Interim Best Practices - PFAS & Biosolids / Residuals

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North East Biosolids & Residuals Association

What are PFAS? They are a group of chemicals used commonly for decades in stain-resistant and water-repellant fabrics, non-stick products, surfactants, paints, coatings, waxes, cleaning products, and fire-fighting foams. PFAS are now generating concern because they are found in trace amounts in environments throughout the world, are unusually persistent and sometimes bioaccumulative, and are associated with some negative human health impacts. Because of these concerns, PFAS are being used less, and two prominent ones – PFOA and PFOS – have been mostly phased out in North America. See key current PFAS information from the ITRC (https://pfas-1.itrcweb.org/) and read NEBRA's 2-page "PFAS & Recycling" perspective (https://www.nebiosolids.org/nebra-publications).

Traces of PFAS are in biosolids, paper mill residuals, digestates, composts, soils. Of course they are, because these materials reflect the chemistry of our daily lives. But their mere presence does not necessarily mean risk. Human exposure to PFAS is mostly through daily living. Pizza boxes, food wrappers, cookware, carpets, fabrics – these and many more products contain some PFAS. Biosolids convey PFAS, but are not a significant source of exposure. Most trace organic chemicals break down in biosolids, residuals, and soils and/or are strongly bound. Such traces don't significantly impact crops, plants, animals, or humans. See more about trace chemicals in residuals (https://www.nebiosolids.org/resources/#/microconstituents/).

However, PFAS are unusual. Here is what we know about PFAS related to biosolids / residuals:

- Today's biosolids, residuals (e.g. paper mill residuals), digestates, and composts have levels of several PFAS typically in the range of ~1 – 40 parts per billion (ppb) (Table 1). A ppb equals 1 second in ~32 years. The PFAS in these materials comes from society's many common uses of PFAS, which make their way into solid waste and wastewater. The production of biosolids, residuals, digestates, and composts does not involve PFAS use, and residuals are not, and have never been, significant conveyors or sources of PFAS. However, wastewater and biosolids treatments, including composting and heat drying, do not destroy PFAS, as they do many trace chemicals.
- There is no significant PFAS risk to human health from handling – or even accidentally ingesting – biosolids, residuals, composts, digestates, and soils. The levels of PFAS in these materials today are typically well below any regulatory standards related to dermal contact and ingestion (Vermont's and Maine's 300 ppb is the lowest such soil cleanup standard in North America).
- Impacts to the environment (plants, animals) from PFAS in these materials are unlikely, and research and experience in using biosolids, residuals, digestates, and composts and their potential impacts on the environment has shown numerous benefits and low risks. Recycling these materials to soils is beneficial to the environment, to farms and other lands, and to society.
- The focus of public concern about PFAS is on PFAS in *drinking water*, which is considered a major route of human exposure. U. S. EPA set an *advisory* level of 70 ng/L (parts per trillion or ppt) for PFOA + PFOS combined in drinking water. This is a tiny amount. A ng/L or ppt is equal to one second in ~31,700 years or one drop of water in 20 Olympic-sized swimming pools. It remains challenging for

labs to measure PFAS in the single ppt range. U. S. EPA considers its advisory level to be highly protective of even the most sensitive individual (e.g. a pregnant woman and her baby). U. S. EPA is not certain that higher levels will cause harm; it advises further evaluation if drinking water is above 70 ppt. A few states are using the 70 ppt level as a regulatory standard. A few states have set lower levels (e.g. 20 ppt in Vermont). *But most states have not regulated PFAS at all.*

