Chemours Response to “Petition to Require Health and Environmental Testing Under the Toxic Substances Control Act on Certain PFAS Manufactured by Chemours in Fayetteville, North Carolina”

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I. Executive Summary

A coalition of six groups ("Petitioners") filed a Petition under Section 21 of the Toxic Substances Control Act ("TSCA") requesting the Environmental Protection Agency ("EPA" or the "Agency") to issue regulations or administrative orders under EPA's TSCA Section 4 testing authority to require The Chemours Company ("Chemours") to generate health and environmental effects testing on 54 per- and polyfluoroalkyl substances ("PFAS") allegedly produced at Chemours' Fayetteville Works facility (hereinafter the "Petition Compounds").

Petitioners assert that there is very limited information regarding many of these substances but, because of alleged chemical similarity to certain other PFAS, all of these substances should be considered to present an unreasonable risk to health and the environment. Based on this alleged unreasonable risk, Petitioners have asked EPA to issue a rule or administrative order pursuant to TSCA Section 21 to require Chemours to undertake and complete an extensive set of studies on each of the Petition Compounds.

For EPA to grant the Petition, Petitioners must set forth facts which establish that its proposed action under Section 4 is necessary. Under Section 4, that means that Petitioners must demonstrate that: (1) EPA lacks sufficient information and experience to reasonably evaluate the risk of the Petition Compounds, (2) these substances may present an unreasonable risk of injury to health or the environment, and (3) testing under Section 4 is necessary to develop the information EPA needs to evaluate the potential risk. Petitioners have not set forth facts that establish any of the three factors.

As to available information, the Petition omits a number of highly-relevant sources of information regarding the Petition Compounds. EPA should consider the full set of available information, and conclude that Petitioners have failed to meet their burden of demonstrating that there is insufficient information from which EPA might evaluate the risk from the Petition Compounds.

Taking into consideration all information that is reasonably available, EPA should also conclude that Petitioners have not presented information indicating that there is an unreasonable risk presented by the Petition Compounds. While Petitioners assume that each of these substances share a toxicological profile with other PFAS (particularly PFOA and PFOS), and create widespread exposure in the vicinity of Fayetteville Works, available information contradicts both of those assumptions. The available toxicological and exposure data do not indicate that there are adverse effects from these Petition Compounds at the levels at which they are found in the environment near Fayetteville Works, and Petitioners provide no information to the contrary. Current PFAS discharges at Fayetteville Works are also subject to extensive release control measures as provided in the site's permits and the Consent Order with the North Carolina Department of Environmental Quality ("NC DEQ"). The purported unreasonable risk set forth in the Petition is drawn from speculation by Petitioners rather than from available information.

Finally, there is no basis to find that the extensive animal testing for each of the Petition Compounds that Petitioners request is "necessary" for EPA to evaluate the risk of the substances. Launching into large-scale testing programs for every chemical, impurity or byproduct that might be unintentionally generated or found to be present in the area of a facility even in trace

quantities is contrary to the TSCA risk assessment and information gathering procedures, and does not comport with basic scientific principles. EPA already is using its resources and experience to address potential PFAS-related concerns and data gaps through its comprehensive PFAS Action Plan, and is evaluating potential risks in a stepwise process rather than an indiscriminate rush into immediately testing the Petition Compounds without reasonable justification.

Chemours supports science-based regulations and has worked with EPA and other regulators to develop and expand scientific knowledge concerning PFAS, including on issues of analytical chemistry, environmental fate and transport, toxicology and remediation. Chemours also understands that perceived issues surrounding PFAS are important to members of the public, including those in communities near its facilities. But precisely because of the importance of the issue, it is critical that scientific studies be carefully designed, implemented and used. In that regard, it bears emphasis that the Petition deals with PFAS issues in North Carolina and that NC DEQ is addressing PFAS concerns relating to the Fayetteville Works facility, including the precise issues which the Petition seeks to address. Among other things, NC DEQ (along with one of the present petitioners) entered into a 2019 judicial Consent Order with Chemours which, among many other things, requires Chemours to undertake extensive toxicological studies of five specified PFAS compounds viewed as a priority by NC DEQ, each of which is among the 54 cited in the Petition. Those studies are ongoing and the Petitioners' request to expand those ongoing studies more than ten times over even before the results of the studies are complete is without merit.

In sum, the Petition is based on unjustified assumptions regarding the Petition Compounds and seeks to require EPA to launch an ineffective, costly, and ill-considered testing regime and to do so in a manner that would affect only one company. Instead, EPA should, after considering all of the relevant information, including information not referenced in the Petition, reject the Petition's invitation to short circuit EPA's normal risk assessment and information gathering procedures. The Petition should be denied.

