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Agency of Natural Resources
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Via Electronic Mail

Re: Comments on Advance Notice on the Regulation of Perfluoroalkyl, Polyfluoroalkyl Substances (PFAS) as a Class

Dear Mr. Montross:

Conservation Law Foundation, Natural Resources Defense Council, Vermont Natural Resources Council, Community Action Works, Vermont Public Interest Research Group, Vermont Conservation Voters, and Safer States respectfully submit these comments on the Advance Notice on the Regulation of Perfluoroalkyl, Polyfluoroalkyl Substances (PFAS) as a Class dated August 14, 2020 (Advance Notice).

Summary of Comments

We do not agree with the conclusion of the Agency of Natural Resources (Agency) that there is insufficient scientific and technical information to support regulation of the PFAS class, PFAS subclasses, or PFAS beyond the five currently regulated. Under Act 21, the Agency must promulgate new rules to protect Vermont communities from PFAS in drinking water unless the Agency demonstrates that there is a scientific, technical, or legal impediment to doing so. Inherent in this mandate is the requirement to conduct a rigorous review of all relevant information. However, the review conducted by the Agency is woefully inadequate and does not include a comprehensive discussion of scientific and technical information and other factors relevant to regulation of PFAS in drinking water.

There is a strong scientific basis and available technology for the management of PFAS as a class, subclasses, and groups, and it is unacceptable for the State to waste limited resources and time to chase these dangerous chemicals down one by one while communities are exposed to unsafe drinking water that has permanent health consequences. The current Maximum Contaminant Level (MCL), which sets a combined 20 ppt standard for perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), perfluorohexane sulfonic acid (PFHxS),

perfluoroheptanoic acid (PFHpA), and perfluorononanoic acid (PFNA), does not protect public health because (1) it does not account for impacts to sensitive endpoints or protect vulnerable populations and (2) only regulates five out of more than 9,000 compounds. Even with incredibly limited testing, PFAS beyond the five currently regulated have been identified in public water supplies and the environment, including perfluorobutanoic acid (PFBA); perfluoropentanoic acid (PFPeA); perfluorohexanoic acid (PFHxA); perfluorodecanoic acid (PFDA); perfluoroundecanoic acid (PFUnA); perfluorododecanoic acid (PFDoA); perfluorotetradecanoic acid (PFTA); perfluorotridecanoic acid (PFTrDA); perfluorobutanesulfonic acid (PFBS); perfluoropentanesulfonic acid (PFPeS); perfluoroheptanesulfonic acid (PFHpS); perfluorononanesulfonic acid (PFNS); perfluorodecanesulfonic acid (PFDS); perfluorododecane sulfonic acid (PFDoS); perfluorooctanesulfonamide (PFOSA); perfluoro-2-methyl-3-oxahexanoic acid (HFPO-DA or GenX); 2-(N- ethylperfluorooctanesulfonamido)a cetic acid (NEtFOSAA); 2-(N- methylperfluorooctanesulfonamido)acetic acid (NMeFOSSA); 4:2 fluorotelomer sulfonic acid (4:2 FTS); 6:2 fluorotelomer sulfonic acid (6:2 FTS); and 8:2 fluorotelomer sulfonic acid (8:2 FTS).

To protect Vermont communities, the Agency should promulgate new rules for the PFAS class and establish a (1) maximum contaminant level goal (MCLG) of zero for the PFAS class; (2) combined MCL below 20 ppt at the lowest, most health protective level technically achievable[1] for the maximum number of quantifiable PFAS; and (3) treatment technique standard for the PFAS class based on total organic fluorine (TOF) measured by combustion ion chromatography (CIC) as soon as an analytical method is validated by an international, federal, or state agency. With respect to the combined MCL, the standard should include all PFAS that can be quantified with a user defined 537-modified method following the Department of Defense (DoD) criteria.[2] In addition, the Agency should require a pre-oxidation step in which perfluoroalkyl acids (PFAA) precursors are oxidized to terminal PFAAs before measuring individual PFAS to capture a more accurate accounting of PFAS in the public water supply.

In the alternative, the State should establish new drinking water rules for PFAS with the subclass approach. At a bare minimum, the Agency should establish a combined MCL below 20 ppt at the lowest, most health protective level technically achievable for the maximum number of quantifiable PFAS pursuant to the additive approach currently utilized.[3] Under any of these approaches, the new rules should be reviewed at least once every two years to ensure drinking water standards reflect the latest science. New rules that remove additional PFAS from drinking water are necessary to protect public health and will result in significant avoided costs and

[1] EPA Method 537.1, EPA Method 533, and user defined 537-modified methods can reliably report PFAS between 2 – 5 ppt. Technical Comments of Anna Reade, PhD, Natural Resources Defense Council, and Katherine Pelch, PhD, University of North Texas Health Science Center to the Vermont Agency of Natural Resources Re the Advance Notice on the Regulation of Perfluoroalkyl, Polyfluoroalkyl Substances (PFAS) as a Class 13 (Nov. 16, 2020) [hereinafter NRDC, Technical Comments]. The Technical Comments are hereby incorporated by reference and made a part of these comments.

[2] Commercial labs are able to quantify approximately 40 PFAS using a user-defined 537-modified method following the DoD criteria at levels between 2 – 5 ppt. *Id.* at 13-14. At a minimum, this list should include all PFAS that can be quantified using EPA Methods 537.1 and 533.

[3] Consistent with our recommendations under a class approach, the Agency should establish a list of PFAS based on the technical capabilities of user defined 537-modified methods following DoD criteria and require a pre-oxidation step before measuring individual PFAS.

benefits for Vermonters and the State. The State and public water systems have options to address the financial costs associated with the clean-up of PFAS contamination in drinking water.

Introduction

State drinking water standards that prevent exposure to unsafe levels of the PFAS class of chemicals are necessary to protect Vermont communities. PFAS chemicals are a public health perfect storm because they (1) are extremely persistent; (2) tend to be highly mobile in the environment; (3) can bioaccumulate; (4) can be toxic in small concentrations; (5) are used in hundreds of different industrial and commercial processes and found in a wide variety of consumer products; and (6) there are over 9,000 different kinds of these dangerous chemicals. PFAS include presumed carcinogens and have been linked to a variety of severe health problems, including learning disorders in infants and children, fertility and pregnancy issues, and impaired liver, thyroid, pancreatic, and immune function.[4] Alarmingly, epidemiological studies identify the immune system as a target of PFAS toxicity.[5] Some studies have found decreased antibody response to vaccines, and associations between blood serum PFAS levels and immune system hypersensitivity (asthma) and autoimmune disorders (ulcerative colitis).[6] On top of these serious health threats, a former Director of the National Institute of Environmental Health Sciences recently warned that exposure to even small amounts of PFAS may make people more vulnerable to COVID-19.[7]

PFAS have been found at unsafe levels in the environment throughout Vermont, including in more than 100 public water supplies, private drinking water wells, groundwater, and surface waters. Drinking water contaminated with PFAS is a significant source of exposure.[8] In addition to PFOA, PFOS, PFHxS, PFHpA, PFNA, at least the following PFAS are present in Vermont: PFBA, PFPeA, PFHxA, PFDA, PFUnA, PFDoA, PFTA, PFTrDA, PFBS, PFPeS, PFHpS, PFNS, PFDS, PFDoS, PFOSA, HFPO-DA or GenX, NEtFOSAA, NMeFOSSA; 4:2 FTS, 6:2

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[4] *See Per- and Polyfluoroalkyl Substances (PFAS) and Your Health*, AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, https://www.atsdr.cdc.gov/pfas/overview.html; U.S. Dep't of Health & Human Serv., Agency for Toxic Substances and Disease Registry, DRAFT TOXICOLOGICAL PROFILE FOR PERFLUOROALKYLS, AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, at 5–6 (JUNE 2018), https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf; Anna Reade et al., NRDC, Scientific and Policy Assessment for Addressing Per- and Polyfluorinated Substances (PFAS) in Drinking Water 19-28 (2019), https://www.nrdc.org/sites/default/files/assessment-for-addressing-pfas-chemicals-in-michigan-drinking-water.pdf.

[5] *See* U.S. Envtl. Prot. Agency, DRINKING WATER HEALTH ADVISORY FOR PERFLUOROOCTANOIC ACID (PFOA) 39 (2016), available at https://www.epa.gov/sites/production/files/2016-05/documents/pfoa_health_advisory_final_508.pdf.

[6] *Id.*

[7] Sharon Lerner, *Scientists Pin Blame for Some Coronavirus Deaths on Air Pollution, PFAS, and Other Chemicals*, June 26, 2020, https://theintercept.com/2020/06/26/coronavirus-toxic-chemicals-pfas-bpa/.

[8] *See* Vt. Dep't of Health, *Health Department Releases PFOA Blood Test and Exposure Assessment Results* (Jan. 26, 2017), https://www.healthvermont.gov/sites/default/files/documents/2017/01/NEWS_PFOA%20Blood%20Test%20&%20Exposure%20Assessment%20Results.pdf (noting that "PFOA levels in blood were strongly correlated with PFOA levels in well water").

FTS, and 8:2 FTS.[9] This most likely does not reflect all PFAS present in the State due to limited testing. Without a drinking water standard for additional PFAS beyond the five PFAS currently regulated, public water systems in Vermont are not required to regularly monitor for all PFAS compounds or to treat water with unsafe levels of PFAS.

DuPont, 3M, and other chemical manufacturers recklessly produced these dangerous chemicals for decades despite being aware of the significant health risks associated with PFAS. In 1981, for example, 3M and DuPont were aware that ingestion of PFOA caused birth defects in rats.[10] After receiving this information, DuPont examined seven children of pregnant workers—two had birth defects.[11] DuPont was also aware that at least one facility had contaminated local drinking water supplies with unsafe levels of PFOA by 1991, but failed to warn anyone.[12] DuPont hid this vital health information from the public and the U.S. Environmental Protection Agency (EPA) while making billions of dollars in profits from continued production of PFOA.[13] Ultimately, DuPont was fined a mere $16.5 million dollars in 2005 for failing to disclose information about toxicity and health risks caused by PFOA.[14]

Although PFOA and PFOS have now been phased out of production in the United States,[15] these compounds will remain in our drinking water, groundwater, and surface waters, as well as our bodies, for decades. In addition, manufacturers have rushed to produce thousands of alternative PFAS, and all of the alternatives tested pose comparable health risks as legacy PFAS.[16] The thousands of untested PFAS are likely to pose comparable health risks as well due to similarities in chemical structure.[17] There are currently over 9,000 different kinds of PFAS.[18]

It is critical that the Agency take action to address PFAS in drinking water because EPA has failed to protect the public from these dangerous chemicals for decades and has still not committed to take meaningful action despite widespread contamination of drinking water. After becoming aware of contamination of drinking water supplies and the significant health risks

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[9] NRDC, Technical Comments at 3, Table 1 (summarizing Act 21 public water supply testing data as of September 1, 2020 and wastewater treatment facility and landfill leachate testing results from a May 3, 2018 report from Steven Shaw and Steven LaRosa, Weston & Sampson, to John Schmeltzer, Vt. Dep't of Envtl. Cons.).
[10] Nathaniel Rich, *The Lawyer Who Became DuPont's Worst Nightmare*, N.Y. TIMES (Jan. 6, 2016), https://www.nytimes.com/2016/01/10/magazine/the-lawyer-who-became-duponts-worst-nightmare.html.
[11] *Id.*
[12] *Id.*
[13] *Id.*
[14] Memorandum from Grant Y. Nakayama, Assistant Administrator, to Environmental Appeals Board Re Consent Agreement and Final Order to Resolve DuPont's Alleged Failure to Submit Substantial Risk Information Under the Toxic Substances Control Act (TSCA) and Failure to Submit Data Requested Under the Resource Conservation and Recovery Act (RCRA) (Dec. 14, 2005), https://www.epa.gov/sites/production/files/2013-08/documents/eabmemodupontpfoasettlement121405.pdf.
[15] *Assessing and Managing Chemicals under TSCA, Fact Sheet: 2010/2015 PFOA Stewardship Program*, U. S. ENVTL. PROTECTION AGENCY, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program#what.
[16] Carol F. Kwiatkowsi et al., *Scientific Basis for Managing PFAS as a Chemical Class*, ENVTL. SCI. & TECH. LETTERS 2020, 7, 532-543, https://pubs.acs.org/doi/pdf/10.1021/acs.estlett.0c00255; *See also* NRDC Technical Comments at 5-7, 11.
[17] *Id.*
[18] U.S. Envtl. Agency, PFAS Master List of PFAS Substances, https://comptox.epa.gov/dashboard/chemical_lists/PFASMASTER (last visited on November 11, 2020).

posed by these dangerous chemicals, EPA gave manufacturers nearly a decade to phase out production and use of PFOA and PFOS through a voluntary program.[19] Despite learning in 2015 that millions of Americans were, and continue to be, exposed to PFAS-contaminated drinking water, EPA has not taken meaningful steps toward requiring public water systems to regularly monitor for PFAS and to treat unsafe water.[20] EPA even attempted to suppress a scientific study suggesting that EPA's current health advisory for PFOA and PFOS does not protect public health.[21] After widespread public outcry, EPA announced the possibility of setting drinking water standards for just two PFAS,[22] yet no enforceable regulatory standard has been proposed to date[23] and there is no reason to expect a final rule anytime soon—even under a new administration.

