NCASI
IMPACT. SCIENCE. SOLUTIONS.

Washington State Department of Ecology
PO Box 47600
Olympia, Washington 98504-7600
submitted on-line (as requested)

JANUARY 22, 2021

Comments on the Chemical Action Plan for Per- and Polyfluorinated Alkyl Substances (Publication 20-04-035)

Executive Summary

The National Council for Air and Stream Improvement, Inc. (NCASI) greatly appreciates the opportunity to submit comments on the Chemical Action Plan for Per- and Polyfluorinated Alkyl Substances. NCASI is a scientific association organized to serve the forest products industry as a center of excellence providing unbiased, scientific research and technical information necessary to achieve the industry's environmental and sustainability goals. Over its 77-year history, NCASI has conducted studies in a variety of areas related to water quality and has worked extensively to develop data that assist industrial and government stakeholders charged with managing water quality in understanding issues related to chemical toxicity and the application of human health risk assessment.

NCASI agrees with the intent of the Washington Chemical Action Plan (CAP) to ensure protection of public health relevant to PFAS in the environment. However, this plan should be supported by the best available science, including both accurate characterizations of the toxicity of relevant PFAS compounds and robust analytical chemistry and modeling techniques to characterize relevant pathways of human exposure. In addition, costs associated with treatment technologies should be fully characterized to accurately assess the economic impact of activities under the CAP.

NCASI's comments regarding scientific issues identified in the Chemical Action Plan for Per- and Polyfluorinated Alkyl Substances, Analytical Methods and Techniques are attached. Feel free to contact us with any questions regarding these comments.

Sincerely,

Dr. Giffe Johnson
Principal Scientist, Toxicology, Epidemiology, Risk Analysis

Dr. Matthew Booth
Analytical Lab Manager

Dr. Phil Pagoria
Water Research Engineer

NATIONAL COUNCIL FOR AIR AND STREAM IMPROVEMENT, INC.

402 SW 140th Terrace
Newberry, FL 32669-3000

(352) 331-1745
(352) 331-1766
ncasi.org

1.0 ANALYTICAL METHODS

Regarding page 120, Section 2.1.2 Non-drinking water sample methods, it is important to note that SW-846 Methods 8327 and 8328 refer only to the instrumental aspects of the methods. SW-846 also typically includes sample preparation as separate methods (3000 for organics). For Method 8327, the only published sample preparation is Method 3512, which is filtration/dilution/acidification for aqueous samples. Because there is no concentration, detection limits are usually quite high. A more comprehensive description of sampling and analysis would be appropriate in this section of the CAP.

On page 127, the CAP indicates, "The TOP assay has not been demonstrated on large molecular weight polymer compounds or newer ether-linked PFAS like GenX. It is unknown if the oxidative process would liberate PFAAs from these types of compounds." GenX is itself a product and does not appreciably degrade in the environment. A Total Oxidizable Precursor (TOP) assay (which uses persulfate but not UV/persulfate) is unlikely to convert GenX. As further indicated in the CAP (page 128, Section 2.3 Challenges of analytical method selection), citing the limitation that GenX and ADONA (another replacement compound for PFOA) cannot be analyzed using TOP is not appropriate. These two compounds are not precursors, but rather PFAS products, and are already target analytes for environmental analysis.

Page 134 of the CAP notes the limitations of non-targeted methods. “An important shortcoming of the non-targeted methods is that they are not standardized or multi-laboratory validated. The use of these methods is limited to research and investigation.” NCASI agrees that this is an important issue that limits the utility of non-targeted methods for risk assessment.

2.0 HEALTH EFFECTS

2.1 Clearance Rates in Humans

On page 293, the CAP indicates:

> “Some long-chain PFAAs are strongly bioaccumulative in people. It takes years for human bodies to excrete PFOS, PFOA, perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and other long-chain PFAS. Other PFAAs, such as perfluorobutanoic acid (PFBA), perfluorobutane sulfonic acid (PFBS), and perfluorohexanoic acid (PFHxA), are more rapidly cleared. The absorption, distribution, and clearance in humans for most PFAS have not been studied.”