II. Legal Standard

Petitioners have filed a petition pursuant to Section 21 of TSCA (15 U.S.C. § 2620) seeking to have the Administrator issue a "rule or order under section 4 of TSCA compelling Chemours to fund and carry out [] testing under the direction of a panel of independent scientists."[1] Under Section 21, such a petition must "set forth the facts which it is claimed establish that it is necessary to issue, amend, or repeal a rule.[2]" Indeed, "a petitioner is required to provide the EPA with all of the facts needed to review the petition and reach a decision that is consistent with the overall statutory scheme," meaning that "it is not unreasonable to think that the petitioner could be tasked with producing substantial information." *Food & Water Watch, Inc. v. United States Envtl. Prot. Agency*, No. 17-CV-02162-EMC, 2019 WL 8261655, at *12 (N.D. Cal. Dec. 30, 2019).

[1] Petition at 1.
[2] 15 U.S.C. § 2620(b)(1).

EPA must make a decision to deny the petition, or grant the petition and "promptly commence an appropriate proceeding," within 90 days of receipt of the petition.[3] Under Section 4, in order to establish a rule or order requiring the testing that petitioners seek here, EPA must determine that:

> (I) the manufacture, distribution in commerce, processing, use, or disposal of a chemical substance or mixture, or that any combination of such activities, may present an unreasonable risk of injury to health or the environment,
>
> (II) there is insufficient information and experience upon which the effects of such manufacture, distribution in commerce, processing, use, or disposal of such substance or mixture or of any combination of such activities on health or the environment can reasonably be determined or predicted, and
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> (III) testing of such substance or mixture with respect to such effects is necessary to develop such information.[4]

The United States Court of Appeals for the District of Columbia Circuit has clarified that in order for EPA to grant a Section 21 petition seeking to have EPA issue a rule or order under 15 U.S.C. § 2603(a)(1)(A)(i), EPA "must have a more-than-theoretical basis for concluding that some amount of exposure takes place and that toxicity at that level of exposure suffices to present an 'unreasonable risk of injury to health.'" *Chem. Mfrs. Ass'n v. U.S. E.P.A.*, 859 F.2d 977, 986 (D.C. Cir. 1988); *see also Ausimont U.S.A., Inc. v. EPA*, 838 F.2d 93, 97 (3d Cir.1988) (Section 4 rule should not be issued "based on little more than scientific curiosity" or if the existence of exposure were "merely a remote possibility founded on theoretical factual situations"). Additionally, "the degree to which a particular substance presents a risk to health is a function of two factors: (a) human exposure to the substance, and (b) the toxicity of the substance."[5] *Chem. Mfrs. Ass'n*, 859 F.2d at 986.

The 2016 amendments to Section 26 of TSCA raised the scientific standards that the Agency must meet when reaching a decision to undertake an action under Section 4. Specifically, when making a determination under Section 4 of the amended statute, EPA must employ the "best available science", and reach a determination based on the "weight of the scientific evidence", while taking into consideration all information that is "reasonably available" to the Agency concerning the substances in question (including hazard and exposure information), "under the conditions of use" of the substances.[6] Thus, Section 26 calls for the Agency to first exhaust its TSCA information-gathering authorities and review all of the information currently available before ordering testing under Section 4.

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[3] 15 U.S.C. § 2602(b)(3).

[4] 15 U.S.C. § 2603(a)(1)(A)(i). A Section 4 rule or order may also be justified under the criteria of 15 U.S.C. § 2603(a)(1)(A)(ii), but Petitioners are explicit that their request is only justified under the (a)(1)(A)(i) criteria. *See* Petition at 2. Additionally, Section 21 contains a similar standard that a district court must apply if EPA's determination is appealed. 15 U.S.C. § 2620(b)(4)(B).

[5] *Id*.

[6] *See* 15 U.S.C. §§ 2625(h)-(k).

III. Bases for Denial of Petition

A. Clarification of Petition Compounds

The Petition assumes that each of the 54 Petition Compounds is produced by Fayetteville Works and in substantial quantities. As depicted in Appendix 1, however, most of the Petition Compounds are byproducts or intermediates,[7] and for several Chemours does not understand them to be associated with operations at Fayetteville Works.[8] The Petition also omits, or overlooks, certain information for some of the compounds that would assist EPA in identifying the compounds. Thus, the identifying information known to Chemours for each of the Petition Compounds is also provided in Appendix 1.