When it comes to setting drinking water standards, EPA has historically been paralyzed. There are federal drinking water standards for less than 100 organic and inorganic chemicals compared to the more than 80,000 chemicals on the Toxics Substances Control Act Inventory.[24] EPA has not established a new MCL for a contaminant in more than 20 years.[25]

Fortunately, the Agency committed to establishing an MCL for PFOA, PFOS, PFHxS, PFHpA, and PFNA in response to the *Petition for Rulemaking to Establish a Treatment Technique Drinking Water Standard for Per- and Polyfluoroalkyl Substances* filed by Conservation Law Foundation, Toxics Action, Vermont Natural Resources Council, Vermont Public Interest

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[19] *See, e.g.*, Consent Order, *In the matter of: Dupont Company,* (Nos. P-08-508 and P-08-509, U.S. E.P.A. Office of Pollution Prevention and Toxics, April 9, 2009), available at https://assets.documentcloud.org/documents/2746607/Sanitized-Consent-Order-P08-0508-and-P08-0509.pdf; Premanufacture Notification Exemption for Polymers; Amendment of Polymer Exemption Rule to Exclude Certain Perfluorinated Polymers, 75 Fed. Reg. 4295, 4296 (Jan. 27, 2010). Yet DuPont and Chemours may still be releasing PFOA into the environment. Melanie Benesh, Environmental Working Group, Why Are DuPont and Chemours Still Discharging the Most Notorious 'Forever Chemical'?, https://www.ewg.org/news-and-analysis/2020/10/why-are-dupont-and-chemours-still-discharging-most-notorious-forever.

[20] David Andrews, *Report: Up to 110 Million Americans Could Have PFAS-Contaminated Drinking Water*, ENVTL. WORKING GROUP (May 22, 2018), https://www.ewg.org/research/report-110-million-americans-could-have-pfas-contaminated-drinking-water#.W6_7a2hKg2w.

[21] Abraham Lustgarten et al., *Suppressed Study: The EPA Underestimated Dangers of Widespread Chemicals*, PROPUBLICA (June 20, 2018), https://www.propublica.org/article/suppressed-study-the-epa-underestimated-dangers-of-widespread-chemicals.

[22] *See The Federal Role in the Toxic PFAS Chemical Crisis, Hearing on SD-342 Before the Subcomittee. on Homeland Security & Governmental Affairs*, 115th Cong. (2018) (statement of Chairman Rand Paul and Ranking Member Gary C. Peters), https://www.hsgac.senate.gov/hearings/the-federal-role-in-the-toxic-pfas-chemical-crisis.

[23] Although EPA announced it was making a preliminary regulatory determination for PFOA and PFOS in drinking water in February of 2020, there has not been a final regulatory determination and these rules do not appear to be under development. 85 Fed Reg. 14,098, 14,098 (Mar. 10, 2020); U.S. Envtl. Prot. Agency, Drinking Water Regulations Under Development or Review, https://www.epa.gov/sdwa/drinking-water-regulations-under-development-or-review (last visited on Nov. 15, 2020) (noting that only drinking water rules related to lead, perchlorate, and chromium are under development or being reviewed for regulation).

[24] U.S. Envtl. Prot. Agency, TSCA Chemical Substance Inventory, https://www.epa.gov/tsca-inventory/how-access-tsca-inventory (last visited Nov. 11, 2020).

[25] Ariel Wittenberg, *EPA Was Always Bad on Drinking Water*, E&E News (Feb. 5, 2019), https://www.eenews.net/stories/1060119665#:~:text=%22But%20while%20this%20is%20not,every%20three%20years%20after%20that.

Research Group, and Rights & Democracy on October 25, 2018.[26] In addition, Act 21 of 2019 set an interim combined MCL of 20 ppt for PFOA, PFOS, PFHxS, PFHpA, and PFNA effective December 1, 2019 and directs public water supply operators to test for a broader suite of PFAS chemicals.[27] The legislature also directed the Agency to promulgate an MCL for PFOA, PFOS, PFHxS, PFHpA, and PFNA no later than February 1, 2020—which was finalized on March 17, 2020—and initiate a rulemaking process to regulate PFAS as a class or subclass by August 1, 2020.[28]

I. The review conducted by the Agency is woefully inadequate and does not include a comprehensive discussion of scientific and technical approaches or other relevant factors that support a class or subclass approach to regulation of PFAS.

Pursuant to basic principles of administrative law, the Agency must articulate a reasonable explanation for its determination regarding regulation of additional PFAS in drinking water, and this determination must be consistent with legislative policy and supported by substantial evidence.[29] In order to meet this criteria, the Agency is required to conduct a rigorous review of all scientific and technical information and other factors relevant to regulating PFAS in drinking water.[30] The Agency's Review, however, falls far short of what is required.

A. The Agency must conduct a rigorous review of all scientific and technical information and other relevant factors regarding regulation of PFAS as a class or subclasses.

Act 21 directs the Agency to initiate a formal rulemaking process to regulate PFAS as a class or subclasses in recognition of the fact that the current MCL for just five PFAS out of more than 9,000 compounds is not adequate to protect Vermonters.[31] The statute sets forth deadlines for the publication of the Advance Notice, as well as proposed and final rules to ensure additional drinking water protections are put in place expeditiously.[32] If the Agency does not publish a proposed rule by March 1, 2021, the Agency must "at a minimum, identif[y] . . . all legal, technical, or other impediments to regulating PFAS compounds as a class or subclasses and a detailed response to all public comments received."[33] The Agency does not have unlimited discretion to choose whether or not to propose and finalize additional drinking water rules for

[26] Conservation Law Foundation et. al, Petition for Rulemaking to Establish a Treatment Technique Drinking Water Standard for Per- and Polyfluoroalkyl Substances (Oct. 25, 2018).
[27] An Act Relating to the Regulation of Polyfluoroalkyl Substances in Drinking and Surface Waters, Act 21 (2019) [hereinafter Act 21 (2019)].
[28] *Id.*
[29] *See Petition of Town of Shelburne*, 154 Vt. 596, 605-607 (1990) (citing *Motor Vehicle Mfrs. Ass'n of U.S., Inc. v. State Farm Mutual Automobile Ins. Co.*, 463 U.S. 29, 43 (1983)).
[30] *See id.* at 606 (noting that a court must determine whether "factual findings are supported by substantial evidence as that concept is used in the field of administrative law"); *See also Motor Vehicle Mfrs. Ass'n*, 463 U.S. at 43-44; 52 (noting that an agency's actions "would be arbitrary and capricious if the agency has relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, [or] offered an explanation for its decision that runs counter to the evidence before the agency . . . .").
[31] Act 21, Sec. 3(b)-3(d).
[32] *Id.*
[33] *Id.* § 3(b)(2).

PFAS.[34] Under Act 21, the Agency must move forward with new rules unless it demonstrates there is a scientific, technical, or legal impediment that prevents the Agency from doing so.[35]

Inherent in this mandate to the Agency is the requirement for the Agency to conduct a rigorous review of all scientific and technical information and other relevant factors regarding regulation of PFAS as a class or subclasses.[36] Agencies must articulate a reasonable explanation for a decision that is consistent with legislative policy, and these decisions must be supported by substantial evidence.[37] Courts have held that an agency must evaluate all substantial scientific and technical information, consider all relevant factors, and provide a detailed and rational explanation for its conclusion.[38] These are basic principles of administrative law, and the Agency is required to meet this same test with respect to new rules to protect Vermonters from PFAS compounds in drinking water.

B. The review does not include a comprehensive discussion of scientific and technical information and other relevant factors that support a class or subclass approach to regulation of PFAS.

The Agency falls far short of the rigorous review required by Act 21 and, in fact, did not perform even basic due diligence when it conducted this review. Although the Review Team—scientists from the Departments of Health and Environmental Conservation—claims there is limited or insufficient information to justify regulating PFAS beyond the five currently regulated,[39] they did not consider or fully consider critical scientific and technical information and other relevant factors. Although the Advance Notice states that "[t]he Review Team consulted with other jurisdictions, interstate organizations, and literature on PFAS analytical methods and toxicology," there is no record of who the Review Team consulted with, what exactly was discussed, or how that informed the Agency's preliminary determination.[40] Further, the literature review is shockingly limited in scope.[41]

As detailed in the Technical Comments, the Agency did not consider health and toxicological data for nearly 30 PFAS, including risk assessments and hundreds of human epidemiological, experimental animal, and mechanistic and/or in in vitro studies.[42] For example, the Advance Notice fails to even acknowledge—much less include a discussion of—the fact that states have conducted risk assessments for PFAS that are not currently part of Vermont's combined standard or that other jurisdictions have derived relative potency factors for many PFAS using PFOA as the index chemical.[43] The information is completely absent from the Advance Notice.[44] Among

[34] *Id.* § 3.
[35] *Id.*
[36] *See, e.g.*, *supra* note 29.
[37] *Petition of Town of Shelburne*, 154 Vt. at 605.
[38] *See, e.g.*, *supra* note 29.
[39] *See* Advance Notice.
[40] *Id.* at 3.
[41] *Id.* at 10-11.
[42] NRDC, Technical Comments at 17-18.
[43] *Id.* 8, 17.
[44] *See* Advance Notice.

other things, health and toxicological data for PFAS beyond the five PFAS currently regulated is critical information that the Agency must fully consider as part of the review.

The Review Team also did not consider the scientific justification for a class-based approach, jurisdictions that are or are proposing to regulate PFAS as a class or subclasses, possible approaches to subclass regulation, and a comprehensive discussion of analytical methods.[45]

With respect to analytical methods, the Advance Notice does not even mention—much less discuss the results of—the pilot project that the Agency was required by Act 21 to conduct to evaluate methods to quantify total PFAS. Act 21 states that "the Secretary shall conduct a pilot project at public water systems to evaluate PFAS that are not quantified by standard laboratory methods using a total oxidizable precursor assay or other applicable analytical method to evaluate total PFAS."[46] The Agency was required to publish a plan by June 1, 2019 explaining how it intended to conduct this pilot as part of its statewide investigation of PFAS sources and implement the plan by July 1, 2019.[47] The Agency has not met this timeline and our understanding is that the pilot project has not been conducted and the Agency has no specific plans to do so at this time. Yet the legislature included this requirement and specific timeline for completion in Act 21 in order for those results to inform the Agency's development of new drinking water rules for PFAS.[48]

In addition, the Advance Notice does not include any discussion of other factors relevant to regulations to better protect Vermonters from exposure to the PFAS class in drinking water, including:

- data that demonstrates that PFAS are present in more than 100 public water supplies;
- data that shows PFAS beyond the five currently regulated are present in public water supplies and other media in Vermont;
- available treatment technologies to remove PFAS from drinking water;
- public health and economic benefits of regulating PFAS as a class or subclasses or PFAS beyond the five currently regulated; and
- the public health and economic benefits associated with the removal of other unregulated contaminants that would occur with installation of treatment to remove PFAS.