- The *only* possible concern about PFAS in biosolids, residuals, composts, and digestates is this: *if traces of PFAS leach to groundwater or surface water and that water is used for drinking water*. Limited research indicates that PFOA and PFOS and other PFAS can leach from soils and cause PFAS levels in groundwater close to the U. S. EPA human health advisory level. For convenience (and not based on science), a few states (e.g. CT, MA) have added three other PFAS chemicals to their screening standard, so that the sum of PFNA, PFOA, PFOS, PFHpA, and PFHxS should be compared to the 70 ppt advisory level. There has been less research on these other PFAS.
- To date, testing has not found levels of PFOA + PFOS in groundwater monitoring wells above 70 ppt under and around land application sites that have received biosolids and residuals for many years, as long as the biosolids and residuals were not directly impacted by large industrial discharges of PFAS chemicals. Even many years of application does not appear to cause excessive levels.
- However, there are a few isolated cases (e.g. in AL and MI) where multiple years of land application of biosolids that contained *high levels* of PFOA, PFOS, and/or other PFAS chemicals discharged by a PFAS-using industry directly to a water resource recovery facility (WRRF) have impacted groundwater PFAS levels at or above the 70 ppt U. S. EPA advisory level. If that groundwater is used for drinking water, this is a concern.
- Because of this one and only concern about PFAS (leaching) some facilities that generate biosolids and residuals are proactively evaluating potential direct industrial inputs of PFAS to wastewater, to ensure they are eliminated and will not cause unusual PFAS levels in their biosolids and residuals products. For example, several states are measuring PFAS in landfill leachates that go to WWRFs.
- Groundwater, surface water, and drinking water have been impacted by PFAS most commonly and significantly from industrial and fire-fighting releases of PFAS; those contaminations are the major focus of state and U. S. military PFAS-related activities.
- Systems for removing PFAS from drinking water – with granular activated carbon – are well developed. However, treatments for dirtier water (surface water, groundwater, wastewater) and solids are less-well developed and costly.
- PFAS have been with us since the 1940s. Maximum exposure for most people is in the past. Most of that exposure was/is from common household products and, in some cases, drinking water. Regulatory agencies are focusing on further reducing exposure at locations where drinking water contains hundreds to thousands ppt of PFOA + PFOS and other PFAS chemicals. Such sites are heavily impacted with PFAS by *industrial activities* (not from anything related to biosolids and other residuals).
- Those PFAS that have been studied the most and are of greatest concern – PFOA and PFOS – have been phased out of most uses in North America. Initial research shows that PFOA and PFOS were in biosolids in 2001 at levels 10 times higher than today's levels (Table1). However, other PFAS chemicals have sometimes

Extensive research shows that biosolids & residuals improve soil health & plant growth.

replaced PFOA and PFOS; many are likely of less concern, but further research is needed to better understand their potential human health impacts and their fate in soils and the environment.

- Therefore, additional scrutiny is being placed on all PFAS, and their uses are also likely to be reduced. Human exposure – your exposure – is already less than it once was and is likely to continue to go down.
- The biosolids and residuals management profession strongly supports removal of chemicals of high potential concern from commerce, which reduces the potential for concerns in the products we manage. We support source reduction and pollution prevention.

Table 1: Biosolids PFAS concentrations compared to the few current existing screening values

Item				Notes
Biosolids Concentrations	**PFOA (ppb)**	**PFOS (ppb)**	**5 PFAS[2] (ppb)**	
Average, 4 NE data sets (n=36)	5	11		2017–2018, modern biosolids, not industrially-impacted
Median, historic levels	37	69		Zareitalabad et al., 2013
Single value, PFOS only (n=1)		765		2018 data, MI DEP, industrially-impacted biosolids
Sum of averages, 5 PFAS (n=7)			47	2017 data, NH DES
Sum of medians, historic level, 5 PFAS			220	sum of medians; Guelfo, 2013, Sepulvado et al, 2011
Soil & Other Screening Levels[1]	**PFOA (ppb)**	**PFOS (ppb)**		*ppb (ug/kg) is used for PFAS in soils, sludges, etc.*
AK – DEC (2018)	0.29	0.53		Proposed soil cleanup levels based on migration-to-groundwater models; these values are from inappropriate models and have been challenged. They are not final.
ME – DEP (Oct. 2018)	9.5	21		Remedial Action Guidelines (RAGs) for soil cleanup based on migration to groundwater risk modeling.
ME – DEP (2017)	2.5	5.2		For screening solid waste for beneficial use (does not apply to biosolids, but could, at DEP discretion)
NY – DEC (2017)	72			A screening value for PFOA + PFOS in one compost facility permit situation.
VT – DEC (2016)	300			Soil screening level based on dermal contact, ingestion
Other Concentrations	**PFOA (ppb)**	**PFOS (ppb)**		
Garden reference soils	0.36	1.4		"uncontaminated" soil, 2005, MN Dept. of Health
Dust, U. S. daycare centers	142	201		median values, Strynar and Lindstrom, 2008
Human blood serum, 2012	2	6		CDC NHANES; levels were ~3 times higher in 1999

