and atmospheric carbon sequestration, increasing crop yields, recycling nutrients, and reducing dependency on chemical fertilizers (USEPA 2023).

- EQ Biosolids and short paper fiber (SPF) are approved in Vermont as components of manufactured topsoil to restore degraded lands. The material must meet the same screening standards as those in Table 2 of this document.

- Many Vermont municipalities have invested in biosolids processing. Those investments are stranded if biosolids recycling is banned or so restricted as to be untenable.

- Indiana, Viginia, Rhode Island, and Massachusetts, New Jersey require EQ biosolids generators to report the delivery amount and location, as either the facility name or address, or both, to the State. Maryland POTWs document recipient names, addresses and volumes of materials received when distributed to the public.

Context for PFAS Occurrence and Exposure

- Per and polyfluoroalkyl substances (PFAS) are a broad class of manufactured chemicals that, due to their widespread use and persistence, are found throughout our environment, including in surface waters, air, precipitation, soils, and biota, as well as in household dust and, even, humans. (NAS 2022).

- Scientific studies have shown that exposure to PFAS may be linked to harmful health effects in humans and animals (ASTDR 2022). Human exposures to PFAS occurs via consumer products containing PFAS in our daily living environment. Greater exposures to PFAS can occur at contaminated sites, typically through consumption of contaminated water resulting from discharges from PFAS-using industries (e.g. St. Gobain in Bennington) and/or fire-fighting foams (aqueous film-forming foam) (e.g. at military sites and airports).

- Two of the most widely used and widely studied PFAS, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), have been phased out of industrial production in the U. S. over the past 20 years (EPA 2017), resulting in significantly diminished concentrations of these two PFAS in human blood levels (ASTDR, 2023).

- In 2019, Vermont conducted a study of PFAS occurrence in shallow soils across the state. PFAS were detected in every sample, and PFOS was the dominant compound detected.

- Wastewater sludges and biosolids, tested in Vermont and across the US, contain PFAS because many consumer products (cosmetics, apparel, food packaging, carpets, floor cleaners) that contain PFAS are ultimately discharged into wastewater and concentrate in sludge/biosolids. Similarly, septage pumped and managed from septic tanks contains PFAS. Short paper fiber, a byproduct from the manufacture of paper, will contain PFAS if the feedstock includes recycled paper, since PFAS has historically been added to some paper products.

- Removing PFAS from waste streams, including wastewater effluents and sludges/biosolids, is expensive, energy-intensive, and technologically challenging (Lenka et al 2021).

- Other management options for residual materials, landfilling and incineration, may result in transfers of PFAS to the environment and are limited by capacity.

- USEPA's own research points to uncertainty around the destruction of PFAS in waste streams and the potential for transferring PFAS to the atmosphere (Krug et al 2022; USEPA 2020). Currently, no sludge or biosolids produced in Vermont are ultimately incinerated.

- Landfilling sludge is limited by capacity and generates landfill leachate that contains elevated levels of PFAS and is typically hauled to a wastewater treatment facility for disposal. Regionally, dwindling landfill capacity is a growing concern (NEWMOA 2021). In Vermont, only one active landfill remains with an estimated capacity of 20 years. In 2022, about 3,300 dry tons (or 27%) of sludge produced in Vermont was landfilled.

- The State of Maine is responding to cases of groundwater, water supply, and food chain (dairy farm) contamination by PFOS because of the historical (1980s and 90s) land application of industrially impacted biosolids and paper processing residuals on farms. These examples speak to the need for industrial source identification and pretreatment of discharges to wastewater facilities.

- Since 2019, Vermont DEC required testing of soils and groundwater at all permitted (Class B and septage) land application sites:

  - Number of permitted land application fields (soils) tested 65
  - Average concentration (ppb) in soil of regulated PFAS 13.9

  - Number of groundwater monitoring wells tested 138
  - Number of wells exceeding the VT GWES 31 (23%)

- Groundwater testing at these land application sites indicates that, in some cases, PFAS has leached from soil to groundwater in concentrations exceeding the Vermont Groundwater Enforcement Standard. In those situations, land application has been prohibited, and the permittee or landowner is required to develop a corrective action plan (CAP). At the time of drafting this interim strategy, seven former, and one current, land application permittees have approved CAPS or are developing them for approval.

- Testing, to date, indicates that drinking water supplies (n =44) adjacent to Class B biosolids and septage land application sites have <u>not</u> been impacted by PFAS associated with land application.