In addition to these major deficiencies, the Agency fails to articulate a specific timeline or plan for action in light of what they perceive to be a lack of scientific studies and toxicology data.[49] For example, the Review Team states that it "plan[s] to closely monitor the work by the National Toxicology Program (NTP) and the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate PFAS as a class."[50] There is no estimated timeline for the completion of the NTP and ATSDR process and no explanation as to what "closely monitor" means.

[45] *See* NRDC, Technical Comments.
[46] Act 21 § 6.
[47] *Id.*
[48] *Id.* §§ 3, 6.
[49] Advance Notice at 9.
[50] *Id.* at 4.

Similarly, the Advance Notice states that the State lacks resources to conduct certain scientific and technical analyses, but does not provide support for these statements or identify what level of resources they believe would be necessary.[51] While this may be true, the Agency must provide support and a more complete explanation for these statements.[52] Moreover, as set forth below, the Agency may not use costs to regulated entities as a rationale for not promulgating new rules for PFAS.[53] There is a scientific basis for regulation of PFAS as a class and technology is available to detect and treat PFAS in drinking water.[54] For all these reasons, the Agency has not met its obligation to conduct a rigorous review of all scientific and technical information and other relevant factors related to class or subclass regulation of PFAS.

II. Protective state standards for the PFAS class are necessary to prevent exposure to unsafe levels of PFAS in drinking water.

In light of EPA's failure to act over decades, states must establish drinking water standards for the PFAS class or subclasses. The Agency has broad authority to protect drinking water, and the legislature specifically directed the Agency to promulgate new rules to better protect Vermonters from the PFAS class of chemicals. PFAS can be highly toxic to humans in small concentrations and testing in the State has revealed these chemicals are in drinking water, groundwater, and surface water, as well as landfill leachate, and wastewater treatment plant discharges and sludge.

The current PFAS MCL is an important first step to prevent exposure to dangerous toxic "forever chemicals." However, the PFAS MCL does not fully protect public health because it does not protect for the most sensitive endpoints or our most vulnerable populations, including fetuses, infants, and children; other states have adopted more protective individual MCLs and the Massachusetts combined standard includes one additional PFAS; and the standard does not address all PFAS compounds. Class regulation is necessary to protect Vermont communities.

A. The Agency must establish drinking water standards for the PFAS class.

The Agency has broad authority to protect drinking water, and the legislature has directed the Agency to promulgate new rules to remove PFAS from public water supplies. PFAS are harmful to public health even in very small concentrations. These toxic "forever chemicals" have been found in drinking water, groundwater, and surface water throughout Vermont. It is critical that the Agency establish strong state standards for the PFAS class in order to protect Vermont communities from these dangerous chemicals.

1. Legal Background

The Agency has broad authority to regulate unsafe chemicals in drinking water.[55] Pursuant to 10 V.S.A. § 1672, the Secretary "shall regulate" drinking water "to prevent and minimize public

[51] *See id.*
[52] *See, e.g.*, *supra* note 29.
[53] *See* discussion *infra* Section II.A.1.
[54] NRDC, Technical Comments.
[55] 10 V.S.A. § 1672(a).

health hazards."[56] The Secretary may adopt a Health Advisory Level set by the Vermont Department of Health as an MCL[57] or establish other standards or requirements for drinking water quality so long as the standards or requirements are at least as stringent as the national primary drinking water regulations.[58] In addition, the Agency has the authority to adopt a treatment technique drinking water standard for PFAS.[59] "A treatment technique is an enforceable procedure or level of technological performance which public water systems must follow to ensure control of a contaminant."[60]

Act 21 directs the Agency to initiate a formal rulemaking process to regulate PFAS as a class or subclasses in recognition of the fact that the current MCL for just five PFAS out of more than 9,000 compounds is not adequate to protect Vermonters.[61] The statute sets forth deadlines for the publication of the Advance Notice, as well as proposed and final rules to ensure additional drinking water protections are put in place expeditiously.[62] If the Agency does not publish a proposed rule by March 1, 2021, the Agency must "at a minimum, identif[y] . . . all legal, technical, or other impediments to regulating PFAS compounds as a class or subclasses and a detailed response to all public comments received."[63] The Agency does not have unlimited discretion to choose whether or not to propose and finalize additional drinking water rules for PFAS.[64] Under Act 21, the Agency must move forward with new rules unless the Agency demonstrates there is a scientific, technical, or legal impediment to doing so.[65]

When promulgating drinking water rules, the Agency is obligated, first and foremost, to establish drinking water standards that fully protect public health.[66] The Agency is not required to conduct a cost-benefit analysis.[67] That said, the benefits that stem from preventing exposure to harmful PFAS—as well as other unregulated contaminants that are removed in the process—in drinking water would far outweigh the costs associated with compliance.[68]

There are substantial societal costs avoided and benefits gained from preventing PFAS exposure. There are significant environmental and human health costs associated with PFAS, and exposure

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[56] *Id.* The State of Vermont has primacy for the Safe Drinking Water Act in Vermont. Water Supply Rule, 12-030-003 VT. CODE R.
[57] Water Supply Rule, 12-030-003 VT. CODE R. § 6.15.
[58] 10 V.S.A. § 1672(b)(1).
[59] *Id.* Several of the national primary drinking water standards are treatment technique rules. U.S. Envtl. Prot. Agency, *How EPA Regulates Drinking Water Contaminants*, https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants (citing Surface Water Treatment Rule, Lead and Copper Rule, and Acrylamide and Epichlorohydrin Rules). The Safe Drinking Water Act authorizes the Administrator to establish a treatment technique standard in lieu of a maximum contaminant level "if the Administrator makes a finding that it is not economically or technologically feasible to ascertain the level of the contaminant." 42 U.S.C. § 300g-1(b)(7)(A).
[60] U.S. Envtl. Prot. Agency, *How EPA Regulates Drinking Water Contaminants*, https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants.
[61] Act 21, Sec. 3(b)-3(d).
[62] *Id.*
[63] *Id.* § 3(b)(2).
[64] *Id.* § 3.
[65] *Id.*
[66] 10 V.S.A. § 1672(a).
[67] *See id.*; Act 21.
[68] Additionally, and as discussed below in Section IV, there are numerous funding assistance options available to offset and assist with monitoring and treatment costs.

can lead to massive, lifelong health-related costs on individuals exposed (including decreased wages and increased medical bills), a lower quality of life, and premature death. For example, with respect to low birth weight alone, a recent study estimated the economic burden of PFOA contamination at $13.7 billion for the period 2003-2014 in the U.S.[69] Low birth weight may be associated with a higher risk of developing diseases in adulthood such as cardiovascular disease, respiratory disease and diabetes,[70] and is associated with impaired cognitive development. In addition, low birth weight can be associated with a 25% lower likelihood of passing high school exit exams; a higher risk of unemployment at age 33 years;[71] and lower income for men 30 years of age and for women between 50 and 60 years of age.[72]

Additionally, a recent report by the Nordic Council estimates that health costs from exposure to PFAS costs far outweigh the costs of remediation.[73] Many of the findings from this report came from studies conducted in the United States. Notably, the economic impacts in the Nordic Council study do not include indirect costs, such as psychological or emotional impacts. Therefore, the total societal costs are likely underestimated in the report. While the exact health-related costs associated with PFAS exposure have not been comprehensively quantified, such costs will undoubtedly far outweigh the costs of monitoring and treatment to remove PFAS from drinking water.[74] In conclusion, the Agency has the authority to establish drinking water regulations for the PFAS class or subclasses, including setting a treatment technique standard.

2. PFAS are harmful to public health.

PFAS are extremely persistent; tend to be highly mobile in the environment; can bioaccumulate; can be toxic in small quantities; are used in hundreds of commercial and manufacturing processes; found in thousands of consumer products; and there are over 9,000 different kinds of these dangerous chemicals. They have been used in non-stick cookware, water-repellent clothing, stain resistant fabrics and carpets, cosmetics, firefighting foams, and other products that resist grease, water, and oil.[75]

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[69] Julia Malits et al., *Perfluorooctanoic acid and low birth weight: estimates of US attributable burden and economic costs from 2003 through 2014*, 221:2 INTERN J HYGIENE ENVIRON HEALTH, 269-75 (2018), available at https://www.ncbi.nlm.nih.gov/pubmed/29175300.

[70] Douglas Almond and Janet Currie, *Killing Me Softly: The Fetal Origins Hypothesis*, 25:3 JOURNAL OF ECONOMIC PERSPECTIVES (2011), 153–72, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4140221/pdf/nihms443660.pdf; Prashant Bharadwaj et al., *Birth Weight in the Long Run*, 53(1) JOURNAL OF HUMAN RESOURCES (2017), 189–231, https://www.nber.org/system/files/working_papers/w21354/w21354.pdf.

[71] Janet Currie and Rosemary Hyson, *Is the Impact of Health Shocks Cushioned by Socioeconomic Status? The Case of Low Birthweight*, 89:2 AMERICAN ECONOMIC REVIEW 245-50 (1999), available at https://www.aeaweb.org/articles?id=10.1257/aer.89.2.245.

[72] Black S. et al., *From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes*, 122:1 THE QUARTERLY JOURNAL OF ECONOMICS 409-39 (2007), https://www.ucd.ie/geary/static/publications/workingpapers/GearyWp200718.pdf; Bharadwaj et al., *supra* note 70.

[73] Nordic Council of Ministers, *The Cost of Inaction: A Socioeconomic Analysis of Environmental and Health Impacts Linked to Exposure to PFAS*, http://norden.diva-portal.org/smash/get/diva2:1295959/FULLTEXT01.pdf.

[74] Notably, the burden of PFAS-related health and environmental costs are largely and unfairly born by individuals and the government, and not the chemical manufacturers and polluters that have contributed and are contributing to the PFAS pollution crisis.

[75] *See Per- and Polyfluoroalkyl Substances (PFAS) and Your Health*, AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, https://www.atsdr.cdc.gov/pfas/overview.html.

PFAS that have been studied so far have been shown to be toxic in concentrations as small as parts per trillion.[76] These chemicals are associated with cancer and have been linked to growth, learning, and behavioral problems in infants and children; fertility and pregnancy problems, including pre-eclampsia; interference with natural human hormones; increased cholesterol; immune system problems; and, interference with liver, thyroid, and pancreatic function.[77] PFAS have been linked to increases in testicular and kidney cancer in human adults.[78]

Developing fetuses and newborn babies are particularly sensitive to PFAS chemicals.[79]

> The impacts of PFAS exposure on fetal development and the young have been studied in both humans and animals. These studies find similar and profound adverse health effects.
>
> Since infants and children consume more water per body weight than adults, their exposures may be higher than adults in communities with PFAS in drinking water. In addition, the young may also be more sensitive to the effects of PFAS due to their immature developing immune system, and rapid body growth during development. Exposure to PFAS before birth or in early childhood may result in decreased birth weight, decreased immune responses, and hormonal effects later in life.[80]

As described in a recent study, PFAS exposure occurs *in utero* as a result of placental transfer of PFAS, and there is also a significant, additive PFAS exposure that occurs in infants through breast-feeding.[81]

Alarmingly, epidemiological studies identify the immune system as a target of PFAS toxicity. Some studies have found decreased antibody response to vaccines, and associations between blood serum PFAS levels and both immune system hypersensitivity and autoimmune disorders like asthma and ulcerative colitis.[82] On top of these serious health threats, a former Director of

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[76] U.S. Dep't of Health & Human Serv., Agency for Toxic Substances and Disease Registry, TOXICOLOGICAL PROFILE FOR PERFLUOROALKYLS, AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, at 5–6, https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf.
[77] *Id.*
[78] *Id.* at 6.
[79] *See* DRINKING WATER HEALTH ADVISORY FOR PERFLUOROOCTANOIC ACID (PFOA) at 9, *supra* note 5.
[80] Anna Reade et al., NRDC, Scientific and Policy Assessment for Addressing Per- and Polyfluorinated Substances (PFAS) in Drinking Water 23 (2019), https://www.nrdc.org/sites/default/files/assessment-for-addressing-pfas-chemicals-in-michigan-drinking-water.pdf.
[81] Helen M. Goeden et al., *A transgenerational toxicokinetic model and its use in derivation of Minnesota PFOA water guidance*, 29 J. OF EXPOSURE SCI. & ENVTL. EPIDEMIOLOGY 183 (2019), https://www.nature.com/articles/s41370-018-0110-5.pdf (concluding that "early life serum levels are predicted to be approximately 40% higher than adult steady-state levels," and that "[w]hen both placental and breastmilk transfer are taken into account. . . early life serum levels were predicted to be sixfold higher than adult steady-state levels.")
[82] *See* DRINKING WATER HEALTH ADVISORY FOR PERFLUOROOCTANOIC ACID (PFOA), *supra* note 5, at 39.

