An Emerging Contaminant of (Legal) Concern:
PFAS Legal Issues at the State and Federal Level

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About the Virginia Coastal Policy Center

The Virginia Coastal Policy Center (VCPC) at the College of William & Mary Law School provides science-based legal and policy analysis of ecological issues affecting the state's coastal resources, by offering education and advice to a host of Virginia's decision-makers, from government officials and legal scholars to non-profit and business leaders.

With two nationally prominent science partners – the Virginia Institute of Marine Science and Virginia Sea Grant – VCPC works with scientists, local and state political figures, community leaders, the military, and others to integrate the latest science with legal and policy analysis to solve coastal resource management issues. VCPC activities are inherently interdisciplinary, drawing on scientific, economic, public policy, sociological, and other expertise from within the University and across the country. With access to internationally recognized scientists at VIMS, to Sea Grant's national network of legal and science scholars, and to elected and appointed officials across the nation, VCPC engages in a host of information exchanges and collaborative partnerships.

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VCPC grounds its pedagogical goals in the law school's philosophy of the citizen lawyer. VCPC students' highly diverse interactions beyond the borders of the legal community provide the framework for their efforts in solving the complex coastal resource management issues that currently face Virginia and the nation.

I. INTRODUCTION[1]

Per- and polyfluoroalkyl substances, or PFAS, are a class of man-made industrial chemicals that have been widely used in a variety of ways, primarily in water-resistant coatings and fire-fighting foam.[2] Their widespread use has led to broad contamination threats to human drinking water sources, including surface and groundwater. As a result, they are an emerging contaminant of concern that are swiftly turning into a global health threat on the forefront of regulatory and policy debates. PFAS have been detected in both aquatic life and humans, and research is increasingly clear that there are concrete health risks to excessive exposure.[3] Currently there are no binding federal restrictions of PFAS, leading some states to take the lead in developing regulations for this class of emerging contaminants. This paper will give a brief overview of what PFAS is, what the federal and state governments are doing about it, and various recommendations.

II. WHAT ARE PFAS AND HOW DO THEY AFFECT HUMANS?

PFAS are a class of industrial chemicals used in a wide variety of ways. The common uses are as (1) surfactants for use in water-resistant coatings (*e.g.*, Teflon), food contact paper (e.g., wax paper), (2) electronics like semiconductors, and (3) firefighting foam.[4] PFAS are a diverse set of chemicals, but the unifying characteristic is the substitution of fluorine for hydrogen in carbon chains.[5] This carbon-fluorine bond is incredibly strong and accounts for why PFAS remain present in the environment and never really break down—leading to their nickname, "forever chemicals."[6] Thus, as a class, they are extremely resistant to degradation in any environment.[7] Their persistence is also why they are dangerous, because they can become ubiquitous in things that humans and animals come in contact with, like water, and then accumulate in the body.[8] PFAS have been detected in humans and animals all around the world, in surface water, and in ground

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[1] The authors would like to thank Emily Russell, Assistant County Attorney, Chesterfield County, Virginia, for her valuable suggestions and insights for this paper.

[2] Mohammad F. Rahman, Sigrid Peldszus, & William B. Anderson, *Behaviour and Fate of Perfluoroalkyl and Polyfluoroalkyl Substances (PFASs) in Drinking Water Treatment: A Review*, 50 WATER RES., 318, 319 (2014), http://dx.doi.org/10.1016/j.watres.2013.10.045.

[3] Gloria B. Post, Jessie A. Gleason, & Keith R. Cooper, *Key Scientific Issues in Developing Drinking Water Guidelines for Perfluoroalkyl Acids: Contaminants of Emerging Concern*, PLOS BIOLOGY, Dec. 20, 2017 at 1, 2, https://doi.org/10.1371/journal.pbio.2002855.

[4] Rahman et al., *supra* note 2, at 319.

[5] *See id.* The "F" in PFAS reflects the fluorine substitution.

[6] *See id.* at 322; Molly M. Ginty, *"Forever Chemicals" Called PFAS Show Up in Your Food, Clothes, and Home*, NAT. RESOURCES DEF. COUNCIL, Jan. 7, 2020, https://www.nrdc.org/stories/forever-chemicals-called-pfas-show-your-food-clothes-and-home. As a result, PFAS can remain in the environment long after introduction stops. Zhanyun Wang, Jamie C. DeWitt, Christopher P. Higgins, & Ian T. Cousins, *A Never-Ending Story of Per- and Polyfluoroalkyl Substances (PFASs)?*, 51 ENVTL. SCI. & TECH. 2508, 2508 (2017), http://dx.doi.org/10.1021/acs.est.6b04806.

[7] Rahman et al., *supra*, note 2, at 322.

[8] *See* Post et al., *supra* note 3, at 1-2; Jessica L. Reiner & Benjamin J. Place, *Perfluorinated Alkyl Acids in Wildlife*, *in* TOXICOLOGICAL EFFECTS OF PERFLUOROALKYL AND POLYFLUOROALKYL SUBSTANCES 127, 132 (Jamie C. DeWitt ed., 2015), doi:10.1007/978-3-319-15518-0_5.

water.[9] In fact, scientists now believe PFAS is likely detectable in all major water supplies in the U.S.[10]

For name brand products like Teflon, Scotchgard, and Gore-Tex, PFAS are used as surfactants precisely because of the strong carbon-fluorine bond, one of the strongest chemical bonds known.[11] Compared to the carbon-hydrogen bond it replaces, the carbon-fluorine bond is almost completely chemically inert, meaning it does not react to any chemical stimuli, like heat, acids, bases, oxidation, reduction, or even biodegradation.[12] This is why it is so good as a surfactant, but also why it persists in the environment.

While several PFAS such as perfluorooctane sulfonic acid (PFOS), perfluorononanoic acid (PFNA), and perfluorooctanoic acid (PFOA) have recently come to the forefront of public and regulatory attention, the thousands of PFAS substances that make up the vast majority of the class remain unstudied.[13] PFOA and PFOS, two of the most well-known and widespread chemicals from the PFAS class, were made in large amounts in the United States from the 1940s until 2006 when they were phased out through a voluntary program with the Environmental Protection Agency (EPA).[14] While most studies have been focused on these common PFAS such as PFOA, the vast majority of compounds currently in use are new PFAS that have replaced PFOA and PFOS in many industrial processes.[15] These compounds lack toxicological or environmental impact data,

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[9] *See* Craig M. Butt, Urs Berger, Rossana Bossi, & Gregg T. Tomy, *Levels and Trends of Poly- and Perfluorinated Compounds in the Arctic Environment*, 408 SCI. OF THE TOTAL ENV'T 2936, 2937-38 (2010) (documenting the finding of PFAS even in Arctic environments without human populations), doi:10.1016/j.scitotenv.2010.03.015. *See also* Andrew B. Lindstrom et al., *Application of WWTP Biosolids and Resulting Perfluorinated Compound Contamination of Surface and Well Water in Decatur, Alabama, USA*, 45 ENVTL. SCI. & TECH. 8015, 8021 (2011), https://doi.org/10.1021/es1039425; Gloria B. Post, Judith B. Louis, R. L. Lippincott, & Nicholas A. Procopio, *Occurrence of Perfluorinated Compounds in Raw Water from New Jersey Public Drinking Water Systems*, 47 ENVT. SCI. & TECH. 13266, 13273 (2013), https://doi.org/10.1021/es402884x; Laurel A. Schaider, Janet M. Ackerman, & Ruthann A. Rudel, *Septic Systems as Sources of Organic Wastewater Compounds in Domestic Drinking Water Wells in a Shallow Sand and Gravel Aquifer*, SCI. OF THE TOTAL ENV'T 470, 473-74 (2016), http://dx.doi.org/10.1016/j.scitotenv.2015.12.081.