VERMONT RESIDUALS MANAGEMENT
Interim Strategy for Managing EQ Biosolids & Short Paper Fiber Soil Amendments
Effective Date: April 1, 2024

1. ***Applicability***

(a) This interim strategy applies to any soil amendment containing EQ biosolids or short paper fiber (SPF), except for:

(1) soil amendments that are one cubic yard or less of material

(b) This interim strategy is effective until the Solid Waste Management Rules are amended, and the provisions of this strategy can be incorporated, or the strategy is repealed.

2. ***Source Control/Reduction Efforts***

The Agency of Natural Resources intends to pursue the following strategies:

(1) Address PFAS transfer to the environment by reducing PFAS use in consumer products.

(2) Improve the quality of biosolids and wastewater effluents by working with Vermont municipalities on pollution prevention strategies to identify potential PFAS sources and to employ pretreatment and/or source control management practices to reduce PFAS use and discharges to wastewater facilities.

3. ***Residuals Management Strategies***

(a) Requires PFAS testing, per the Solid Waste Rules, §6-1306(r)(Table 2), for EQ and Class B biosolids, stabilized septage, and soil, groundwater, and crops at certified land application sites.

(b) Encourage use of EQ biosolids and short paper fiber at non-food-chain crop agricultural sites, such as horticulture, land reclamation, establishment of vegetative cover at construction and roadside areas, etc. Use of Class B biosolids for agricultural sites continues to require a solid waste facility certification (permit) issued by DEC.

(c) Land application of any soil amendment containing EQ biosolids or SPF must meet the following conditions:

(1) Land application onto hydric soils is prohibited.

(2) Seasonal high groundwater depth must exceed 3 feet. Vertical separation shall be measured from the ground surface, or bottom of the zone of incorporation if applicable, to the saturated zone existing at the time of land application.

(3) Distance from the land application area to drinking water supplies must be 300 ft or greater.

(4) Use of soil amendments containing EQ biosolids and SPF are not recommended for crops for direct human consumption.

(5) If used in Vermont agricultural settings, the end user must include the importation of biosolids or SPF soil amendments in the nutrient management plan.

(6) Provide end user/landowner with information sheet containing (3)(c) (1)-(5) and (3)(d)(1)-(5).

(d) Require that the preparer or end user if soil amendments containing EQ biosolids or SPF to electronically report, quarterly, to DEC, the following:

(1) Description of material(s) – residual type(s).

(2) Amount (tons/cubic yards) and application rate of material(s) land applied.

(3) Generator(s) (facility name) of residual material(s).

(4) PFAS content of material(s) - testing frequency is quarterly for quarters when residual material is distributed or utilized by end user. Testing methods can be EPA 1633 or EPA M537, with a minimum of 24 compounds analyzed and reported.

(5) Recipient names and addresses/locations.

(6) Certification from residuals manager that information provided is accurate.

Table 2. PFAS Screening Values (Residual Materials)

PFAS Compound	Concentration (ug/kg; ppb)
Perfluorooctane sulfonic acid (PFOS)	3.40
Perfluorooctanoic acid (PFOA)	1.60
Perfluoroheptanoic acid (PFHpA)	0.84
Perfluorononanoic acid (PFNA)	0.44
Perfluorohexane sulfonate (PFHxS)	0.38

(7) If conditions (d) (1) – (6) are completed and testing results from the material(s) indicate that regulated PFAS are below soil concentrations in Table 2, preparer/end user are exempt from conditions (7)(A)-(B).

(A) Pre-application, a composite soil sample from the application site (one composite per 10-15 acres) must be analyzed for PFAS with results obtained prior to land application. If soil PFAS concentrations exceed those in Table 2, then use of residuals is prohibited at that location. If soil PFAS concentrations are below those in Table 2, land application may proceed, and the land applier must complete condition 7(B).

(B) A calculation of post-application PFAS content of soil at the land application site. Alternatively, the land applier may complete a post-application composite soil test (one composite per 10-15 acres) analyzed for PFAS. Results from either method should be submitted with the corresponding quarterly report.

The following provided input to develop this interim strategy:

Eamon Twohig, VTDEC Residuals Management & Emerging Contaminants
Josh Burns, VTDEC Residuals Management & Emerging Contaminants
Steve Cash, Vermont Agency of Agriculture, Food and Markets
Pamela Wadman, Vermont Department of Health
Robert Wheeler, Chief Operator, Bellows Falls Wastewater
Anthony Drouin, NHDES Residuals Management
Jeff McBurnie, Casella Waste Management
Christina Adams, Resource Management, Inc.
Nicholas LeBlanc, Englobe, Inc.
Ned Beecher, Consultant

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