the National Institute of Environmental Health Sciences recently warned that exposure to even small amounts of PFAS may make people more vulnerable to COVID-19.[83]

While a great deal of public attention has recently been paid to PFOA, PFOS, and other long-chain PFAS, EPA and other scientists have raised concerns that other chemicals in the PFAS class of compounds are similar in chemical structure and are likely to pose similar health risks.[84] For example, all PFAS share a strong carbon-fluorine bond and "degrade very slowly, if at all, under environmental conditions."[85] Although we have less information about these newer compounds, the information we do have suggests that they are not safe and some may even be more harmful.[86] While some newer fluorinated alternatives seem to be less bioaccumulative, they are still as environmentally persistent as long-chain substances or have persistent degradation products.[87] For example, "[a] recent hazard assessment based on the internal dose of Gen X[, a short-chain PFAS,] suggests that it has a higher toxicity than PFOA after accounting for toxicokinetic differences."[88] Because some of the newer PFAS are less effective, larger quantities may be needed to provide the same performance.[89] In addition, these newer PFAS compounds are more mobile in the environment. In conclusion, scientific experts agree that these chemicals should be managed as a class due to extreme environmental persistence, toxicity of the PFAS that have been studied, and the potential toxicity and health risks posed by the entire class due to similarities in chemical structure.[90]

3. PFAS have been found in drinking water, groundwater, and surface waters throughout Vermont.

Not only can PFAS be toxic in very small amounts, PFAS can also be highly mobile in groundwater and surface water. PFAS, including compounds that are not currently regulated, have been found in waters throughout Vermont. Notably, the Advance Notice did not include a discussion of this data.

a. Drinking Water

The results of recent public water supply testing required by Act 21 is alarming. PFAS were detected in more than 100 water supplies in 2019-2020.[91] Concentrations of the 18 PFAS tested

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[83] Sharon Lerner, *Scientists Pin Blame for Some Coronavirus Deaths on Air Pollution, PFAS, and Other Chemicals*, June 26, 2020, https://theintercept.com/2020/06/26/coronavirus-toxic-chemicals-pfas-bpa/.
[84] *See, e.g.*, NRDC, Technical Comments at 4-6; Kwiatkowski et al., *supra* note 16; Arlene Blum et al., *The Madrid Statement on Poly- and Perfluoroalkyl Substances (PFASs)*, 123 ENVTL. HEALTH PERSPECTIVES A 107 (2015), https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1509934.
[85] Blum et al., *supra* note 84.
[86] Kwiatkowski et al., *supra* note 16; Elsie Sunderland et al., *A review of the pathways of human exposure to poly- and perfluoroalkyl substances (PFASs) and present understanding of health effects*, 29 J. OF EXPOSURE SCI. & ENVTL. EPIDEMIOLOGY 131 – 147 (2018), https://www.nature.com/articles/s41370-018-0094-1.
[87] Blum et al., *supra* note 84.
[88] Sunderland et al., *supra* note 86.
[89] *Id.*
[90] *See, e.g.*, NRDC, Technical Comments at 4-6.
[91] Agency of Natural Resources, Dept. of Env. Conservation, Per and Polyfluoroalkyl Substances (PFAS), PFAS Data, available at https://anrweb.vt.gov/DEC/DWGWP/license.aspx?Report=PFASData. The sampling data was downloaded on September 1, 2020.

ranged from 2 ppt to 335 ppt.[92] In addition to the 5 PFAS currently regulated by an MCL, the following PFAS were detected: PFBS, PFHxA, HFPO-DA or GenX, NEtFOSAA, and NMeFOSA.[93]

These results likely underestimate PFAS concentrations in Vermont's water supplies because the scope of testing was just 18 compounds out of more than 9,000 PFAS.[94] Other PFAS have been detected in Vermont including PFBA, PFPeA, PFDA, PFUnA, PFDoA, PFTA, PFTrDA, PFPeS, PFHpS, PFDS, PFDoS, PFOSA, 4:2 FTS, 6:2 FTS, and 8:2 FTS.[95] Further, the testing that has been conducted with respect to media besides drinking water also captures a very limited number of compounds—approximately 24—compared to the number of compounds in the class.[96] Notably, at least one study has demonstrated that while concentrations of older, short-chain PFAS like PFOA and PFOS may be decreasing in some water supplies because these compounds are no longer manufactured in the U.S., concentrations of newer PFAS are increasing significantly.[97]

In addition to the sampling required by Act 21, in February 2016, the Agency discovered widespread PFAS contamination in over 400 drinking water wells in Bennington County at levels as high as 4,600 ppt.[98] DEC has conducted sampling in other locations near known sources of PFAS, and found the following:

- In the Town of Pownal, near a former wire coating facility and a tannery superfund site, a contaminated public water well supplying water to 400 people measured above the current PFAS MCL.[99] DEC also identified 30 private drinking water wells in Pownal that were similarly contaminated with elevated levels of PFAS.[100] One well contained PFAS levels at more than five times the PFAS MCL.[101]
- At the Southern Vermont Airport in Clarendon, three private residential water supply wells and a public drinking water system with two bedrock wells serving the Rutland Business Park were contaminated with PFAS above the MCL.[102]
- A drinking water supply near the Shaftsbury Landfill was contaminated with PFAS above the MCL.[103]

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[92] *Id.*
[93] *Id.*
[94] *Id.*
[95] NRDC, Technical Comments at 3, Table 1.
[96] *Id.*
[97] Xindi Hu et al., *Tap Water Contributions to Plasma Concentrations of Poly- and Perfluoroalkyl Substances (PFAS) in a Nationwide Prospective Cohort of U.S. Women*, ENVTL. HEALTH PERSPECTIVES, 127(6) (2019), https://pdfs.semanticscholar.org/bc6f/4cbf6645144f5026923b7596ad3348ab5d28.pdf?_ga=2.4146612.522471167.1605404285-478512305.1605404285.
[98] Vt. Dep't of Envtl. Conservation, *Perfluoroalkyl Substances (PFAS) Contamination Status Report*, 2 (July 2018), https://dec.vermont.gov/sites/dec/files/documents/PFAS%20Sampling%20Report%207.10.18%20FINAL.pdf [hereinafter PFAS Contamination Status Report].
[99] *Id.* at 3.
[100] *Id.*
[101] *Id.*
[102] *Id.* at 6.
[103] *Id.* at 8.

PFAS have also been found at elevated levels in drinking water at Vermont schools. For example, sampling conducted by DEC at the Grafton Elementary School revealed PFAS concentrations at 22 ppt.[104] In addition, PFAS was also detected at Eden Central School at 5.3 ppt.[105]

Earlier sampling conducted by EPA at the former Kocher Drive Dump in Bennington as part of a national PFAS testing effort detected PFAS above the groundwater enforcement standard in four overburden monitoring wells, as well as one offsite private supply well, and an offsite geothermal well.[106]

b. Groundwater

DEC's PFAS investigation also found levels of contamination above the groundwater enforcement standard for PFAS in groundwater at or near the following locations:

- wire coating facility in Colchester (Champlain Cable facility);[107]
- former wire coating operation in Shelburne;[108]
- battery manufacturing facility in St. Albans;[109] and
- groundwater recovery trench at the Air National Guard site in South Burlington, where Aqueous Film-Forming Foam Concentrations (AFFF) fire-fighting foam containing PFAS was used.[110]

Elevated levels of PFAS were also found in groundwater at several landfill sites in Bennington and Windham Counties. Specifically, the Burgess Brothers C&D landfill, Putney Paper sludge landfill, Shaftsury MSW landfill, and Halifax landfill reported groundwater concentrations above the PFAS enforcement standard.[111]

c. Sludges and Land Application Sites

PFAS have also been detected in the sludges of wastewater treatment facilities (WWTF) and in the soils and groundwater at sites where sludges are applied to land. Sludge sample results from the Bennington WWTF showed PFOA and PFOS at an average concentration of 7,000 and 8,000 ppt, respectively. [112] The sludge samples were also analyzed using a synthetic precipitation leaching procedure (SPLP) to detect whether PFAS would leach into the groundwater from any sludge that was land-applied. The results of this testing showed PFOA at 68 ppt.[113]

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[104] Jim Therrien, *School water tests provide encouraging results*, VT DIGGER, Aug. 17, 2018, https://vtdigger.org/2018/08/17/school-water-tests-provide-encouraging-results/.
[105] *Id.*
[106] PFAS Contamination Status Report at 8.
[107] *Id.* at 4.
[108] *Id.*
[109] *Id.* at 5.
[110] *Id.* at 6.
[111] *Id.* at 8.
[112] *Id.* at 11.
[113] *Id.*

In addition, PFOA sample results from sludges at six WWTF that receive leachate from Vermont landfills reached levels of 13,000 ppt.[114] PFOS concentrations ranged from 5,600 to 17,700 ppt.[115] DEC also analyzed the sludge samples from the South Burlington-AP and Burlington-Main WWTF using SPLP.[116] The results detected PFOA at concentrations ranging from 4.99 and 4.25 ppt, respectively, and PFOS at 22.7 and 3.34 ppt, respectively.[117]

Finally, PFAS was also detected in some samples of septage from residential septic tanks in Bennington in May and June of 2016.[118] Typical septic systems are not equipped to filter PFAS before water seeps through, providing another pathway for PFAS to reach groundwater sources.[119]

In November 2019, DEC requested that operators of certified land application sites throughout Vermont sample for PFAS in soils and groundwater at the sites where residuals were spread.[120] The results show that PFAS are ubiquitous in the groundwater at these land application sites,

[114] *Id.* at 13.
[115] *Id.*
[116] *Id.*
[117] *Id.*
[118] *Id.* at 12.
[119] *See* Schaider et al., *Septic systems as sources of organic wastewater compounds in domestic drinking water wells in a shallow sand and gravel aquifer*, 547 SCIENCE OF THE TOTAL ENVIRONMENT 470-481 (March 2016) ("Incomplete degradation or sorption during treatment in septic tanks and leach fields, as well as leaks of poorly treated sewage from aging and failing systems, allow some [organic wastewater compounds ("OWCs"), including PFAS] to percolate through vadose zone soils and enter groundwater. Some OWCs can persist during subsurface transport and end up in groundwater, surface water and drinking water."), https://www.sciencedirect.com/science/article/pii/S0048969715312353?via%3Dihub.
[120] *See, e.g.*, *PFAS Sampling, Town of Bradford Biosolids Land Application Site: Sweet Field* ("Bradford Report"), Waite Heindel Environmental Management 1 (Feb. 19, 2020), Waite Heindel Environmental Management (confirmatory sampling conducted in May and August 2020).

and in some instances, are present at alarmingly high levels.[121] The samples also show presence of PFAS in soils.[122]

Seventeen out of 90—or nearly 20% of—downgradient groundwater monitoring wells had PFAS concentrations above the groundwater enforcement standard for five regulated PFAS.[123] Alarmingly, nearly every land application site where groundwater samples were taken indicated presence of PFAS in the groundwater.[124]

The amounts of the five regulated PFAS found in the monitoring wells at the land application sites with exceedances were at significantly higher concentrations than the 20 ppt enforcement