[10] SYDNEY EVANS, DAVID ANDREWS, TASHA STOIBER, & OLGA NAIDENKO, ENVTL WORKING GROUP, PFAS CONTAMINATION OF DRINKING WATER FAR MORE PREVALENT THAN PREVIOUSLY REPORTED (January 22, 2020) [hereinafter *EWG*], https://www.ewg.org/research/national-pfas-testing/. The Environmental Working Group (EWG) is a non-profit organization that commissioned laboratory tests of water samples from every state in the US, finding PFAS contamination in forty-nine out of the fifty states. *See id.*

[11] *See* Xindi C. Hu et al., *Detection of Poly- and Perfluoroalkyl Substances (PFASs) in U.S. Drinking Water Linked to Industrial Sites, Military Fire Training Areas, and Wastewater Treatment Plants*, 3 ENVTL. SCI. & TECH. LETTERS 344, 344-45 (2016), https://doi.org/10.1021/acs.estlett.6b00260; Rahman et al., *supra* note 2, at 319; Wang et al., *supra* note 6, at 2511.

[12] Cheryl Hogue et al., *A Guide to the PFAS Found in Our Environment*, CHEMICAL & ENGINEERING NEWS, https://cen.acs.org/sections/pfas.html (last visited Feb. 14, 2020); Rahman et al., *supra* note 2, at 322.

[13] Wang et al., *supra* note 6, at 2508.

[14] *See* ENVTL. WORKING GROUP, WHAT ARE PFAS CHEMICALS? (2017), https://www.ewg.org/pfaschemicals/what-are-forever-chemicals.html.

[15] Alex Ebert & Maya Goldman, *PFAS Sleuths Seek 'Forever Chemical' Fingerprint*, BLOOMBERG ENV'T, July 9, 2019, https://news.bloombergenvironment.com/environment-and-energy/pfas-sleuths-seek-forever-chemical-fingerprints. Of the approximately 6000 PFAS compounds, only a dozen can be reliably tested for at the moment, and fewer than that have accurate toxicological data. *Id.*

and are more resistant to traditional water cleaning techniques such as carbon filtration.[16] The lack of regulation of the compounds combined with their high solubility, low sorption and both biological and chemical resistance has resulted in their widespread presence in aquatic environments.[17]

As a result of their long half-lives and widespread use, PFAS have found their way into waters, sediments, soils, wastewater, compost, plants, animals, and humans.[18] Multiple studies have shown that even limited exposure to PFAS can result in a wide range of negative health impacts.[19] Funded through a multi-million dollar settlement with DuPont de Nemours, Inc., the largest study of PFAS effects on human health to date was undertaken to identify the exposure-disease relationship in over 69,000 participants in the Ohio River Valley.[20] The study found a correlation between PFAS exposure and cancers[21] (specifically testicular cancer[22] and kidney cancer[23]), ulcerative colitis,[24] thyroid disease,[25] pregnancy-induced hypertension,[26]

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[16] Mohamed Ateia, Amith Maroli, Nishanth Tharayil, & Tanju Karanfil, *The Overlooked Short- and Ultrashort-Chain Poly- and Perfluorinated Substances: A Review*, 220 CHEMOSPHERE 866, 874 (2019), https://doi.org/10.1016/j.chemosphere.2018.12.186.

[17] *Id.*; *see also* READE ET AL., *infra* note 36, at 12-14.

[18] *See* Para Zareitalabad, Jan Siemans, M. Hamer, & Wulf Amelung, *Perfluorooctanoic Acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) in Surface Waters, Sediments, Soils and Wastewater – A Review on Concentrations and Distribution Coefficients*, 91 CHEMOSPHERE 725, 728 (2013), https://doi.org/10.1016/j.chemosphere.2013.02.024; ENVTL. PROTECTION AGENCY, RISK MANAGEMENT FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFASS) UNDER TSCA, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/risk-management-and-polyfluoroalkyl-substances-pfass#tab-3 (last visited Feb. 14, 2020); PA. DEP'T OF HEALTH, PERFLUOROOCTANESULFONIC ACID (PFOS) AND PERFLUOROOCTANOIC ACID (PFOA), http://files.dep.state.pa.us/RegionalResources/SERO/SEROPortalFiles/Community%20Info/EastonRoadPFC/PA%20Department%20of%20Health%20Fact%20Sheet-%20PFOS%20and%20PFOA.pdf (last visited Feb. 14, 2020).

[19] *See generally* Alissa Cordner et al., *Guideline Levels for PFOA and PFOS in Drinking Water: The Role of Scientific Uncertainty, Risk Assessment Decisions, and Social Factors*, 29 J. OF EXPOSURE SCI. & ENV'L EPIDEMIOLOGY 157, 161 (2018), https://doi.org/10.1038/s41370-018-0099-9 (describing PFAS studies documenting negative health effects below the EPA's lifetime advisory guideline of 70 ppt).

[20] Lauren Richter, Alissa Cordner, & Phil Brown, *Non-stick Science: Sixty Years of Research and (In)action on Fluorinated Compounds*, 48 SOC. STUD. OF SCI. 691, 704 (2018), doi:10.1177/0306312718799960. The scientists who studied the Ohio River Valley contamination were known as the C8 Science panel. C8 was one of the PFAS compounds manufactured by DuPont. *See* C8 SCI. PANEL, http://www.c8sciencepanel.org/panel.html (last visited Feb. 14, 2020).

[21] Vaughn Barry, Andrea Winquist, & Kyle Steenland, *Perfluorooctanoic Acid (PFOA) Exposures and Incident Cancers Among Adults Living Near a Chemical Plant*, 121 ENVTL. HEALTH PERSPECTIVES 1313, 1316-17 (2013), https://doi.org/10.1289/ehp.1306615.

[22] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF CANCER 8-12 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Cancer_16April2012_v2.pdf (last visited Feb. 14, 2020).

[23] *Id.*

[24] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF AUTOIMMUNE DISEASES 5-7 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Autoimmune_Disease_30Jul2012.pdf (last visited Feb. 14, 2020).

[25] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF THYROID DISEASE 6-11 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Thyroid_30Jul2012.pdf (last visited Feb. 14, 2020).

[26] C8 SCI. PANEL, PROBABLE LINK EVALUATION OF PREGNANCY-INDUCED HYPERTENSION AND PREECLAMPSIA 3-5 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_PIH_5Dec2011.pdf (last visited Feb. 14, 2020).

preeclampsia,[27] and hypercholesterolemia.[28] Other studies in lab and in-vivo have shown links to DNA methylation among firefighters,[29] changes in renal gene expression from a single exposure,[30] association with atopic dermatitis in children,[31] high cholesterol,[32] and other health complications.[33]

III. STATUS OF THE LAW CONCERNING PFAS

A. Federal

The EPA currently recommends a lifetime health advisory limit for PFOA and PFOS of 70 parts per trillion (ppt).[34] However, the Agency for Toxic Substances and Disease Registry (ATSDR) within the U.S. Department of Health and Human Services announced that health impacts from PFAS exposure could be significant at levels seven to ten times lower than the current EPA standard, with multiple assessments from other states and independent scientists concurring.[35] One of the significant reasons why there is such disparity in health guidelines stems from who the health researchers identify as their target population—"an average male adult versus a lactating mother versus a breastfeeding or formula-fed infant"—as well as inherent calculation assumptions, including "drinking water intake rate, body weight, relative source contribution from drinking water, [and] the exposure levels."[36]

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[27] *Id.*

[28] C8 SCI. PANEL, PROBABLE LINK EVALUATION FOR HEART DISEASE 6-10 (2012), http://www.c8sciencepanel.org/pdfs/Probable_Link_C8_Heart_Disease_29Oct2012.pdf (last visited Feb. 14, 2020).