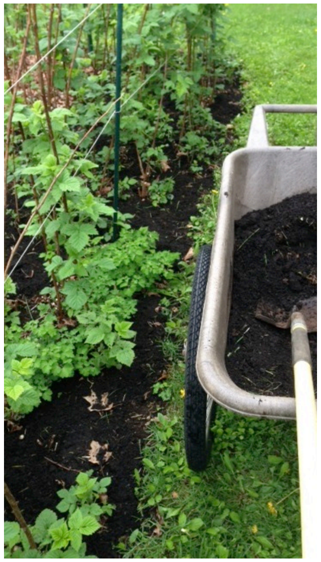
1 The standards and guidance limits here are the most stringent (lowest values) of which we are aware; some additional jurisdictions have established more lenient limits.

2 Sum of 5 of the 6 U. S. EPA drinking water UCMR 2013 PFAS chemicals: PFNA, PFOA, PFOS, PFHpA, PFHxS (the 6th UCMR PFAS chemical is PFBS)

Best Management Practices – PFAS and Biosolids and Residuals

The regulatory requirements and best management practices (BMPs) routinely followed by professionals managing biosolids, residuals, digestates, and composts also reduce any potential risk of PFAS leaching from land application programs. Leaching to groundwater and/or surface water is the *only* potential significant risk from PFAS in these materials. Here's what you can do, even as research and understanding continue to advance:

- *Continue to apply biosolids, residuals, and composts (including Class A / EQ) in accordance with the agronomic rate. This controls the amount of any traces of chemicals thus conveyed to the environment, including PFAS. Healthy soils break down and sequester most trace chemicals. Limited research shows that longer-chain PFAS, such as PFOA and PFOS, are more likely to be bound in the soil; shorter chain PFAS leach more easily.*
- *Near surface waters, maintain reasonable setback distances and create/maintain vegetated buffers. Setbacks protect against nutrient pollution of waters and also protect against any trace PFAS migration to surface water.*
- *Evaluate potential sources of PFAS in wastewaters, biosolids, residuals, digestates, and compost. Look upstream for industries that use any of these chemicals. Evaluate waste streams, such as landfill leachate, which may convey PFAS. Sample and test and consider reducing any significant industrial inputs of PFAS. Sampling and testing for PFAS is challenging. NEBRA has sampling and analysis guidance. Consult experts and understand the limitations of PFAS lab analysis.*
- *Consider testing your program's biosolids, residuals, digestate, and/or compost products for PFOA and PFOS and other PFAS. Be careful, because these chemicals are everywhere and the analytical levels (ppt) are challenging, especially when testing solids. Be a savvy lab customer and proceed thoughtfully.*
- *Honestly communicate with your residuals management employees and customers (farmers, landowners) about traces of chemicals – including PFAS – in various media, including biosolids, residuals, composts, digestates, animal manures, and soils. Honor their questions and address them as best you can. Offer to provide further information. See NEBRA info and contact NEBRA for assistance, if needed* (https://www.nebiosolids.org/resources/#/microconstituents/).
- *Communicate with regulatory agencies and monitor research and the development of legislation and regulation. Discourage jurisdictions from setting regulatory standards for drinking water, groundwater, surface waters, and soils without careful consideration of the implications for management of wastewater and the uses of biosolids, residuals, digestates, and composts. Very low standards may create severe impediments and significant costs to municipalities and ratepayers.*
- *Support targeted, practical field research on PFAS in residuals and soils.*
- *Support societal efforts to reduce the use of PFAS – at least any persistent, bioaccumulative (e.g. longer-chain) versions. Support source reduction and pollution prevention.*



NEBRA staff and members continue to use biosolids products, even knowing that they contain traces of PFAS. The benefits to soils and healthful crops outweigh any potential PFAS concerns. Photo: Biosolids compost applied to home raspberries in NEBRA's hometown, Tamworth, NH.