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[121] *Bradford Report* at p. 7-22; *Investigation of PFAs at Biosolids and Septage Land Application Sites, Village of Essex Junction* ("Essex Junction Report"), Weston & Sampson 10-13 (Feb. 28, 2020) (confirmatory sampling conducted in May 2020); *Investigation of PFAS at Biosolids and Septage Land Application Sites, Solid Waste Certification Permittee ID 253 NorthStar Vermont Yankee Decommissioning Project, Vernon, Vermont* ("Vernon Report"), Haley & Aldrich, Inc. 2-3 (Feb. 12, 2020).; *VT DEC PFAS Analysis; VT SGS Job Number: FA67958* ("Williston Report"), SGS North America Inc. 10-37 (Sept. 26, 2019); *VT SGS Job Number: FA68018* ("St. Johnsbury Report 1"), SGS North America Inc. 5-25 (Sept. 26, 2019); *VT DEC PFAS Analysis; VT SGS Job Number: FA68016* ("St. Johnsbury Report 2"), SGS North America Inc. 12-49 (Sept. 23, 2019); *VT DEC PFAS Analysis; VT 280EM00427 SGS Job Number: FA67675* ("Barton GW Report"), 7-23 (Sept. 24, 2019) (confirmatory sampling conducted in Dec. 2019); *VT DEC PFAS Analysis; VT SGS Job Number: FA67778* ("Barton Soil Report"), SGS North America Inc. 9-33 (Sept. 24, 2019); *VT DEC PFAS Analysis; VT SGS Job Number: FA67779* ("Barton GW and Soils Report"), SGS North America Inc. 10-48 (Sept. 24, 2019); *VT DEC PFAS Analysis; VT 280EM00427 SGS Job Number: FA67758* ("Swanton GW Report"), SGS North America Inc. 6-24 (Sept. 24, 2019); *VT DEC PFAS Analysis; VT SGS Job Number: FA67992* ("Windsor GW Report") SGS North America Inc. 6-20 (Sept. 24, 2019); *VT DEC PFAS Analysis; VT SGS Job Number: FA67996*, ("Swanton Report"), SGS North America Inc., 6-22 (Sept. 26, 2019); *PFAS Soil & Water Sampling Report – Fall 2019 Town of Hartford – Bio-Solids Application Fields* ("Hartford Report"), Stantec Consulting Services Inc. 5-6 (Jan. 22 2020); *Londonderry SAF/PFAS GW/Soil* ("Londonderry Report"), Endyne Inc. 2-7 (Jan. 24, 2020); *Stowe Letter from Weston & Sampson* ("Stowe Report"), Weston & Sampson Engineers, Inc. 1 (Feb. 14, 2020); *Site Investigation Results Pertaining to PFAS in Soils, Groundwater, and Drinking Water at Garvey Farm, 8186 VT. Rte. 116, Hinesburg, VT* ("Hinesburg Report"), Waite & Heindel 1-3 (Dec. 17, 2019); *Investigation of PFAS at Biosolids and Septage Land Application Sites Summary Report, Sweet Farm – Fletcher Road Fairfax, Vermont* ("Fairfax Report"), ATC Group Services, LLC 27-44 (Feb. 6, 2020); *PFAS Soil & Water Sampling Report – Fall 2019 Town of Woodstock – Bio-Solids Application Fields*, ("Woodstock Report") Stantec Consulting Services Inc. 5-6 (Jan. 8, 2020); (confirmed, date not available); *PFAS Report Submittal for Waterbury WWTP Land Application Site, Permit No.171*, ("Waterbury Report"), Waterbury Wastewater Treatment Facility 1-2 (Jan. 28, 2020); *Letter Report for St. Johnsbury Biosolids and Septage Land Application Sites PFAS Evaluation* ("Lyndonville/Danville/Barton Report"), Stone Environmental, Inc. 5 (Feb. 21, 2020) (confirmation sampling conducted May 2020); *Investigation of PFAS at Biosolids and Septage Land Application Sites Summary Report Townsend Sites Bethel, Vermont* ("Bethel Report"), ATC Group Services, LLC 2-3 (Feb 28, 2020); and *Investigation of PFAS at Biosolids and Septage Land Application Sites Summary Report Silloway Site East Randolph, Vermont* ("East Randolph Report"), ATC Group Services, LLC 3-4 (Feb. 27, 2020).

[122] *Bradford Report* at 7-22; *Essex Junction Report* at p.10-13; *Vernon Report* at p. 2-3; *Williston Report* at p. 10-37; *St. Johnsbury Report 2* at p. 12-49; *Barton Soil Report* at p. 9-33; *Barton GW and Soils Report* at p.10-48; *Swanton Report* at p. 6-22; *Hartford Report* at p. 5-6; *Londonderry Report* at p. 2-7; *Stowe Report* at p. 1; *Hinesburg Report* at p. 1-3; *Fairfax Report* at p. 27-44; *Woodstock Report* at p. 5-6; *Waterbury Report* at p.1-2; *Bethel Report* at p. 2-3 and *East Randolph Report* at p. 3-4.

[123] *Bradford Report* at 7-22; *Essex Junction Report* at 10-13; *Barton GW Report* at 7-23; *Woodstock Report* at 5-6; and *Lyndonville/Danville/Barton Report* at 5.

[124] *Bradford Report* at 7-22; *Essex Junction Report* at 10-13; *Vernon Report* at 2-3; *St. Johnsbury Report 1* at 5-25; *Barton GW Report* at 7-23; *Barton GW and Soils Report* at 10-48; *Fairfax Report* at 27-44; *Woodstock Report* at 5-6; *Lyndonville/Danville/Barton Report* at p. 5; *Bethel Report* at 2-3 and *East Randolph Report* at p. 3-4.

standard. For example, at a land application site in Lyndonville/Danville, the combined levels of the five regulated PFAS at three of the tested wells measured at 77 ppt, 66 ppt, and 233 ppt.[125] Two groundwater samples at a land application site in Woodstock significantly exceeded the regulatory standard for the five regulated PFAS at two wells (113 ppt and 57 ppt).[126] Multiple wells at the Essex Junction Land Application site (36 ppt, 23 ppt, and 24 ppt)[127] and the Richmond Land Application site (228 ppt, 110 ppt, 57 ppt, and 48 ppt)[128] exceeded the groundwater enforcement standard.

Unregulated PFAS were also identified in the groundwater at land application sites. For example, the combined level of just two unregulated PFAS at a groundwater monitoring well at a land application site in Essex Junction was a staggering 330 ppt.[129] At that same site, two well samples contained 391 ppt and 239 ppt of five unregulated PFAS combined, with 17 more detections of combinations of unregulated PFAS in the other 21 groundwater samples drawn from the site.[130] At a site in St. Johnsbury, a variety of unregulated PFAS at three monitoring sites also totaled significant amounts of unregulated PFAS compounds (289 ppt of five chemicals; 110 ppt of three chemicals; and 41 ppt of three chemicals.[131]

d. Surface Water

PFAS are also present at elevated levels in surface waters throughout Vermont due to several exposure pathways. First, PFAS can end up in surface waters based on proximity to PFAS-emitting facilities, like the former ChemFab site in Bennington. In its investigation, DEC found PFAS in surface waters, sediment, and fish tissue samples collected in Bennington, most likely due to contamination from airborne particles of PFAS from the former ChemFab plant.[132] Likewise, sludge sampled from Bennington's WWTF (which likely received PFAS through contaminated discharges associated with the former ChemFab facility), showed presence of PFAS.[133]

Second, PFAS—regulated and unregulated compounds—are present in discharges from WWTF effluent.[134] In addition to other industrial and residential wastewater, PFAS are present in landfill leachate that is discharged to surface waters via a WWTF.[135] DEC found elevated levels of PFAS in the leachate of every landfill in Vermont that has an active leachate collection

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[125] *Lyndonville/Danville/Barton Report* at 5.
[126] *PFAS Soil & Water Sampling Report, Town of Woodstock Bio-Solids Land Application Fields*, Stantec 5-6 (Jan. 8, 2020).
[127] *Essex Junction Report* at 10-13.
[128] *Id.*
[129] *Investigation of PFAs at Biosolids and Septage Land Application Sites, Village of Essex Junction*, Weston & Sampson 10-13, (Feb. 28, 2020).
[130] *Id.*
[131] *Report for St. Johnsbury Biosolids and Septage Land Application Sites PFAS Evaluation*, Stone Environmental 4-7 (Feb. 21, 2020).
[132] PFAS Contamination Status Report at 11.
[133] *Id.*
[134] Report from Steven Shaw and Steven LaRosa, Weston & Sampson, to John Schmeltzer, Vt. Dep't of Envtl. Cons. Re Wastewater Treatment Facility and Landfill Leachate PFAS Sampling (May 3, 2018).
[135] *Id.*

system.[136] We are not aware of any WWTF in Vermont that has controls in place to remove PFAS before effluent is discharged to surface waters.

B. The PFAS MCL does not protect public health.

The current PFAS MCL is not sufficient to protect Vermont communities. As a preliminary matter, the Agency has already set a MCLG of zero for PFOA, PFOS, PFHxS, PFHpA, and PFNA.[137] An MCLG is "the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety."[138] Thus, the Agency has already determined that there is no safe level of these five PFAS and has not provided a technical justification for setting the MCL at 20 ppt for PFOA, PFOS, PFHxS, PFHpA, and PFNA combined.[139] As discussed below, these compounds can be reliably reported at levels as low as 2 ppt using standard laboratory methods[140] and treatment technologies are available to remove these PFAS to below detection limits.[141]

The current combined MCL is not reflective of the recently adopted MCLG of zero, and the MCL is based on an outdated risk assessment that does not account for the most sensitive endpoints, including cancer, development and immune harm, or health impacts to vulnerable populations such as fetuses, infants, and children. In addition, other states have adopted more protective individual MCLs and the Massachusetts combined standard includes more PFAS. Finally, the current PFAS MCL addresses just five out of more than 9,000 PFAS.

1. The Reference Dose selected by the Department of Health does not protect for sensitive endpoints and vulnerable populations.

The PFAS MCL is based on assumptions that do not protect public health. Specifically, several studies indicate that the Chronic Oral Reference Dose (Reference Dose) selected by the Department of Health for PFOA, PFOS, PFHxS, PFHpA, and PFNA is not protective for the most sensitive endpoints and our most vulnerable populations—fetuses, infants, and children.

Decisions made when developing a health benchmark, such as evaluation of data gaps, the selection of uncertainty factors, and choice of exposure parameters to use, should address the most sensitive endpoints and be protective of the most vulnerable populations, particularly developing fetuses, infants, and children. Fetuses and infants have greater exposure to PFAS than adults, and are also more sensitive to the effects of these contaminants.[142] Almost all fetuses and infants will have some degree of exposure, including exposure as fetuses during pregnancy

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[136] PFAS Contamination Status Report at 11.
[137] Water Supply Rule, 12-030-003 VT. CODE R. § 6.12, Table 6-1.
[138] 40 C.F.R. § 141.2.
[139] Vt. Dep't of Envtl. Cons., Responsiveness Summary for the Proposed PFAS MCL (Jan. 31, 2020).
[140] NRDC, Technical Comments at 15.
[141] Reade et al., *supra* note 80 at 6, 53-58.
[142] Agency for Toxic Substances and Disease Registry (ATSDR), 2018. Toxicological Profile for Perfluoroalkyls: Draft for Public Comment (June 2018), https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf; Reade et al., *supra* note 80.

through placental transfer.[143] For infants, exposure may be further elevated due to ingestion of contaminated breastmilk (a result of the mothers' ingestion of contaminated water and other sources) or infant formula prepared with contaminated drinking water.[144]

Levels of PFOA and other PFAS in breastmilk are much higher than what is typically found in drinking water, as PFOA and other PFAS bioaccumulate in the body and are then transferred into the breastmilk.[145] Moreover, since infants consume approximately five times more water per body weight than adults,[146] their exposure is likely higher than adults regardless of whether they are breastfeed or are fed infant formula prepared with PFAS-contaminated drinking water. Infant blood serum levels of PFAS are often the highest of any age group in studies that compare people in multiple stages of life.[147]

Compounding the issue of increased exposure, fetuses, infants, and children are also more vulnerable to exposure-related health effects than adults. The young may be more sensitive to the effects of PFAS due to their immature, developing biological systems (such as the immune system), and rapid body growth during development.[148] For example, exposure to PFAS before birth and/or in early childhood may result in decreased birthweight, decreased immune responses, and hormonal effects later in life.[149] In fact, the National Academy of Sciences (NAS) has recommended the use of an additional uncertainty factor of 10 to ensure protection of fetuses, infants and children who often are not sufficiently protected from toxic chemicals such as pesticides by the traditional intraspecies (human variability) uncertainty factor.[150] Considering the many health effects linked to PFAS that affect this vulnerable population and the substantial data gaps on exposure and toxicity of these compounds in complex mixtures, the Department of Health should rely on the most sensitive endpoints, adopt the most conservative assumptions,

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[143] Cyntia B. Manzano-Salgado et al., *Transfer of perfluoroalkyl substances from mother to fetus in a Spanish birth cohort*, ENVTL. RES. 142:471-478 (Oct. 2015), available at https://doi.org/10.1016/j.envres.2015.07.020; Jiaying Liu et al., *Comparison on gestation and lactation exposure of perfluorinated compounds for newborns*, ENV'T INT'L 37(7):1206-1212 (2011), available at https://doi.org/10.1016/j.envint.2011.05.001.