[29] Jin Zhou et al., *DNA Methylation Among Firefighters*, PLOS ONE, Mar. 26, 2019, at 6-8, https://doi.org/10.1371/journal.pone.0214282. DNA methylation refers to the alteration of DNA by the addition of a methyl group (CH_3) and is associated with an increased risk of cancer because hypermethylation can interfere with tumor suppressor gene expression. *Id.* at 2.

[30] Akiko Sakuma et al., *Changes in Hepato-Renal Gene Expression in Microminipigs Following a Single Exposure to a Mixture of Perfluoroalkyl Acids*, PLOS ONE, Jan. 4, 2019, at 1, https://doi.org/10.1371/journal.pone.0210110.

[31] Hui-Ju Wen et al., *Prenatal Perfluorooctanoic Acid Exposure and Glutathione s-Transferase T1/M1 Genotypes and Their Association with Atopic Dermatitis at 2 Years of Age*, PLOS ONE, Jan. 16, 2019, at 1, https://doi.org/10.1371/journal.pone.0210708.

[32] VT. DEP'T OF HEALTH, PFOA EXPOSURE & HEALTH STUDIES 1 (2016), http://www.healthvermont.gov/sites/default/files/documents/2016/12/Env_DW_PFOA_c8_health_project_summary.pdf (last visited Feb. 14, 2020).

[33] Other complications include low birth weight, infertility, early onset menopause, increased impulsivity in children, and low semen quality. *See* AGENCY FOR TOXIC SUBSTANCES & DISEASE REGISTRY, PER- & POLYFLUOROALKYL SUBSTANCES (PFAS) & YOUR HEALTH: WHAT ARE THE HEALTH EFFECTS*?* (2020), https://www.atsdr.cdc.gov/pfas/health-effects.html; ENVTL. PROTECTION AGENCY, DRINKING WATER HEALTH ADVISORIES FOR PFOA AND PFOS, https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos (last visited Feb. 14, 2020).

[34] ENVTL. PROTECTION AGENCY, *supra* note 33.

[35] Cordner et al., *supra* note 19, at 157, 159-160; Matthew Thurlow, *Fear and Loathing of PFAS*, AM. BAR ASS'N. (2018), https://www.americanbar.org/groups/environment_energy_resources/publications/trends/2018-2019/january-february-2019/fear-and-loathing/.

[36] ANNA READE, TRACY QUINN, & JUDITCH S. SCHREIBER, NAT. RESOURCES DEF. COUNCIL, SCIENTIFIC AND POLICY ASSESSMENT FOR ADDRESSING PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) IN DRINKING WATER 44 (2019), https://www.nrdc.org/sites/default/files/media-uploads/nrdc_pfas_report.pdf. *See also* Cordner et al., *supra* note 19, at 157-171.

Through the PFOA Stewardship Program, the EPA has worked with eight major chemical companies to voluntarily phase out PFOA and PFOS from production in America.[37] However, modeling studies have shown than this will only shift the production overseas and potentially increase the overall production of PFOA and PFOS as developing economies ramp up production to meet increasing import demand.[38] The EPA has collected data on six PFAS,[39] and PFAS potentially could be regulated at the federal level through the Safe Drinking Water Act (SDWA)[40], the Toxic Substances Control Act (TSCA)[41], the Comprehensive Environmental Response, Compensation and Liability Act ("Superfund")[42], or the Clean Air Act.[43] However, at the time of this research, there is no binding, nationwide environmental regulation of any PFAS at the federal level,[44] since the 70 ppt EPA lifetime health level for PFOA and PFOS is advisory only.[45] There are currently 330 non-Confidential Business Information (CBI) and 148 CBI PFAS that have been reported to the EPA;[46] from 2006 to 2008 the EPA reviewed 294 new PFAS for commercial purposes and regulated the commercial uses of 191 of them.[47]

Despite the current lack of federal regulations, efforts are underway to address the PFAS problem, although challenges remain. For example, the 2020 National Defense Authorization Act (NDAA) that was signed into law in December 2019 addresses PFAS that are related to

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[37] ENVTL. PROTECTION AGENCY, FACT SHEET: 2010/2015 PFOA STEWARDSHIP PROGRAM, https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program (last visited Feb. 14, 2020).

[38] Raphael M. Janousek, Jens Mayer, & Thomas P. Knepper, *Is the Phase-Out of Long-Chain PFASs Measurable as Fingerprint in a Defined area? Comparison of Global PFAS Concentrations and a Monitoring Study Performed in Hesse, Germany from 2014 to 2018*, TRAC TRENDS IN ANALYTICAL CHEMISTRY, Feb. 1, 2019, at 2, https://doi.org/10.1016/j.trac.2019.01.017; *see* ENVTL. PROTECTION AGENCY, *supra* note 37;

[39] Perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), perfluoroheptanoic acid (PFHpA), and perfluorobutanesulfonic acid (PFBS).

[40] 42 U.S.C. § 300 *et seq*. (2018).

[41] 15 U.S.C. § 2601 *et seq*. (2018).

[42] 42 U.S.C. § 9601 *et seq*. (2018).

[43] 42 U.S.C. §§ 7401*et seq.* (2018).

[44] *But see* National Defense Authorization Act (NDAA) for Fiscal Year 2020, *infra* note 47. The 2020 NDAA prohibits firefighting foam containing PFAS, but only on military bases. *Id.*

[45] ENVTL. PROTECTION AGENCY, *supra* note 33.

[46] ENVTL. PROTECTION AGENCY, PFAS LAWS AND REGULATIONS, https://www.epa.gov/pfas/pfas-laws-and-regulations (last visited Feb. 14, 2020). CBI are information collected by the EPA under the TSCA § 14 that are considered proprietary and cannot be disclosed through Freedom of Information Act requests or otherwise. ENVTL. PROTECTION AGENCY, CONFIDENTIAL BUSINESS INFORMATION UNDER TSCA, https://www.epa.gov/tsca-cbi (last visited Feb. 14, 2020).

[47] These substances were reported to the EPA under the revised TSCA, and the reporting requirements are for industrially manufactured chemicals in the U.S. over the past ten years. Since this information is only used by the EPA to determine if the substances are "active" or "inactive" in the U.S., they cannot be considered binding regulation. 15 U.S.C. § 2607(b); *see also* Hogue, *supra* note 12; ENVTL. PROT. AGENCY, USCA INVENTORY NOTIFICATION (ACTIVE-INACTIVE) RULE, https://www.epa.gov/tsca-inventory/tsca-inventory-notification-active-inactive-rule (last visited Feb. 14, 2020); PFAS LAWS & REGULATIONS, *supra* note 46; ENVTL. PROTECTION AGENCY, PFAS MASTER LIST OF PFAS SUBSTANCES, https://comptox.epa.gov/dashboard/chemical_lists/PFASMASTER (last visited Feb. 14, 2020).