On page 335 it indicates:

> “For both PFOA and PFOS there are large differences between humans and laboratory animals in how external dose (the amount of intake) translates into internal dose (the amount in blood and organs). Humans retain PFOA and PFOS much longer than laboratory rats and mice, which leads to a higher internal dose in humans given the same external dose. EPA used toxicokinetic modelling to derive equivalent human doses for exposure levels in rodents associated with minimal to no observable adverse developmental effects.”

It is important for the CAP to note, and take into consideration, that the clearance of some PFAS mimics the structure of fatty acids that are retained by a receptor-mediated mechanism in the kidney. As a result, higher serum concentrations of some PFAS (as often found in animal studies) may be observed to clear more rapidly from the body because the receptor-mediated retention mechanism is saturated. At lower serum concentrations (as often found in studies of PFAS in humans), this mechanism may be the key limiting factor in regulating clearance. Evidence of this was demonstrated by Elcombe et al. (2013), where a PFAS was evaluated as a component of a chemotherapeutic regimen for cancer patients and it was determined that higher doses of PFAS in humans resulted in faster elimination rates. Underestimating the relative clearance

of PFAS in humans compared to animal studies can lead to inaccurate extrapolations of Human Equivalent Dose (HED) and resulting toxicity values that could potentially be applied to humans from animal studies.

Elcombe, C.R., Wolf, C.R., and Westwood, A.L. 2013. US Patent Application Publication. Pub. No. US 2013/0029928. https://patentimages.storage.googleapis.com/24/ee/73/f58267c7d70dde/WO2011101643A1.pdf.

2.2 Regulating PFAS as a Class

While the issue of regulating PFAS as individual substances versus regulating them as a class is not explicitly discussed in the CAP, it is an important issue that other state agencies have considered. Broadly grouping PFAS substances to develop regulatory criteria or using a single criterion to regulate all PFAS compounds is not scientifically defensible. PFAS, as a group, includes thousands of substances with unique physio-chemical properties, unique fate and transport properties, and unique toxicological profiles. Using a single criterion or broadly inclusive criteria is unlikely to produce a standard with a well characterized margin of safety or that accurately reflects the hazards posed by individual substances within the group. This has been evidenced in the scientific literature, even in studies that have evaluated PFAS of relatively similar chemical structure. For example, Pizzurro et al. (2019) examined the toxicokinetics of several PFAS compounds and came to these conclusions (**emphasis added**):

> "Overall, our analysis provides one of the first syntheses of available empirical PFAS toxicokinetic data to facilitate interpreting human relevance of findings observed in animal studies and developing health-based criteria for PFAS from such studies. Our analysis highlighted **several notable differences among the different PFAS regarding species and substance-specific tissue partitioning, half-life, and transfer to developing offspring via the placenta or lactation**, as well as highlighted data gaps for certain substances."

> "Lastly, the results of this analysis indicate that there are toxicokinetic differences among the different PFAS based on chain length, and **these substances should not be regulated as a group without careful consideration of how the substance-specific toxicokinetics may impact potential toxicity, including differing specific target organ toxicity and overall body burden.**"

Pizzurro, D.M., Seeley, M., Kerper, L.E., and Beck, B.D. 2019. Interspecies differences in perfluoroalkyl substances (PFAS) toxicokinetics and application to health-based criteria. *Regulatory Toxicology and Pharmacology* 106:239-250. https://doi.org/10.1016/j.yrtph.2019.05.008.

3.0 BIOSOLIDS

Page 401 of the CAP indicates:

> "Several states in the U.S. are considering setting PFAS contaminant levels in soil and biosolids. A PFAS task force in Maine developed PFAS biosolids standards of low ppb for PFOS, PFOA, and perfluoro butane sulfonate (PFBS). Leaching models used in the calculations of these limits use impractical values for parameters such as the fraction of organic carbon in soil (FOC) and degree of molecular sorption (KOC). This can result in calculating unrealistically low soil contaminant limits. Adoption of extremely low regulatory limits for soil PFAS could have adverse consequences for organics and residual recycling. Such limits could interfere with established goals and benefits of recycling programs, but may not provide demonstrated risk-reduction for human health and the environment."

The recommendations on page 415 include:

> "Evaluate the basis of contaminant limits set in other states and Canada. Such an evaluation would include a review of baseline biosolids data, contaminant models and their parameters, pathways of exposure, and level of uncertainty."