[144] Gyllenhammar K, et al., 2018. Perfluoroalkyl Acids (PFAAs) in serum from 2-4-month-old infants: Influence of maternal serum concentration, gestational age, breast-feeding, and contaminated drinking water. *Environ Sci Technol* 52:7101-7110, available at https://pubs.acs.org/doi/10.1021/acs.est.8b00770; Llorca M, et al., 2010. Infant exposure of perfluorinated compounds: levels in breast milk and commercial baby food. *Environ Int* 36(6): 584-592, available at https://doi.org/10.1016/j.envint.2010.04.016.

[145] Mondal D, et al., 2014. Breastfeeding: a potential excretion route for mothers and implications for infant exposure to perfluoroalkyl acids. *Environ Health Perspect* 122(2):187-192, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3915259/pdf/ehp.1306613.pdf; Kim SK, et al., 2011. Distribution of perfluorochemicals between sera and milk from the same mothers and implications for prenatal and postnatal exposures. *Environ Pollut* 159(1):169-174, available at https://doi.org/10.1016/j.envpol.2010.09.008.

[146] U.S. Envt'l Prot. Agency (EPA), 2011a. Exposure Factors Handbook, 2011 Edition (Final Report), https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252.

[147] Goeden et al., *supra* note 81.

[148] Landrigan P and Goldman L, 2011. Children's Vulnerability to Toxic Chemicals: A Challenge and Opportunity to Strengthen Health and Environmental Policy. *Health Affairs* 30(5):842-850, https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2011.0151.

[149] Kristen M. Rappazzo et al., 2017. Exposure to Perfluorinated Alkyl Substances and Health Outcomes in Children: A Systematic Review of the Epidemiologic Literature, *Int J Envrion Res Public Health* 14(7): 691, https://www.mdpi.com/1660-4601/14/7/691.

[150] National Academy of Sciences (NAS), 1993. Pesticides in the Diets of Infants and Children, National Research Council, https://www.nap.edu/catalog/2126/pesticides-in-the-diets-of-infants-and-children. Congress adopted this requirement in the Food Quality Protection Act for pesticides in foods. 21 U.S.C. § 346a(b)(2)(C)(ii)(II).

and use the additional uncertainty factor recommended by the NAS when deriving health-protective benchmarks for PFAS.

The Department of Health selected 2 x 10^{-5} mg/kg BW-day for these five PFAS, which is "based on a non-cancer endpoint and derived using the oral reference dose . . . provided in US EPA's 2016 Health Effects Support Documents for PFOA and PFOS."[151] However, the EPA's reference dose for PFOA and PFOS is not protective of the most sensitive endpoints currently linked to PFAS exposure and does not include the additional uncertainty factor recommended by the NAS.[152]

Studies suggest a more protective reference dose is appropriate to account for more sensitive endpoints such as increased cancer risk, impacts to mammary gland development, and immune system dysfunction.[153] For example, in August of 2019, California's Office of Environmental Health Hazard Assessment (OEHHA) developed reference levels for PFOA and PFOS in drinking water for both cancer and non-cancer effects.[154] The cancer effect reference level is based on the concentration of the chemical in drinking water that would not pose more than a one in one million cancer risk over a lifetime.[155] For PFOA, OEHHA derived a reference level of *0.1 ppt* based on pancreatic and liver tumors found in male rats in a new NTP study.[156] For PFOS, OEHHA derived a reference level of *0.4 ppt* based on liver tumors in male rats and the structural and biological similarity of PFOS to PFOA.[157]

New Jersey has calculated a reference dose based on mammary gland development, which if used to calculate a health advisory or MCL for PFOA, would be *less than 1 ppt*.[158] In addition, one research team documented a strong dose-response between a child's exposure to PFAS and reduced antibody concentrations against tetanus and diphtheria toxoids in serum two years later.[159] Based on the results of the study, the researchers concluded that even exposure to PFOA

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[151] Memo from Mark Levine, Dep't of Health to Emily Boedecker, Dep't of Envtl. Cons. Re Drinking Water Health Advisory for Five PFAS 3 (July 10, 2018), https://www.healthvermont.gov/sites/default/files/documents/pdf/ENV_DW_PFAS_HealthAdvisory.pdf [hereinafter Levine Memo].

[152] National Toxicology Program. TR-598: Technical Report Pathology Tables and Curves – PFOA. 2018. Assessed at: https://tools.niehs.nih.gov/cebs3/views/?action=main.dataReview&bin_id=13658; Reade et al., *supra* note 80. The use of infant drinking water exposure parameters is not sufficient to protect this population because the Department of Health relies on an RfD that is not protective.

[153] *Id.*

[154] Office of Environmental Health Hazard Assessment, *Notification Level Recommendations: Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water* (Aug. 2019), https://oehha.ca.gov/media/downloads/water/chemicals/nl/final-pfoa-pfosnl082119.pdf; National Toxicology Program. TR-598: Technical Report Pathology Tables and Curves - PFOA. 2018. Assessed at: https://tools.niehs.nih.gov/cebs3/views/?action=main.dataReview&bin_id=13658.

[155] *Id.*

[156] *Id.*

[157] Office of Environmental Health Hazard Assessment, *Notification Level Recommendations: Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water* (Aug. 2019), available at https://oehha.ca.gov/media/downloads/water/chemicals/nl/final-pfoa-pfosnl082119.pdf.

[158] Reade et al. at 40, *supra* note 80.

[159] Phillippe Grandjean and Esben Budtz-Jorgensen, *Immunotoxicity of perfluorinated alkylates: calculation of benchmark doses based on serum concentrations in children*, 12 ENVTL. HEALTH 1 (2013) (documenting adverse

and PFOS concentrations as low as *approximately 1 ppt* may have adverse health effects for children.[160]

If these studies were taken into account and an additional uncertainty factor applied to protect the most vulnerable populations, the Reference Dose for these five PFAS would be much more protective than the Reference Dose selected by the Department of Health. In recognition of the significant toxicity of PFAS and the vulnerability of sensitive populations like fetuses, infants, and children to PFAS exposure, the Department of Health should rely upon only the most conservative assumptions and incorporate an additional uncertainty factor to protect children in the derivation of a health advisory for PFAS.

2. Several states have adopted more protective MCLs for individual compounds.

Several states have adopted MCLs for some PFAS that are more protective than the numeric component of Vermont's MCL.[161]

Chemical	Vermont (ppt)	Massachusetts (ppt)	New Jersey (ppt)	New Hampshire (ppt)	Michigan (ppt)	New York (ppt)
PFOA	20 (combined)	20 (combined)	14	12	8	10
PFOS			13	15	16	10
PFNA			13	11	6	
PFHxS				18	51	
PFHpA						
PFDA						

Although the combined standard may offer greater protection in some instances, the numeric component of Vermont's MCL—20 ppt—will result in individuals being exposed to unsafe levels of PFAS in other instances.

3. The current MCL does not address all PFAS.

The current PFAS MCL is not comprehensive and does not address all PFAS that are in the environment. There are over 9,000 different PFAS compounds.[162] Recent testing in Vermont shows that PFAS beyond the five regulated are present in drinking water, and the environment including: PFBA, PFPeA, PFHxA, PFDA, PFUnA, PFDoA, PFTA, PFTrDA, PFBS, PFPeS, PFHpS, PFNS, PFDS, PFDoS, PFOSA, HFPO-DA or GenX, NEtFOSAA, NMeFOSSA; 4:2

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health effects where PFOA and PFOS concentrations are approximately 1 ppt), https://ehjournal.biomedcentral.com/track/pdf/10.1186/1476-069X-12-35.

[160] *Id.*

[161] 310 MASS. CODE REGS. 22.00; N.H. Rev. Stat. § 485:16-e; MICH. ADMIN. CODE R 325.10401a, Table 1; N.Y. COMP. CODES R. & REGS. tit. 10, § 5-1.52, Table 3; NJ Dep't of Envtl. Prot., Drinking Water Facts: Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water (Sep. 2020), https://www.state.nj.us/health/ceohs/documents/pfas_drinking%20water.pdf.

[162] U.S. Envtl. Agency, PFAS Master List of PFAS Substances, available at https://comptox.epa.gov/dashboard/chemical_lists/PFASMASTER (last visited on November 11, 2020).

FTS, 6:2 FTS, and 8:2 FTS.[163] As noted previously, the testing that has been done to date likely significantly underestimates PFAS concentrations in drinking water.

As discussed below and in greater detail in the Technical Comments, there is a strong scientific basis for regulating PFAS as a class.[164] The significant toxicity and the unique characteristics of the PFAS class of chemicals, along with the potential combined and synergistic effects from exposure to multiple PFAS chemicals, demand a class, subclass, or grouping approach to regulation. Vermont communities should not be forced to continue to bear the health risks associated with these unsafe chemicals while regulators take decades to chase down these chemicals one by one. For all these reasons, the combined 20 ppt MCL for PFOA, PFOS, PFHxS, PFHpA, and PFNA does not fully protect public health.

III. The Agency must promulgate new drinking water rules that protect Vermont communities from the PFAS class.

PFAS beyond the five currently regulated are present in public water supplies and environmental media, and the testing to date likely underestimates PFAS compounds.[165] The Agency must establish drinking water rules that prevent exposure to the PFAS class in order to protect public health. We do not agree with the Agency's conclusion that there is insufficient scientific and technical information to regulate PFAS beyond the five compounds currently regulated.[166] As the Technical Comments outline in detail, there is a strong and sufficient scientific basis and available technology for managing PFAS as a class, in subclasses, or groupings beyond the five currently regulated based on the persistence of PFAS and other characteristics.[167]

To protect Vermont communities, the Agency should promulgate new rules for the PFAS class and establish a (1) maximum contaminant level goal (MCLG) of zero for the PFAS class; (2) combined MCL below 20 ppt at the lowest, most health protective level technically achievable[168] for the maximum number of quantifiable PFAS; and (3) treatment technique standard for the PFAS class based on TOF measured by CIC as soon as an analytical method is validated by an international, federal, or state agency.[169] With respect to the combined MCL, the standard should include all PFAS that can be quantified with a user defined 537-modified method following the DoD criteria.[170] In addition, the Agency should require a pre-oxidation step in which perfluoroalkyl acids (PFAA) precursors are oxidized to terminal PFAAs before measuring individual PFAS to capture a more accurate accounting of PFAS in the public water supply.[171]

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[163] NRDC, Technical Comments at 3, Table 1.
[164] *Id.* at 6, 10.
[165] *See* discussion in Section II.A.3.
[166] *See* NRDC, Technical Comments.
[167] *Id.*
[168] EPA Method 537.1, EPA Method 533, and user defined 537-modified methods using the DoD criteria are can reliably report PFAS between 2 – 5 ppt. NRDC, Technical Comments at 13.
[169] *Id.* at 11-16.
[170] *Id.* at 13. Commercial labs are able to quantify approximately 40 PFAS using a user-defined 537-modified method following the DoD criteria at levels between 2 – 5 ppt. *Id.* At a minimum, this list should include all PFAS that can be quantified using EPA Methods 537.1 and 533. *Id.*
[171] NRDC, Technical Comments at 12.

If the Agency refuses to establish standards for the PFAS class despite a clear scientific basis for regulation, the State should establish new drinking water rules for all subclasses of PFAS.[172] At a bare minimum, the Agency should establish a combined MCL below 20 ppt at the lowest, most health protective level technically achievable for the maximum number of quantifiable PFAS pursuant to the additive approach currently utilized.[173] Under any of these approaches, the Agency should review these rules at least once every two years and revise drinking water standards for PFAS to ensure standards reflect the latest scientific and technical information.[174]

A. The Agency should establish an MCLG of zero for the PFAS class; a combined MCL at the lowest, most health protective level technically achievable for the maximum number of quantifiable PFAS; and a treatment technique drinking water standard for the PFAS class.