Department of Defense (DoD) activities.[48] Most notably, it phases out the use of PFAS in firefighting foam on military bases beginning in 2024.[49] This is significant because environmental contamination by PFAS is common around military bases throughout the country and is usually attributed to firefighting foam.[50] The act also bans PFAS use in food packaging[51] and directs additional DoD monitoring of PFAS around military communities.[52] It also requires the Department of Defense to provide blood serum tests for PFAS to every Department of Defense firefighter as part of their annual physical exams.[53] However, key provisions that were initially included in the NDAA were ultimately removed, including a provision that required DoD to organize clean-up of PFAS-contaminated military areas and directions to the EPA to step up PFAS monitoring.[54] In a further sign of the halting nature of the federal response, the PFAS Action bill passed the House of Representatives in January 2020 and includes notable measures such as requiring the EPA to designate PFAS as a hazardous substance and to develop an enforceable threshold level.[55] However, the bill faces hurdles in the Senate and would face a likely veto from President Trump.[56] Other bills have been introduced by members of Congress but have not advanced since introduction.[57]

B. State

Lacking federal guidance, states have been leading the way in protecting their own citizens and waters from these substances. There are currently 142 proposals working their way through the legislatures of 29 states and 21 policies regulating PFAS adopted in 10 states.[58] For a full list of enacted state laws, see Appendix 1, infra. There are currently three states that have state-binding maximum advisory levels lower than the EPA's health advisory for PFOA and PFOS,[59] while multiple other states either follow the EPA guidelines or have significantly higher guidelines than the EPA.[60] Several states' attorneys general have filed suit against chemical manufacturers, while

[48] National Defense Authorization Act (NDAA) for Fiscal Year 2020, Pub. L. No. 116-92, 133 Stat. 1198 (2019), https://www.govinfo.gov/content/pkg/BILLS-116s1790enr/pdf/BILLS-116s1790enr.pdf.
[49] *Id.* § 322(c).
[50] *EWG*, *supra* note 10.
[51] NDAA § 329(a).
[52] *Id.* § 332(a).
[53] *Id.* §707(a).
[54] SAFER CHEMICALS, HEALTHY FAMILIES, NDAA CONFERENCE REPORT FAILS TO INCLUDE PFAS CLEAN-UP MEASURES; WILL END MILITARY USE OF PFAS FIREFIGHTING FOAM (2019), https://saferchemicals.org/2019/12/10/ndaa-conference-report-fails-to-include-pfas-clean-up-measures-will-end-military-use-of-pfas-firefighting-foam/.
[55] PFAS Action Act of 2019, H.R. 535, 116th Cong. §§ 2, 5 (2019), https://www.congress.gov/bill/116th-congress/house-bill/535/all-actions?overview=closed&KWICView=false.
[56] Office of Mgmt. & Budget, Exec. Office of the President, Statement of Administration Policy (Jan. 7, 2020), https://www.whitehouse.gov/wp-content/uploads/2020/01/SAP_HR-535.pdf.
[57] PFAS Release Disclosure Act, S. 1507, 116th Cong. (2019); Protect Drinking Water from PFAS Act of 2019, H.R. 2377, 116th Cong. (2019).
[58] *Bill Tracker for PFAS*, SAFER STATES, http://www.saferstates.com/toxic-chemicals/pfas/ (last visited Mar. 20, 2020); *see* Appendix 1 *infra*.
[59] Minnesota (15 ng/l), New Jersey (14 ng/l), and Vermont (20 ng/l). Cordner et al., *supra* note 19, at 159-160.
[60] *Id.*

some administrative agencies and legislatures have initiated bans, set binding health guidelines, and started state-wide testing programs.[61] Some of the leading state actions are discussed below, culminating in a detailed look at Virginia.

1. New Jersey

"In the absence of action at the federal level to meaningfully regulate these contaminants, New Jersey has acted to protect its citizens and environment" by creating the nation's strictest regulations of PFAS to date.[62] New Jersey has established Maximum Contaminant Levels (MCLs) at 14 nanograms per liter (ng/l)[63] for PFOA, 13 ng/l for PFNA, and 13 ng/l for PFOS.[64] New Jersey was also the first state to regulate PFNA.[65] New Jersey MCLs are added to its administrative code pursuant to the Safe Drinking Water Act (SDWA), and the limits apply to public and private water systems and create mandatory monitoring and containment requirements if the MCL is exceeded.[66] The State has also set Groundwater Quality Standards (GWQs) at 14 ng/l for PFOA, 13 ng/l for PFNA, and 13 ng/l for PFOS;[67] GWQs are binding limits on groundwater discharges pursuant to pollutant discharge and groundwater remediation standards within the New Jersey code.[68] The state started testing programs for PFAS in 2006, finding PFAS in 70% of tested drinking water.[69] As of March 2019, 70 public water systems not previously identified reported PFAS above the new New Jersey MCL.[70] In a study testing around 1,000 wells in 2018, 43% were found to contain PFAS at a level 31% above the MCL and 21% required "point of entry treatment systems."[71] A study of 13 PFAS compounds in waterway ecosystems found PFAS in the fish from every single waterbody, and lead to consumption restrictions imposed by the New Jersey Department of Environmental Protection (NJDEP).[72] The State also filed suit in 2019 against 3M and other corporations including Tyco Fire, Chemguard, Buckeye Fire, National Foam, and DuPont for "injuries to the natural resources of the State"[73] and fraud.[74]

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[61] *See infra* part 3b i-iv.
[62] N.J. DEP'T OF ENVTL. PROTECTION, STATEWIDE PFAS DIRECTIVE (2019) [hereinafter *N.J. Directive*], https://www.nj.gov/dep/docs/statewide-pfas-directive-20190325.pdf.
[63] A note on units: 1 nanogram per liter equals 1 part per trillion, so state regulations that are promulgated in "ng/l" are directly comparable to the EPA health advisory that is in "ppt." *See* ENVTL. PROTECTION AGENCY, CONVERTING LABORATORY UNITS INTO CONSUMER CONFIDENCE REPORT UNITS at 2, https://www.epa.gov/sites/production/files/2015-09/documents/epa816f15001.pdf (last visited Mar. 5, 2020).
[64] *N.J. Directive*, *supra* note 62, at 3; 51 N.J. Reg. 437(a) (April 1, 2019).
[65] *N.J. Directive*, *supra* note 62,62 at 3-4. PFNA has not been as widely studied as PFOS or PFOA. *See* Cheryl Rockwell et al., *Acute Immunotoxic Effects of Perfluorononanoic Acid (PFNA) in C57BL/6 Mice*, J. CLINICAL & EXPERIMENTAL PHARMACOLOGY, April 18, 2013, at 1, doi:10.4172/2161-1459.S4-002.
[66] *N.J. Directive*, *supra* note 62, at 3.
[67] *Id*; N.J. Admin. Code § 7:9C-Appendix (2018); 51 N.J. Reg. 437(a) (April 1, 2019).
[68] *N.J. Directive*, *supra* note 62, at 3.
[69] *Id*. at 4.
[70] *Id*. at 4.
[71] *Id*. at 4-5.
[72] *Id*. at 4.
[73] Compl. at 1, 5, Grewal v. 3M Co., MER-L-000953-19 (N.J. Super. Ct. Law Div. 2019), https://www.nj.gov/oag/newsreleases19/AFFF_Complaint.pdf.
[74] *Id*. at 2-3.