Regarding this assessment of biosolids/land applied residuals, NCASI agrees with the need to use appropriate models with inputs that accurately reflect the fate and transport of PFAS in the environment. To assist with this need, NCASI, Water Environment Federation, and the National Association of Clean Water Agencies, in collaboration with subject matter experts from Arcadis, have prepared a review of models that could potentially be chosen to derive criteria for PFAS in land applied residuals. It considers the strengths and weakness of these models relevant to the unique properties of PFAS in the environment and discusses the impact of decision making for input selection on the functionality of selected models. This review is publicly available and can be found at: https://www.ncasi.org/resource/review-of-models-for-evaluating-per-and-polyfluoroalkyl-substances-in-land-applied-residuals-and-biosolids/

4.0 TREATMENT TECHNOLOGY COSTS

Appendix 10 presents an Economic Analysis. Treatment for PFAS removal is only one of many economic impacts assessed (e.g., human health costs and benefits, product substitution costs and benefits, additional sampling costs). Treatment is only given overview assessment, and that only for drinking water and groundwater. To the extent that treatment costs are addressed in Appendix 10, the focus is entirely on drinking water treatment and remediation of contaminated sites. Wastewater treatment, municipal or industrial, is not addressed. Additional issues should be considered in this analysis:

1. The CAP does not require publicly owned treatment works (POTW) influent and effluent testing, so no estimated costs for such testing is provided for consideration (pages 442, 464).

2. Treatment for removal of PFAS compounds in POTWs or industrial wastewater treatment systems is not mentioned in the cost analysis. The CAP specifically notes (page 442) that recommended actions do not include requiring POTWs to test influents and effluents for PFAS.

3. Examples are provided for known or estimated costs for drinking water treatment for PFAS removal in Washington (page 443). Those costs, mostly involving use of granular activated carbon absorption, are in the range of capital and operating costs for groundwater and drinking water treatment that have been observed in other states. With regards to estimated state costs for drinking water treatment the report also states, "Total site specific or statewide costs for PFAS mitigation in drinking water will not be known until further water testing defines the scope of the problem in Washington state." This is likely, as costs are not included for destroying or otherwise ultimately disposing of separated and concentrated PFAS waste streams. The options here are currently limited (i.e., landfilling or incineration), are expensive, and have associated risks (leachate and/or groundwater contamination, air emissions from incineration).

4. Appendix 10 refers to Section 4.5.1 Removal of PFAS from water (page 219). The technologies discussed–GAC, IX, and membrane filtration–are briefly and accurately described, but no costs for those separation technologies or for destruction of concentrated waste streams are noted. Furthermore, there is no discussion of the costs associated with treating municipal or industrial wastewaters to remove PFAS, which is both more complicated and more costly compared with drinking water. Such a discussion should be included in this section that specifically addresses the extensive pretreatment required for wastewaters in order for previously discussed treatment technologies that target PFAS (such as GAC, IX, and membrane processes) to be effective. In addition, this section should discuss costs associated with destruction of PFAS sorbed to treatment media after it has been separated from wastewater.

5. Costs for testing landfill leachates are discussed on page 463. Leachates from industrial landfills are not specifically mentioned and there is no discussion of treatment of landfill leachates to remove PFAS. Costs for managing landfill leachates to address PFAS contamination are not insignificant. Brown and Caldwell (2019) engineers prepared a conceptual PFAS treatment scoping study for leachate from a Vermont landfill. A treatment system consisting of reverse osmosis plus granulated activated carbon (RO+GAC) was proposed for PFAS removal from a mean leachate flow of 50,000 gallons per day. The system included treatment and disposal of RO reject concentrate and offsite GAC regeneration. The estimated capital costs in 2019 ranged from $13.7 million to $34.2 million, while annual operating costs ranged from $0.7 million to $1.7 million. A discussion of these costs should be part of the CAP.

Brown and Caldwell. 2019. *Conceptual Leachate Treatment Scoping Study for New England Waste Services of Vermont (NEWSVT) Landfill*. Prepared for Castella Waste Systems, Inc. Ramsey NJ: Brown and Caldwell.

In summary, several sources of costs from treatment activity have not been addressed in the CAP. NCASI recommends that these potential costs be included when considering remediation activity under the CAP to more accurately assess the potential economic impact of this activity.