As discussed in detail in the Technical Comments, there is a strong scientific basis for regulating all PFAS due to their persistence in the environment.[175] Thus, the Agency should take a three-part approach to prevent exposure to the PFAS class in drinking water. First, the MCLG for the PFAS class should be zero.[176] Second, the Agency should adopt a combined MCL below 20 ppt at the lowest, most health protective level technically achievable[177] for the maximum number of quantifiable PFAS.[178] The standard should include all PFAS that can be quantified with a user defined 537-modified method following the DoD criteria.[179] In addition, the Agency should require a pre-oxidation step in which PFAA precursors are oxidized to terminal PFAAs before measuring individual PFAS to capture a more accurate accounting of PFAS in the public water supply.[180] Finally, the Agency should establish a treatment technique standard for the PFAS class based on TOF measured by CIC as soon as this analytical method is validated by an international, federal, or state agency.[181] Once a treatment technique is set, ANR should review the standard every two years to ensure standards reflect the latest scientific and technical information.[182]

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[172] *Id.* at 14-15.

[173] NRDC, Technical Comments at 15-19. Consistent with our recommendations under a class approach, the Agency should establish a list of PFAS based on user defined 537-modified methods using DoD criteria and require a pre-oxidation step before measuring individual PFAS. *Id.*

[174] Massachusetts recently finalized an MCL for PFAS that requires periodic review and revision to ensure that the standard keeps pace with scientific and technical advancements. 310 MASS. CODE REGS. 22.07G(3)(e) ("Not later than December 31, 2023, and once every three years thereafter, the Department shall perform a review of relevant developments in the science, assessment and regulation of PFAS in drinking water for the purpose of evaluating whether to amend 310 CMR 22.07G(3) in light of any advancements in analytical or treatment technology, toxicology and/or any other relevant information. Information about this review shall be made available to the public.")

[175] NRDC, Technical Comments.

[176] *See* discussion *infra* Section III.A.1.

[177] EPA Method 537.1, EPA Method 533, and user defined 537-modified methods using the DoD criteria are can reliably report PFAS between 2 – 5 ppt. NRDC, Technical Comments at 13.

[178] *Id.*

[179] *Id.* Commercial labs are able to quantify approximately 40 PFAS using a user-defined 537-modified method following the DoD criteria at levels between 2 – 5 ppt. *Id.* At a minimum, this list should include all PFAS that can be quantified using EPA Methods 537.1 and 533. *Id.*

[180] *Id.* at 13.

[181] *Id.* at 11-16.

[182] *Id.* at 12.

1. The MCLG for the PFAS class should be zero.

The MCLG for the PFAS class of chemicals should be zero. Vermont has already established an MCLG of zero for PFOA, PFOS, PFHxS, PFHpA, and PFNA.[183] PFAS share similar structures and properties, including extreme persistence and high mobility in the environment.[184] Many PFAS are also associated with similar health endpoints, some at extremely low levels of exposure.[185] There is additional potential for additive or synergistic toxicity among PFAS.[186] Given the similarity among chemicals of the PFAS class and the known risk of the well-studied PFAS, there is reason to believe that other members of the PFAS class pose similar risk.[187] Therefore, health-protective standards for PFAS should be based on the known adverse effects of the well-studied members of the PFAS class.

First, there is sufficient evidence to classify PFOA as a known or probable carcinogen. Both the International Agency for Research on Cancer and EPA's findings on PFOA's carcinogenic potential are based heavily on the C8 study, whose Science Panel determined that PFOA is a probable carcinogen.[188] There is also significant additional animal and human evidence for an association between PFOA exposure and cancer, particularly kidney and testicular cancer, and more recently for pancreatic cancer.[189] OEHHA recently derived a reference level of 0.1 ppt for PFOA based on pancreatic and liver tumors found in male rats exposed to very low levels of PFOA in a NTP study.[190] Although the evidence of carcinogenic potential for other PFAS is not as well established as PFOA, given the similarities in structure and toxicity to PFOA, their potential for carcinogenicity cannot be ruled out.[191]

In addition to being a carcinogen, PFOA causes adverse non-cancer health effects at exceedingly low doses. A MCLG based on altered mammary gland development would be well below 1 ppt for PFOA, for example.[192]

Other shared health effects amongst PFAS occur at extremely low levels, such as immunotoxicity, developmental harm, and liver damage.[193] For example, evidence indicates that

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[183] Water Supply Rule, 12-030-003 VT. CODE R. § 6.12, Table 6-1.
[184] *See, e.g.*, NRDC, Technical Comments at 4-6, 10.
[185] *Id.* at 11, 18-19.
[186] Reade et al., *supra* note 80 at 27-28.
[187] *See, e.g.*, NRDC, Technical Comments at 5-7, 11, 18-19.
[188] *See, e.g.*, Kwiatkowski et al., *supra* note 16 at C-D; U.S. Envtl. Prot. Agency, Technical Fact Sheet - Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) (Nov. 2017), https://www.epa.gov/sites/production/files/2017-12/documents/ffrrofactsheet_contaminants_pfos_pfoa_11-20-17_508_0.pdf; Reade et al., *supra* note 80.
[189] *Id.*; National Toxicology Program. TR-598: Technical Report Pathology Tables and Curves - PFOA. 2018. Assessed at: https://tools.niehs.nih.gov/cebs3/views/?action=main.dataReview&bin_id=13658; Reade et al., *supra* note 80.
[190] Office of Environmental Health Hazard Assessment, *Notification Level Recommendations: Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water* (Aug. 2019), https://oehha.ca.gov/media/downloads/water/chemicals/nl/final-pfoa-pfosnl082119.pdf.
[191] *See* Kwiatkowski et al., *supra* note 16; NRDC, Technical Comments at 4-6, 10.
[192] *See* discussion *supra* Section II.B.1; Reade et al., *supra* note 80 at 40.
[193] *See* discussion *supra* Section II.B.1; NRDC, Technical Comments at 17-18; Kwiatkowski et al., *supra* note 16; Reade et al., *supra* note 80 at 19-28.

PFOS causes adverse cancer and non-cancer health effects at exceedingly low doses.[194] A MCLG based on immunotoxicity or cancer would be well below 1 ppt for PFOS.[195] A MCLG for PFNA based on developmental toxicity is below 1 ppt, approximately 2 ppt for PFHxS based on thyroid toxicity, and below 1 ppt for GenX based on liver toxicity.[196]

"All PFAS share a common structural feature, the carbon-fluorine bond, which is the strongest single bond in organic chemistry and confers environmental persistence to all PFAS. In addition, PFAS can also share several other problematic properties, including bioaccumulation, environmental mobility, and toxicity. Experts agree that persistence alone is cause for concern and sufficient for regulation" as a class in order to protect public health,[197] and Vermont has already adopted an MCLG of zero for five PFAS. For all these reasons, the MCLG should be zero for the entire PFAS class of chemicals.

2. The Agency should establish a combined MCL at the lowest, most health protective level technically achievable for the maximum number of quantifiable PFAS.

The Agency should establish a combined MCL below 20 ppt at the lowest, most health protective level technically achievable for the maximum number of quantifiable PFAS.[198] As discussed previously, the 20 ppt standard does not protect for the most sensitive endpoints or the most vulnerable populations.[199] The Agency has already set an MCLG of zero for five PFAS and scientific studies suggest that adverse health impacts from exposure to some PFAS can occur at 1 ppt or below.[200] Commercial labs can reliably report quantifiable PFAS at levels between 2 – 5 ppt.[201]

The Agency should employ user defined 537-modified methods following DoD criteria to establish a pre-specified number of PFAS that is no less than those covered by US EPA Methods 537.1 and 533.[202] In addition, this combined standard should establish a test method that captures the maximum number of quantifiable PFAS and requires an oxidation step in which PFAA precursors are oxidized to terminal PFAAs before measuring individual PFAS.[203]

As the Technical Comments note, there are several targeted analytical methods that can reliably

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[194] *See* discussion *supra* Section II.B.1; Office of Environmental Health Hazard Assessment, *Notification Level Recommendations: Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water* (Aug. 2019), https://oehha.ca.gov/media/downloads/water/chemicals/nl/final-pfoa-pfosnl082119.pdf.
[195] *Id.*; Reade et al., *supra* note 80 at 42.
[196] Reade et al., *supra* note 80 at 44, 46.
[197] NRDC, Technical Comments at 10.
[198] *Id.* at 12-14.
[199] *See* discussion *supra* Section II.B.1.
[200] *Id.*
[201] NRDC, Technical Comments at 14.
[202] *Id.*
[203] *Id.* at 12-14.

detect between 18 – 40 individual PFAS to 2 – 5 ppt.[204] In addition,

> [i]n order to be most health protective, the validated method for measuring individual PFAS should be conducted following an oxidation step in which PFAA precursors are oxidized to terminal PFAAs. At a minimum, a pre-oxidation step should be performed prior to a targeted analysis. It may not be necessary to perform targeted testing prior to the oxidation step (as is routinely done in the TOP assay) unless Vermont deems understanding the amount of precursor present in every sample important. This approach would reduce the cost of testing while providing the benefit of capturing a more accurate level of PFAS in water.[205]

Total Oxidizable Precursor (TOP) Assay is commercially available, and we do not agree with the Agency's characterizations of its limitations for the reasons outlined in the Technical Comments.[206]

Existing treatment technologies are able to remove long and short chain PFAS to concentrations below 2 ppt, including granular activated carbon, ion exchange, and reverse osmosis.[207] Reverse osmosis appears to be the most robust technology for preventing exposure to PFAS and other unidentified contaminants.[208] These treatment technologies will also confer significant co-benefits for public health because the same technologies that are effective in removing PFAS are also effective in removing a host of other dangerous chemicals, including RDX, arsenic, benzene, cryptosporidium, MTBE, mercury, perchlorate, tetrachloroethylene, trichloroethylene, 1,4-dioxane, alachlor, chromium, malathion, and nitrates.[209] Thus, the technology is available to put these health-protective standards in place immediately.[210]

3. The Agency should establish a treatment technique standard based on TOF as measured by CIC for the PFAS class of chemicals as soon as an international, federal, or state agency validates a method.

The Agency should establish a treatment technique drinking water standard for the PFAS class of chemicals based on TOF as measured by CIC as soon as an international, federal, or state agency validates a method. As discussed previously, the Agency has broad authority to adopt a treatment technique drinking water standard. "A treatment technique is an enforceable procedure or level of technological performance which public water systems must follow to ensure control of a

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[204] *Id.* at 13-14.
[205] *Id.* at 12.
[206] *Id.* at 12-13.
[207] Reade et al., *supra* note 80, at 54–55; SCOTT BARTEL ET AL., MICHIGAN PFAS SCIENCE ADVISORY PANEL, SCIENTIFIC EVIDENCE AND RECOMMENDATIONS FOR MANAGING PFAS CONTAMINATION IN MICHIGAN 60–63 (Dec. 7, 2018), https://www.michigan.gov/documents/pfasresponse/Science_Advisory_Board_Report_641294_7.pdf.
[208] Reade et al., *supra* note 80 at 56–57.
[209] U.S. Envtl. Prot. Agency, *Drinking Water Treatability Database*, *Granular Activated Carbon*, https://oaspub.epa.gov/tdb/pages/treatment/treatmentContaminant.do.
[210] NRDC, Technical Comments at 13.

contaminant."[211] In other words, the Agency has the authority to develop a procedure that would require the use of specific drinking water treatment technologies under certain circumstances.[212]

EPA has adopted several treatment technique drinking water standards in lieu of an MCL where EPA has determined that it is "not economically or technologically feasible to ascertain the level of [a] contaminant."[213] For example, the Lead and Copper Rule is a treatment technique.[214] This rule requires public water systems to test drinking water in the homes of consumers and undertake additional treatment measures to control lead if 10 percent of the samples exceed 15 ppb.[215] The Surface Water Treatment Rule is also a treatment technique.[216] Under this rule, most public water systems that obtain water from surface water or groundwater under the direct influence of surface water must use filters and disinfectants to reduce pathogens.[217] In both cases, EPA had to establish a unique procedure to address the risks posed by a specific contaminant because an MCL would not have been practical or protective of public health due to the unique characteristics of the contaminants.