2. Vermont

In 2016, Vermont was the first state to set a primary groundwater enforcement standard below the revised EPA guidelines at 20 ng/l for both PFOA and PFAS[75] and expanded to 20ng/l cumulatively for five PFAS substances in 2018.[76] Vermont calculated their health advisory standard based on direct ingestion via drinking water and a non-cancer endpoint.[77] In 2019, the Vermont legislature passed bills to regulate PFAS that include mandating testing of all public water systems and requiring the Vermont Agency of Natural Resources to treat the contamination and issue "do not drink" notices until the contamination has been treated.[78] Vermont also initiated a public notice and comment process to regulate PFAS compounds as a class, requiring that the state's Secretary of Natural Resources undertake a state-wide investigation of contamination sources and submit both a class-wide regulation proposal by 2021 and water quality standards by 2020.[79] Vermont's legislature also passed a law, vetoed by the governor, that would have prohibited businesses operating in the state to use or manufacture PFAS.[80] The bill was spurred by discovery of PFOA in regional groundwater, but Vermont Governor Phil Scott said the bill would make the state less competitive for business.[81]

In June 2019, Vermont filed suit against the 3M Company, DuPont, and other chemical companies and manufacturers in the Vermont Superior Court.[82] The suit is based on several causes of action including: (1) natural resource damages and restoration,[83] (2) violations of the Vermont Groundwater Protection Act,[84] (3) strict liability for design and product defects,[85] (4) strict liability

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[75] Memorandum from Sarah Vose, State Toxicologist, Vt. Dep't of Health, to Chuck Schwer, Director, Waste Management, Vt. Department of Envtl. Conservation (June 22, 2016), https://anrweb.vt.gov/PubDocs/DEC/PFOA/PFOA%20-%20PFOS%20Health%20Advisories/Vermont/PFOA_PFOS_HealthAdvisory_June_22_2016.pdf.

[76] Memorandum from Emily Boedecker, Commissioner, Vt. Dep't of Health, to Mark A. Levine, Commissioner, Vt. Dep't of Health (July 10, 2018), https://www.healthvermont.gov/sites/default/files/documents/pdf/ENV_DW_PFAS_HealthAdvisory.pdf. The five PFAS that Vermont regulates are PFOA, PFOS, PFHxS, PFHpA and PFNA. *Id.*

[77] *Id.* at 3. Endpoints are an objective measurement to see if the intervention being studied is harmful or beneficial. NAT'L CANCER INST., NCI DICTIONARY OF CANCER TERMS, https://www.cancer.gov/publications/dictionaries/cancer-terms/def/endpoint (last visited Feb. 14, 2020). Here, a non-cancer endpoint would be the level of exposure before developing cancer.

[78] S. 49 (Vt. 2019).

[79] *Id.*

[80] S. 103 (Vt. 2019).

[81] *See* Cole Alder, *Vermont Governor Vetoes Chemical Regulation Bill*, PFAS PROJECT, NORTHEASTERN U. (April 19, 2018), https://pfasproject.com/2018/04/19/vermont-governor-vetoes-chemical-regulation-bill/.

[82] Compl. at 2, Vermont v. 3M Co. (Vt. Super. Ct. 2019), https://ago.vermont.gov/wp-content/uploads/2019/06/20190626-SOV-v-3M-et-al-Complaint-AFFF-FILE-STAMPED-COPY.pdf.

[83] *Id.* at 50.

[84] *Id.* at 51; Vt. Stat. Ann. tit. 10, § 1410 (2012).

[85] Compl. at 53, Vermont v. 3M Co. (Vt. Super. Ct. 2019).

for failure to warn,[86] (5) negligence,[87] (6) public nuisance,[88] (7) private nuisance,[89] (8) trespass,[90] and (9) violation of the Vermont Voidable Transactions Act.[91] Vermont is requesting a jury trial and asking for both compensatory and punitive damages.[92]

3. Minnesota

The Minnesota Department of Health (MDH) has issued "health-based values" on PFOS, PFOA, PFBS, PFBA, and PFHxS. In April 2019, the State updated their PFOS advisory level to 15 ng/l (from 27 ng/l) and set an advisory of 47 ng/l for PFHxS.[93] In March 2019, after testing over 2700 private wells and public water supplies, MDH issued over 1,100 drinking water advisories.[94] In the 2019 legislative session, the Minnesota legislature banned the use of PFAS firefighting foams in testing and firefighting training exercises,[95] passed a quarter of a million dollars in funding to study the effect of PFAS on raptors,[96] and prohibited manufacturers and wholesalers from selling, distributing, or offering to sell any PFAS firefighting foams except at oil refineries, airports, and the Camp Ripley base.[97]

In 2018, on the day it was supposed to go to trial, Minnesota settled their 8-year-old, $5 billion suit against 3M for $850 million.[98] The State is using those funds for safe drinking water and natural resource projects.[99] In addition to the 2018 settlement, 3M is also bound by a 2007 Consent Order between Minnesota and 3M over the release of PFAS at three specific sites in the State. The order requires 3M to fund all costs for "remedial investigations and response actions to address" discharges and to "cover all drinking water expenses due to the contamination" even after the settlement money runs out, as well as pay for remediation costs for three contaminated disposal sites in the State.[100]

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[86] *Id*. at 55.
[87] *Id*. at 58.
[88] *Id*. at 61.
[89] *Id*. at 64.
[90] *Id*. at 65.
[91] *Id*. at 67; Vt. Stat. Ann tit. 9, § 2285, *et seq*. (2018).
[92] Compl. at 2, Vermont v. 3M Co. (Vt. Super. Ct. 2019).
[93] MINN. DEP'T OF HEALTH, PERFLUOROALKYL SUBSTANCES (PFAS), https://www.health.state.mn.us/communities/environment/hazardous/topics/pfcs.html#guidancerelease (last visited Feb. 14, 2020).
[94] *Id*.
[95] H.B. 359, 91st Reg. Sess. (Minn. 2019).
[96] S.B. 7A, 1st Spec. Sess. (Minn. 2019).
[97] S.B. 2314 91st Reg. Sess. (Minn. 2019).
[98] Bob Shaw, *Minnesota, 3M Reach Settlement Ending $5 Billion Lawsuit*, TWIN CITIES PIONEER PRESS (Feb. 20, 2018), https://www.twincities.com/2018/02/20/minnesota-3m-reach-settlement-ending-5-billion-lawsuit/.
[99] MINN. POLLUTION CONTROL AGENCY, SETTLEMENT AGREEMENT & CONSENT ORDER, 1-2, May 22, 2017, https://www.pca.state.mn.us/sites/default/files/pfc-3mchemolite-consent.pdf; *see also* 3M PFC SETTLEMENT, https://3msettlement.state.mn.us/ (last visited Feb. 14, 2020).
[100] MINN. POLLUTION CONTROL AGENCY, 3M SETTLEMENT: KEY FACTS (2019), https://3msettlement.state.mn.us/sites/default/files/3M%20settlement-FINAL.pdf.

4. Virginia

As of this writing, the Virginia General Assembly has adopted two bills related to PFAS. House Bill 586 directs the Commissioner of Health to study the levels of PFAS in drinking water across the State and recommend MCLs for PFOA, PFOS, and other PFAS for inclusion in regulations of the Board of Health applicable to waterworks.[101] House Bill 1257 directs the State Board of Health to adopt regulations establishing MCLs in public drinking water systems for PFOS, PFOA, and other PFAS.[102] A third bill addressing PFAS in food packaging was continued to 2021.[103] If signed by the Governor, these laws would join an existing ban on PFAS in firefighting foam.[104]

The recent Environmental Working Group study of PFAS hot spots identified ten locations in Virginia where PFAS levels exceeded the EPA recommended levels in water sources.[105] Military sites in the Tidewater area such as Fort Eustis and Langley Air Force Base show PFAS levels in the tens of thousands and even millions of parts per trillion, likely from widespread use of firefighting foam.[106] Several counties and cities also have elevated levels from previous industrial processes.[107] See Table 1 for a full list of sites from the EWG study.