Similarly, the unique characteristics of the PFAS class pose a public health threat that cannot be adequately addressed with the establishment of an MCL for one or a few PFAS chemicals.[218] The Agency should require the installation of treatment technologies to remove long and short-chain PFAS where total organic fluorine is detected as measured by CIC as soon as an international, federal, or state agency validates a method.[219] The Review Team noted that TOF would be over-inclusive and capture other contaminants like pharmaceuticals or pesticides.[220] However, "these chemicals also do not belong in the drinking water or groundwater. Removing other organofluorine contaminants from the ground and drinking water is not detrimental to public health or the environment, and can be considered a co-benefit to regulating PFAS."[221] Further, the Agency could utilize USGS data to screen for pharmaceuticals and pesticides.[222]

While we recognize there may be current limitations with TOF, the Technical Comments note:

> Commercial laboratories like Eurofins and Bureau Veritas offer TOF by CIC with detection limits in the low (single digit) part per billion range. Commercially validated methods are already available in Australia and Europe. Bureau Veritas (located in Canada)

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[211] U.S. Envtl. Prot. Agency, *How EPA Regulates Drinking Water Contaminants*, https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants.
[212] 10 V.S.A. § 1672.
[213] U.S. Envtl. Prot. Agency, *How EPA Regulates Drinking Water Contaminants*, https://www.epa.gov/dwregdev/how-epa-regulates-drinking-water-contaminants.
[214] U.S. Envtl. Prot. Agency, *Lead and Copper Rule*, https://www.epa.gov/dwreginfo/lead-and-copper-rule.
[215] *Id.*
[216] U.S. Envtl. Prot. Agency, *Surface Water Treatment Rules, https://www.epa.gov/dwreginfo/surface-water-treatment-rules*.
[217] *Id.*
[218] NRDC, Technical Comments at 10-14.
[219] *Id.* at 10-12.
[220] Advance Notice at 7. For a complete response to the Review Team's analysis of TOF, see NRDC, Technical Comments at 12-13.
[221] NRDC, Technical Comments at 11.
[222] *Id.*

> released a commercially validated TOF method this year and Eurofins expects to have a commercially validated TOF method in the US by the end of the year. This approach has been validated by academic institutions in the U.S. as well. In addition, efforts are currently underway to develop and validate more sensitive methods for TOF analysis.[223]

Thus, we recommend that the Agency establish a treatment technique using this analytical method as soon as an international, federal, or state agency validates a method. Once a treatment technique is set, ANR should review the standard every two years to ensure standards reflect the latest scientific and technical information.[224] As discussed previously, existing treatment technologies are able to remove long and short chain PFAS to concentrations below 2 ppt.[225]

In conclusion, there is a strong scientific basis for regulating the PFAS class based on the extreme persistence of these chemicals, and the Agency should promulgate rules consistent with this recommendation by the statutory deadline.

B. In the alternative, the Agency should establish new rules for subclasses of PFAS that protect Vermonters from the PFAS class.

The Agency should establish new drinking water rules for PFAS subclasses in the alternative. As the Technical Comments note, there are numerous different approaches for grouping PFAS based on intrinsic properties or technical capabilities.[226] The Review Team did not consider many of these approaches and did not fully evaluate the few approaches they did identify.[227]

The Review Team also appeared to dismiss potential approaches out-of-hand for a variety of reasons, including because not all PFAS can be quantified at this time, regulations would need to be regularly reviewed and updated to account for new information, and there would be a "learning curve" associated with certain programs.[228] However, none of these reasons provide justification for delaying health protections to Vermonters. As noted previously, commercial laboratories can reliably detect up to 40 PFAS between 2 – 5 ppt and, "alternative methods, such as TOF and TOP, greatly increase our ability to protect drinking water and ground water from PFAS."[229] Further, as part of a core mission to protect public health, it is not unreasonable to expect that the Agency and the Department of Health will regularly review drinking water rules to ensure they are current with the latest science and that agency staff are responsible for learning how to implement new technical and regulatory approaches that are necessary to protect Vermonters. The review conducted by the Agency does not support its finding that there is insufficient scientific and technical information to regulate PFAS subclasses.

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[223] *Id.* at 10-11.
[224] *Id.* at 11.
[225] *See* discussion in Section III.A.2.
[226] NRDC, Technical Comments at 14-15.
[227] *Id.*
[228] Advance Notice at 6-7. For a complete response to the conclusions in the Advance Notice re subclasses, see NRDC, Technical Comments at 14-15.
[229] *Id.* at 15.

C. At a minimum, the Agency should establish a combined MCL at the lowest, most health protective level that is technically achievable for the maximum number of quantifiable PFAS pursuant to the additive approach currently utilized.

At a minimum, there is sufficient scientific and technical information for the Agency to utilize the additive approach to establish a combined MCL below 20 ppt at the lowest, most health protective level technically achievable for the maximum number of quantifiable PFAS consistent with our recommendations in Section III.A.2.[230]

VDH guidance sets forth a process for regulating multiple chemicals together to protect public health.[231] "For chemicals that do not have established toxicity values from authoritative sources but are part of a group of chemicals in which one or more chemicals do have toxicity values, a single Health Advisory may be developed that is applicable to the sum of multiple contaminants, including chemicals that do not have toxicity values."[232] VDH has already acknowledged that combined regulation of PFOA, PFOS, PFHxS, PFHpA, and PFNA—even where toxicity values for some compounds are not available—is appropriate because these five compounds satisfy four criteria: (1) they are "currently being investigated in Vermont and have been found in drinking water," (2) they are all "members of the PFAS family . . . and are considered sufficiently similar," (3) they "are often found together," and (4) they "elicit similar health effects . . . ."[233]

The same four criteria are met with respect to the class of PFAS compounds. First, in addition to five PFAS currently regulated, other PFAS that have been found or are being investigated in Vermont, including, PFBA, PFPeA, PFHxA, PFDA, PFUnA, PFDoA, PFTA, PFTrDA, PFBS, PFPeS, PFHpS, PFNS, PFDS, PFDoS, PFOSA, HFPO-DA or GenX, NEtFOSAA, NMeFOSSA; 4:2 FTS, 6:2 FTS, and 8:2 FTS.[234] There are likely many other PFAS in Vermont that the State is simply not aware of yet given the speed and secrecy with which chemical manufacturers have introduced these dangerous chemicals into commerce.

Second, as the Technical Comments noted, PFAS are similar with respect to chemical structure and other attributes like persistence, toxicity, potential for bioaccumulation, and mobility in

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[230] NRDC, Technical Comments at 15-19.
[231] Vermont Dep't of Health, *Drinking Water Guidance, Grouping Process for Drinking Water Health Advisories,* Aug. 24, 2018, http://www.healthvermont.gov/sites/default/files/documents/pdf/ENV_ECP_GeneralScreeningValues_Water.pdf [hereinafter VDH, Drinking Water Guidance]. EPA has applied similar concepts to establish an MCL for a group of chemicals. 63 Fed. Reg. 69390, 69409 (Dec. 16, 1998), https://www.gpo.gov/fdsys/pkg/FR-1998-12-16/pdf/98-32887.pdf#page=1. For example, EPA established an MCL for five haloacetic acid disinfection byproducts (HAA5) because it did not have sufficient information regarding (1) the occurrence of individual haloacetic acids; (2) how water quality parameters affect the formation of haloacetic acids; (3) how "treatment technologies control the formation of individual . . . [haloacetic acids];" and (4) toxicity information for some of the individual haloacetic acids. *Id.* In light of the unique challenges associated with regulation of these chemicals, EPA promulgated a group MCL even in the absence of complete information about each individual haloacetic acid in order to better protect public health. *Id.*
[232] VDH, Drinking Water Guidance.
[233] Levine Memo; *see also* VDH, Drinking Water Guidance.
[234] NRDC, Technical Comments at 3, Table 1.

water.[235] Third, these PFAS chemicals are often found together and some break down into each other.[236] Fourth, these PFAS are likely to have similar health effects.[237] As noted previously, commercial labs can reliably quantify up to 40 PFAS to 2 ppt – 5 ppt and treatment technologies are available to remove both long-chain and newer PFAS.

The Review Team, however, summarily dismissed this potential approach to regulating PFAS beyond the five currently regulated.[238] Specifically, the Review Team noted that there is "limited data" to support "the inclusion of additional PFAS."[239] This is just not accurate. As the Technical Comments note, "states have already conducted risk assessments for PFAS that are not currently part of Vermont's combined standard including: PFBA, PFPeA, PFHxA, PFDA, PFUnA, PFDoA, PFTA, PFTrDA, PFBS, PFDS, PFOSA, and HFPODA (Gen X). Thus, established toxicity values do exist for additional PFAS beyond the five currently regulated in Vermont."[240]

The Review Team also noted as a "con" that this approach could lead to the need for regular review and revision of the regulatory standard to keep pace with science and outreach to public water supply operators due to an increase in compliance costs.[241] As discussed previously, the need for regular review of public health standards is expected and required, and absolutely cannot be used as an excuse to delay putting in place drinking water rules that are necessary to protect Vermonters from PFAS.

In addition, the economic impacts to public water supply operators is not an appropriate justification for failing to move forward with new drinking water rules for PFAS, and the Agency is not required to conduct a cost-benefit analysis when setting drinking water standards.[242] Here, the Review Team has not articulated what the anticipated increased costs to regulated entities will be.[243] Nor has it identified the significant avoided costs and benefits associated with removing additional PFAS from drinking water.[244] At a bare minimum, if the Agency intends to rely on costs to public water supply operators as a rationale, the Agency must also include a comprehensive accounting of the avoided costs and benefits associated with removal of additional PFAS from drinking water. For all these reasons, the Agency cannot support a determination that promulgating new rules based on the additive approach is not possible. In conclusion, the Agency should move forward with new rules to protect Vermonters from all PFAS chemicals consistent with the recommendations set forth in this section.

[235] *See, e.g.*, NRDC, Technical Comments at 4-6, 10, 16.
[236] *Id.* at 16-17.
[237] *Id.* at 17-18.
[238] *See* Advance Notice at 5-6.
[239] *Id.* at 5.
[240] NRDC, Technical Comments at 16.
[241] Advance Notice at 6.
[242] *See* 10 V.S.A. § 1672.
[243] Advance Notice at 6.
[244] *See id.*

IV. The State and public water systems have options to address the financial costs associated with the clean-up of PFAS contamination in drinking water.

DuPont, 3M, and other chemical manufacturers recklessly produced these dangerous chemicals for decades despite being aware of the significant health risks associated with PFAS and must ultimately be held accountable for cleaning up toxic drinking water. In the short term, there will be monitoring costs, and may be costs associated with the treatment to remove PFAS from drinking water, to water system operators. There are also substantial avoided costs and benefits from stopping or preventing exposure to these dangerous chemicals in Vermont communities.[245]

Water system operators have a legal obligation to provide safe drinking water to consumers. In fulfilling these obligations to provide safe drinking water and protect public health, the State, public water systems, and other impacted entities have funding assistance options they can pursue, including the Drinking Water State Revolving Loan Fund or Environmental Contingency Fund.[246] Ultimately, the chemical manufacturers that created this crisis should be held accountable for the costs associating with cleaning up PFAS contamination. The Attorney General has filed a lawsuit against 3M, Du Pont, and other entities to hold chemical manufacturers and polluters that have contributed and are contributing to the PFAS pollution crisis accountable for the harm they have caused. This lawsuit should generate substantial resource support to compensate the State and public entities for incurring costs to clean up PFAS contamination.

Conclusion

Thank you for the opportunity to provide these comments. We appreciate the Agency's attention to the significant public health and environmental problem posed by PFAS pollution. We urge the Agency to propose a draft rule no later than March 1, 2021 consistent with our recommendations to ensure Vermont communities have access to safe drinking water free of all PFAS.

Respectfully submitted,

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[245] *See* discussion *supra* Section II.A.1.
[246] 10 V.S.A. § 1283; U.S. Envtl. Prot. Agency, Drinking Water State Revolving Fund (DWSRF), https://www.epa.gov/dwsrf.

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