Table 1: Known PFAS Sites in Virginia [108]

PFAS Location	*Concentration & Type*	*Suspected Source*
Fort Eustis, Newport News – Groundwater	PFOA 4,600 ppt PFOS 73,000 ppt	Firefighting foam
Naval Air Station Oceana, Virginia Beach – Groundwater	Combined PFOA/PFOS 493,600 ppt	Firefighting foam
Norfolk Virginia Naval Base, Norfolk – Groundwater	Combined PFOA/PFOS 3,373 ppt	Firefighting foam
Naval Auxiliary Landing Field Fentress, Chesapeake	Combined PFOS/PFOA: - Drinking water 1,660 ppt - Groundwater 52,900 ppt	Firefighting foam
Langley Air Force Base, Hampton – Groundwater	PFOA 26,000 ppt PFOS 2,200,000 ppt	Firefighting foam
Henrico County: Richmond International Airport - Groundwater	PFNA 50 ppt PFOA 588 ppt PFOS 1,680 ppt	Firefighting foam
Richmond: James River - Surface water	PFOA 7,500 ppt	Industrial Manufacturing

[101] H.B. 586, 2020 Sess. (Va. 2020).
[102] H.B. 1257, 2020 Sess. (Va. 2020).
[103] H.B. 1712, 2020 Sess. (Va. 2020).
[104] VA. CODE ANN. § 9.1-207.1(B) (2020).
[105] *EWG*, *supra* note 10.
[106] *Id.*
[107] *Id.*
[108] *Id.*

Prince William County Service Authority's East End Service Area - Drinking water	PFHpA 12 ppt	Industrial Manufacturing
Washington County Service Authority - Drinking water	PFOA 22 ppt	Industrial Manufacturing
NASA Wallops Flight Center, Chincoteague - Drinking water	Total PFAS 70 ppt	Firefighting foam

In the Tidewater region, PFAS could be an additional issue facing an underway project to restore the Potomac Aquifer. The Hampton Roads Sanitation District's Sustainable Water Initiative for Tomorrow (SWIFT) project treats wastewater in Hampton Roads before injecting it back into the aquifer.[109] SWIFT uses a combination of sedimentation, ozone, biologically active carbon (BAC), granular activated carbon (GAC), ultraviolet light (UV), and chlorine to filter water before reinjecting it into the Potomac Aquifer.[110] Because the carbon-fluorine bond is chemically inert, PFAS are resistant to biological and oxidative processes.[111] Thus, the UV, ozone, and BAC steps will not remove PFAS from the water. However, GAC, as the most studied treatment for PFAS removal,[112] offers known, effective filtration that should serve SWIFT well. While not perfect, GAC is the current water treatment standard for removing PFAS[113] and can remove 90% of PFOA.[114] Going forward, the biggest issue facing SWIFT, and other water treatment facilities, is the effectiveness of any current filtering strategy against the newer forms of PFAS that are not as well studied.[115]

IV. LEGAL ACTION

In addition to state government regulation, citizens and environmental groups are also taking action to demand PFAS clean up. As mentioned above, states have had success suing large companies that produce PFAS like 3M and Dupont,[116] and recent action by the Southern Environmental Law Center (SELC) provides a potential model for how private citizens can show standing and harm when suing for relief from PFAS contamination. In November 2019, SELC sent a Notice of Intent to sue to the city of Burlington, North Carolina for violations of the federal Clean Water Act (CWA) and Resource Conservation and Recovery Act (RCRA).[117] The letter

[109] HAMPTON ROADS SANITATION DISTRICT, *What is SWIFT?*, https://www.hrsd.com/swift/about (last visited Mar. 5, 2020); s*ee also* CONOR M. JENNINGS, VA. COASTAL POLICY CTR., GROUNDWATER INJECTION PROJECTS: MITIGATING THE RISK OF EMERGING CONTAMINANTS 1 (2018), https://law.wm.edu/academics/programs/jd/electives/clinics/vacoastal/reports/emergingcontaminantsfinal2.pdf.
[110] *Id.* at 5-7.
[111] *See* Rahman et al., *supra* note 2, at 322.
[112] READE ET AL., *supra* note 36, at 52.
[113] *Id.*
[114] *Id.* at 52-53.
[115] *Id.*
[116] *See* section 3(b) ii-iii *supra*.
[117] Letter from Kelly Moser, Geoff Gisler, & Jean Zhuang, Southern Envtl. Law Center, to The Honorable Ian Baltutis, Mayor, City of Burlington at 1 (Nov. 7, 2019),

alleged that two wastewater treatment plants (WWTP) are illegally discharging PFAS into local waterways.[118] SELC is representing the Haw River Assembly (HRA), a non-profit corporation dedicated to protection of the Haw River, which is downstream of the WWTPs.[119]

As an entity with nearly 900 members who live near, drink from and use the Haw River, HRA believes it can demonstrate the necessary harm to achieve standing to sue.[120] HRA collected its own data about PFAS contamination in the waterways surrounding Burlington.[121] Although PFAS are not yet classified as a hazardous compound by the federal government, SELC pointed in its letter to the developing scientific literature demonstrating clear harm from PFAS exposure.[122]

SELC's legal theory asserts violations of the CWA and RCRA.[123] The CWA prohibits the discharge of pollutants into waterways without a permit, and, in the letter, SELC argued that PFAS is a harmful pollutant that the WWTPs are discharging without a permit.[124] Thus, SELC points to the WWTPs as the point source, and uses current scientific research to support the characterization of PFAS as a pollutant. HRA collected samples of water discharged from the WWTPs to show they are the source of the PFAS. RCRA allows citizens to sue when there is disposal of solid or hazardous waste that endangers the environment, and SELC points to the WWTPs' biosolid discharge as a qualifying solid disposal that also contains PFAS and is therefore harming the environment.[125]

While SELC's case against Burlington has not yet commenced, it provides a model for framing the standing, harm, and legal violation issues that citizens face when seeking relief from PFAS contamination. In other litigation, in December 2018, seventy-five cases brought by firefighters and localities involving 3M firefighting foam were consolidated as multidistrict litigation (MDL) and transferred to the District of South Carolina and are currently pending.[126] In addition to pending litigation, influential and completed litigation includes the Ohio River Valley

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https://www.southernenvironment.org/uploads/words_docs/2019_11_07_-Notice_of_Intent_-_City_of_Burlington_.pdf.

[118] *Id.* at 2.

[119] *Id.* at 3.

[120] *Id.*

[121] *Id.* at 12-17.

[122] *Id.* at 6-7.

[123] *Id.* at 1.

[124] *Id.* at 19.

[125] *Id.* at 27-28.

[126] *In re:* Aqueous Film-Forming Foams Products Liability Litigation, 357 F. Supp. 3d 1391, 1395 (J.P.M.L. 2018); Aaron Leibowitz, *3M Fire Suppressant MDL Will Be Heard In South Carolina*, LAW360 (Dec. 11, 2018), https://www.law360.com/articles/1109934. Judge Richard M. Gergel, who will hear the case in the District of South Carolina, held a "Science Day" in October prior to trial where experts arranged by both the plaintiffs and defendants explained how PFAS work, how they are used, and their potential dangers. David Shultz, *Judge Asks for Crash Course in the Science of PFAS Chemicals*, Bloomberg Env't, Oct. 4, 2019, https://news.bloombergenvironment.com/environment-and-energy/judge-asks-for-crash-course-in-the-science-of-pfas-chemicals.

class action suit, certified in 2004 for persons in the Parkersburg, West Virginia regional area.[127] The original case, *Leach v. E. I. DuPont*, was settled after confidential negotiations in February 2005 for $70 million to plaintiffs and an additional $30 million for a health study into the effects of PFAS contamination on people's health.[128] The settlement also required the installation of "state-of-the-art water treatment technology for the six identified water districts and private wells" for affected residents, which subsequent research has found reduced blood serum levels of PFOA by 40-60%.[129] Finally, common law claims have also been used by citizens seeking relief and include the following causes of action with representative examples:

- Natural Resource Damages - In 2018, Minnesota and 3M entered into a settlement agreement resolving a suit by the state over toxic discharge from a 3M plant.[130] As part of the agreement, 3M will reimburse the Minnesota Pollution Control Agency for damages to state natural resources caused by PFAS discharge.[131]
- Injury to Property - Landowners with property surrounding a Saint-Gobain's chemical plant in New Hampshire sued the company for harming their property by releasing a form of PFOA that migrated to the soil and groundwater.[132] The court held that the plaintiffs alleged compensable injury under the common law torts of trespass and nuisance, since PFOA harmed their property through a diminution in value, which in turn harmed the plaintiffs themselves.[133]
- Medical Monitoring Damages - A majority of states allow damages to pay for medical monitoring of likely future medical harm.[134] Courts do not require a showing of present physical injury, as long as plaintiffs can show a significantly increased risk to health that is not speculative.[135] With the adverse health effects of PFAS becoming clearer, courts are willing to consider medical monitoring for effects of exposure to PFAS discharge.[136]
- Consumer Fraud - The State of New Jersey, its localities, and local fire departments are suing 3M and other chemical companies for violations of state anti-fraud acts.[137] The plaintiffs' argument is that 3M knowingly offered PFAS-tainted firefighting foam for sale without

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[127] HILL, PETERSON, CARPER, BEE & DEITZLER, PLLC, C8 CLASS ACTION SETTLEMENT, https://www.hpcbd.com/Personal-Injury/DuPont-C8/C8-Class-Action-Settlement.shtml (last visited Feb. 14, 2020).
[128] Class Action Settlement Agreement at 13-14, Leach v. E.I. du Pont de Nemours Co., No. 01-C-608 (W. Va. Cir. Ct. 2005), https://www.hpcbd.com/dupont/Settlement-Agreement.pdf (last visited Feb. 14, 2020).
[129] *Id*; Robert L. Herrick et al., *Polyfluoroalkyl Substance Exposure in the Mid-Ohio River Valley, 1991-2012*, 228 ENV'T POLLUTION 50, 50 (2017), doi:10.1016/j.envpol.2017.04.092.
[130] Agreement and Order, Minn. v. 3M, No. 27-CV-10-28862 (Minn. Fourth Jud. Dist. Ct. 2018), http://www.mncourts.gov/mncourtsgov/media/High-Profile-Cases/27-CV-10-28862/Agreement-and-Order.pdf (last visited Mar. 16, 2020).
[131] *Id.* at 6.
[132] Brown v. St. Gobain Performance Plastics Corp., 2017 U.S. Dist. LEXIS 200490, at *5-*6 (D. N.H. 2017).
[133] *Id.* at *10-*11.
[134] *See* Exxon Mobil Corp. v. Albright, 71 A.3d 30, 80 (Md. 2013).
[135] *Id.*
[136] *Brown*, 2017 U.S. Dist. LEXIS 200490 at *16.
[137] Compl., Grewal v. 3M Co., MER-L-000953-19 (N.J. Super. Ct. Law Div. 2019), https://www.nj.gov/oag/newsreleases19/AFFF_Complaint.pdf (last visited Mar. 20, 2020).

disclosure of the health risks associated with PFAS contamination.[138] This amounted to a deceptive sales practice that is compensable under state anti-fraud laws.[139]

- Strict Products Liability - In the same New Jersey litigation, the plaintiffs are alleging a two count product liability claim.[140] First, they claim that the presence of PFAS in 3M firefighting foam is a design defect that 3M knew would harm the environment, creating an unreasonably dangerous product.[141] Second, the plaintiffs argue that 3M breached its duty to warn the state, as trustee of all state natural resources, of the foreseeable harm that releasing PFAS into the environment would cause.[142]
- Public Nuisance - New Jersey also asserted a public nuisance allegation in its complaint.[143] The plaintiffs argued that natural resources like groundwater and soil are held in trust by the state for the common use of the general public.[144] Firefighting foam containing PFAS unreasonably interferes with the use of these resources by the public and the state.[145]
- Class Action Suits - In addition to the cases in South Carolina and West Virginia already mentioned, a group of rural utilities (and one locality) sued 3M in a class action suit over clean-up costs caused by PFAS in firefighting foam.[146] The complaint included several claims already discussed, including design defect,[147] failure to warn,[148] public nuisance,[149] and trespass.[150] As these cases move forward, the viability of these claims will continue to become clearer.

V. RECOMMENDATIONS AND FUTURE CONSIDERATIONS

Recommendations to address PFAS contamination can be consolidated into three branching categories: (1) addressing military sites, (2) addressing existing contamination at other sites, and (3) preventing future contamination.

A. Military Sites

Some primary sites of concern with known high PFAS contamination levels in Virginia are at and around military sites which the Commonwealth does not control.[151] Under the provisions

[138] *Id.* at 60-61.
[139] *Id.* at 60.
[140] *Id*, at 38, 45.
[141] *Id.* at 38-40.
[142] *Id.* at 45-46.
[143] *Id.* at 55.
[144] *Id.* at 55-56.
[145] *Id.* at 56.
[146] Compl., City of Millington v. 3M Co., No. 1:20-cv-00546 (Dist. D.C. 2020), https://www.bloomberglaw.com/document/X1Q6O69VVAO2/download?imagename=1-1.pdf.
[147] *Id.* at 30.
[148] *Id.* at 32.
[149] *Id.* at 34.
[150] *Id.*
[151] *See EWG*, *supra* note 10.

of the 2020 NDAA that did pass, the Governor could request the Secretary of Defense to create a cooperative agreement to address testing, monitoring, removal, and remedial action for PFAS contamination around military sites in Virginia.[152] Taking advantage of this opportunity could help Virginia, with its high military presence, address some of the most pressing PFAS contamination in the Commonwealth. Virginia, and many other states, will also benefit from the phase-out of PFAS-laden firefighting foam by the DoD.[153]

B. Existing Contamination

In order to address existing PFAS in the Commonwealth, Virginia first needs an accurate picture of where and who is affected. The legislature could start by instructing the Department of Environmental Quality (DEQ) and Virginia Department of Health (VDH) to perform investigations at PFAS at-risk sites as well as compile a state-wide survey of PFAS levels in public water supplies. Indeed, current legislation in the General Assembly would help spur increased monitoring.[154]

Virginia could establish testing priorities for areas near former PFAS manufacturing or processing facilities, fire-fighting training stations, and communities adjacent to military bases, airports, and landfills. Under legislation adopted by the General Assembly this year, Virginia would develop a MCL for PFAS, which then could be used as a reference to define high risk areas.[155]

C. The End of Forever? – Preventing New Contamination

In order to break the "never ending story of PFAS," the states will have to pursue new ways to address chemical contamination in the drinking water of their citizens. Rather than wait for potential federal regulations to be adopted, the Commonwealth can follow the precedent of states on the frontlines of PFAS regulation like New Jersey, Vermont, and Minnesota, while also adhering to the precautionary principle[156] to protect the quality of its drinking water for the future. The precautionary principle can help guide states, localities, and agencies when deciding how to manage the mounting problem of PFAS.[157]

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[152] NDAA § 329(a).
[153] NDAA § 322(c).
[154] H.B. 586, 2020 Sess. (Va. 2020). As of March 20, 2020, H.B. 586 has passed both houses of the Virginia General Assembly and has been communicated to the Governor. H.B. 1257, 2020 Sess. (Va. 2020). As of March 20, 2020, H.B. 1257 has passed both houses of the Virginia General Assembly and has been communicated to the Governor.
[155] H.B. 586, 2020 Sess. (Va. 2020), H.B. 1257, 2020 Sess. (Va. 2020).
[156] "Precautionary principles are the foundations for policy when it has to deal with weakly understood causes of potential catastrophic or irreversible events, and where protective decisions require certain and costly policy interventions that may not solve the problem that they are designed to correct." JAYDEE HANSON, ENCYCLOPEDIA OF THE ANTHROPOCENE: PRECAUTIONARY PRINCIPLE: CURRENT UNDERSTANDINGS IN LAW AND SOCIETY 361 (Dominick A. Dellasala & Michael I. Goldstein eds., 2018).
[157] *See* Ian Cousins et al., *The precautionary principle and chemicals management: The example of perfluoroalkyl acids in groundwater*, 94 ENV'T INT. 331 (2016), https://doi.org/10.1016/j.envint.2016.04.044.

There are multiple ways that Virginia could build on its ban of PFAS-laden firefighting foam for training and testing purposes,[158] and implement a precautionary approach to address PFAS that would allow the Commonwealth to ensure the health of its citizenry while staying ahead of federal requirements – if, and when, they are implemented. The Commonwealth could set a binding health advisory limit for known PFAS compounds (like New Jersey); have DEQ and VDH develop and implement drinking and groundwater regulations for PFAS as a class (like pending legislation in Vermont); and promote best PFAS alternative practices, products, and chemicals.

D. CONCLUSION

The thousands of PFAS compounds are united by their similar structures and properties that allow them to persist and move quickly through the environment. Although the hazards of exposure continue to be documented, the vast majority of the class remains unknown and unstudied. In the absence of strong federal guidance, many states have initiated testing, remediation, and litigation to address the mounting issue. While a handful of the most egregiously affected citizens have brought successful claims against companies, PFAS is a prevalent nationwide problem that is not abating soon. Decades of manufacture have created a problem in nearly every state that requires containment and prevention. Virginia has the opportunity to take advantage of the groundwork and research done by other states to address PFAS while retaining the ability to be on the cutting edge of dealing with this issue.

[158] VA. CODE § 9.1-207.1(B) (2019).

APPENDIX 1

Adopted PFAS Legislation by State as of March 20, 2020[159]

Arizona	SB 1526: Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019)
California	AB 1879: Establishes a process to identify, prioritize and evaluate chemicals of concern in consumer products, determine how best to limit exposure or reduce the level of hazard, and establishes green chemistry challenge grants and a Green Ribbon Science Panel (Adopted in 2008) AB 756: Requires public water systems to monitor for PFAS. (Adopted in 2019)
Colorado	HB 19-1279: Prohibits the sale of PFAS-containing firefighting foam in certain circumstances, prohibits the use of PFAS foam for training, requires manufacturers to disclose if protective equipment they produce includes PFAS, and requires the Department of Health to conduct a survey to determine the amount of PFAS foam currently held, used, and disposed by fire departments. (Adopted in 2019)
Georgia	HB 458: Prohibits the use of PFAS-containing firefighting foam for testing purposes. (Adopted in 2019)
Kentucky	SB 104: Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019)
Maine	LD 2048: Identifies chemicals of high concern, and requires reporting on usage and replacement with safer alternatives. (Adopted in 2008) LD 1129: Selects up to seventy chemicals as Chemicals of High Concern based upon likely exposure to children or fetuses and uses this list to designate Priority Chemicals which will require reporting and disclosure when used in children's products. (Adopted in 2011) LD 1433: Prohibits the sale of food packaging with intentionally added toxic heavy metals, PFAS, or phthalates. (Adopted in 2019)
Minnesota	HF 2123: Generates a list of chemicals of high concern and priority chemicals, along with participation in Interstate Chemicals Clearinghouse. (Adopted in 2009) HF 2209: Bans manufacture and sale of organohalogen flame retardants in residential upholstered furniture, children's products, residential textiles, and mattresses. Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019) SF 321: Bans manufacture and sale of halogenated, phosphorus-based, nitrogen-based, and nanoscale flame retardants in residential upholstered furniture, children's products, and residential and business textiles. Prohibits the manufacture and sale of PFAS-containing firefighting foam. (Adopted in 2019)

[159] SAFER STATES, *supra*, note 58. In addition to these enacted bills, there are currently 142 bills in progress in state legislatures. *Id.*

New Hampshire	SB309: Requires the commissioner of the department of environmental services to adopt a state drinking water standard, and ambient and surface groundwater standards for perflurochemicals.(Adopted in 2018) HB 737: Establishes a commission to investigate and analyze the environmental and public health impacts relating to releases of perfluorinated chemicals in the air, soil, and groundwater in Merrimack, Bedford and Litchfield. (Adopted in 2019) SB 257: Prohibits the manufacture, sale, use, and purchase of firefighting foams containing PFAS. (Adopted in 2019)
New York	A 445: Prohibits the manufacture, sale, and distribution for use of firefighting foam containing PFAS. (Adopted in 2019)
North Carolina	S99: State budget included funding for university research to monitor for PFAS in rivers, provisions for alternative water supplies for residents near a factory that has contaminated nearby wells, and funding for studies of downstream impacts. (Adopted in 2018)
Oregon	SB 478: Establishes a list of high priority chemicals of concern for children's products, posts the list online, requires manufacturer disclosure of these chemicals, and requires their eventual removal. Authorizes participation in the Interstate Chemicals Clearinghouse. (Adopted in 2015)
Vermont	S 239: Establishes a process for identifying chemicals of high concern; prohibits sale or distribution of consumer products containing priority chemicals. (Adopted in 2014) S10: Creates liability and penalties for contaminating water supplies with perfluorinated chemicals. (Adopted in 2017) S 49: Sets Maximum Contaminant Levels for 5 PFAS chemicals in water of 20ppt each and cumulatively, requires testing for PFAS chemicals, and requires landfills to treat leachate to remove PFAS chemicals. (Adopted in 2019)
Virginia	H 2762: Prohibits the use of PFAS-containing firefighting foam for training purposes. (Adopted in 2019)
Washington	HB2658: Prohibits the manufacture and sale of food packaging containing PFAS chemicals and requires the Department of Ecology to conduct an assessment on safer alternatives. (Adopted in 2018) HB2793: Prohibits the manufacture and sale of class B firefighting foam containing PFAS chemicals. (Adopted in 2018) HB 1194: Directs the Department of Ecology to identify and take regulatory action on consumer products that are a significant source of chemicals that are a concern for sensitive populations and species. Prioritizes PCBs, PFAS, organohalogen flame retardants, phthalates, and phenolic compounds (BPA, APEs) for initial consideration. (Adopted in 2019) HB 2265: Eliminates exemptions from restrictions on use of PFAS-containing firefighting foam. (Adopted in 2020)