B. Emissions of Certain of the Petition Compounds by Chemours are Decreasing and Expected to Decrease Further

While the Petition focuses on alleged PFAS discharges from Chemours' Fayetteville Works facility, it fails to account for Chemours's continuing work to reduce PFAS discharges and emissions from Fayetteville Works, which are comprehensive across the facility and have already dramatically reduced such discharges and emissions. On February 25, 2019, the Superior Court for Bladen County entered the Consent Order among Chemours, NC DEQ, and Cape Fear River Watch (a party to the instant Petition). The Consent Order was entered in an action entitled "State of North Carolina, ex rel, Michael S. Regan, Secretary, North Carolina Department of Environmental Quality, Plaintiff, and Cape Fear River Watch, Plaintiff-Intervenor, v. The Chemours Company FC, LLC, Defendants."[9] The Consent Order was subject to a public comment process, voluminous public comments were received[10], and extensive changes were made to the Consent Order in light of the comments.

In line with the Consent Order, Chemours has virtually eliminated discharges and emissions of PFAS from its ongoing manufacturing operations at Fayetteville Works. Since 2017 Chemours has captured all of its process wastewater for safe off-site disposal, which has reduced levels of one group of PFAS that had been the subject of significant attention, referred as GenX, in the Cape Fear River by at least 95%, and is working with NC DEQ to renew the NPDES permit for its main outfall and any associated discharges of process wastewater. Chemours has also installed, and continues to operate, a $100 million thermal oxidizer facility, which is destroying over 99.99% of PFAS air emissions routed to it as provided in the Consent Order.

Pursuant to the Consent Order, Chemours also continues to implement an expansive program to sample private drinking water wells in the vicinity of Fayetteville Works and provide replacement drinking water supplies to qualifying residences and other private well users. As Chemours reported in its last Consent Order quarterly progress report to NC DEQ and Cape Fear River Watch, approximately 2,500 residences are receiving bottled water, and whole building

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[7] Some of the Petition Compounds may be substances that are not intentionally manufactured at Fayetteville Works for commercial purposes as chemical substances *per se*, but may have been unintentionally generated or formed upon contact with other chemicals that may have been present during disposal or already in the environment.
[8] Those substances not associated with Fayetteville Works are discussed further below.
[9] https://files.nc.gov/ncdeq/GenX/2019-02-25-Consent-Order---file-stamped-and-fully-executed--b--w-.pdf.
[10] *See* https://files.nc.gov/ncdeq/Chemours-Comments---2.22.19.pdf.

granular activated carbon ("GAC") or under sink reverse osmosis ("RO") filtration systems have been installed at over 1,200 residences.[11]

Many scientific studies have been commenced under the Consent Order and a number of these studies remain ongoing. Most importantly, and most relevant to the pending Petition, the Consent Order requires an initial set of mammalian toxicity and ecological toxicity studies on five PFAS (PFMOAA, PMPA, PFO2HXA, PEPA, and Hydro-PS Acid[12]) following applicable EPA protocols.

The toxicity studies required by the Consent Order are in progress. Because each of the five substances are byproducts generated during operations in very small quantities, much smaller than needed for animal testing, Chemours had to first contract with outside laboratories to generate sufficient quantities of some substances to meet the testing needs. Production of four of the five chemical substances is complete, while for the fifth substance (Hydro-PS Acid) the laboratories have had difficulties producing pure samples; however, production of that substance is expected to be completed soon. For the four other substances, initial "range finding" studies are being completed, and the remaining protocols will be finalized with NC DEQ. Chemours's expectation is that the studies will be completed in 2021 or 2022.

In addition to all of the activities noted above, Chemours also has been focused on reducing the remaining loadings of PFAS at Fayetteville Works to the Cape Fear River, as provided for in the Consent Order, as well as in the Addendum to Consent Order Paragraph 12 entered by the Bladen County Superior Court on October 12, 2020.[13] The remaining areas of PFAS contamination at the site, and associated discharges therefrom, are almost entirely the legacy of prior operations. Scientific studies by Chemours's consultants have identified the largest remaining sources of loadings to the Cape Fear River as (i) a drainage channel called Old Outfall 002, (ii) four groundwater seeps originating from under the facility, and (iii) other groundwater from under the facility that is migrating to the River. Each of these sources is being remediated as follows:

- Pursuant to the Consent Order and a NPDES permit issued by DEQ, Chemours began operation on September 30, 2020 of a capture and treatment system for Old Outfall 002 that is required to be at least 99% effective in controlling indicator PFAS compounds.
- Pursuant to the Consent Order Addendum, Chemours is currently in the process of installing interim systems to treat and reduce PFAS loadings caused by the seeps. The interim systems are flow-through cells containing carbon treatment, constructed in the existing seep channels. The initial flow-through cell began operation on December 16, 2020 and the system is expected to be fully operational in the first half of 2021.
- Under the Addendum, Chemours also is taking multiple measures to address PFAS loadings from onsite groundwater. The most extensive of these measures is

[11] *See* https://www.chemours.com/en/-/media/files/corporate/fayetteville-works/28-ncdeq-quarterly-progress-report-10282020.pdf.
[12] As reflected in Appendix 1, this substance is referred to by a descriptive chemical name, "Hydro-PS Acid." In Consent Order Attachment B, this substance was referred to as "Nafion Byproduct 2."
[13] https://files.nc.gov/ncdeq/GenX/consentorder/10122020-Addendum-to-the-Chemours-Consent-Order.pdf.

expected to be the construction of an underground barrier wall to prevent migration of PFAS-containing groundwater to the River, and an extraction and treatment system (to a 99% level of control) on the facility's side of the barrier wall. This system is also expected to provide a long-term solution to the seep discharges by largely drying up the seeps or capturing and treating any remaining flow before it reaches the barrier wall.[14]

In sum, Chemours: (1) has virtually eliminated discharges and emissions of PFAS (including GenX) from its ongoing manufacturing operations at Fayetteville Works, (2) continues to implement an expansive program to sample private drinking water wells and provide replacement drinking water supplies to reduce potential exposure to PFAS already released, (3) is conducting many studies to advance the science on PFAS in a holistic way, including multiple toxicity studies of the type Petitioners seek, and (4) is reducing the remaining loadings of PFAS at Fayetteville Works to the Cape Fear River. Because the Petition presumes human and environmental exposures to each of the substances are sufficient to support a "may present an unreasonable risk" finding by EPA, the context provided by the Consent Order that any potential exposure to the substances is substantially decreasing is critically important to the consideration of the Petition.

C. There is Sufficient Information and Experience Upon Which The Effects of the Petition Compounds on Health or the Environment Can Reasonably be Determined or Predicted

Under Section 21, it is a petitioner's burden to "set forth the facts which it is claimed establish that it is necessary to issue, amend, or repeal a rule." [15] Under that standard, the Petition is incomplete regarding the available information on the Petition Compounds. For instance, Petitioners assert that, besides GenX and the substances subject to Consent Order testing, "[n]o health or environmental effects testing has been conducted on the remainder of the 54 PFAS."[16] To the contrary, and as described below, health or environmental effects data exist for many of the substances, and such information is publicly available. Moreover, EPA has decades of experience in evaluating the potential risk of chemical substances that have not been subjected to the full battery of tests that Petitioners seek for each of the Petition Compounds.

1. Experience

Petitioners allege the Agency has insufficient information and experience to reasonably determine or predict the effects of all 54 of the Petition Compounds identified in Petitioners' request for a Section 4 rulemaking. Yet, Petitioners are comfortable reaching the conclusion that all 54 of the Petition Compounds may present an unreasonable risk. Moreover, Petitioners

[14] The Addendum also addresses another source of remaining loadings to the River, albeit a smaller source, namely stormwater flow to the River through the facility's existing outfall to the River. Under the Addendum, Chemours will construct and implement a system by the first half of 2021 to capture and treat (again to a 99% level of control) the stormwater created during one-inch rain events from the facility's specified manufacturing area. The Addendum also provides for six other measures for Chemours to undertake to reduce PFAS loading to the Cape Fear River from stormwater and non-process wastewater.

[15] 15 U.S.C. § 2620(b)(1).

[16] Petition at 2.

contend that generating the data that would be required under the expansive and costly testing regime they propose is the only way in which EPA could acquire sufficient information to reasonably assess the risks all 54 substance might present. However, during the 40-plus years that EPA has administered the requirements of Section 5 of TSCA, the Agency has demonstrated its ability to review and reach regulatory determinations on tens of thousands of new chemical substances before they are permitted to enter US commerce. In so doing, the Agency has cultivated and enhanced its considerable experience in using limited, existing data, coupled with structural activity relationship (SAR) analyses, modeling, and other predictive tools to reach risk-based regulatory conclusions for new chemical substances before those substances may enter commerce in the United States. The Agency describes the new chemicals program as having "evolved into an efficient mechanism for identifying those new chemicals which are of greatest concern . . . [using] an integrated approach that draws on knowledge and experience across disciplinary and organizational lines to identify and evaluate concerns regarding health and environmental effects, exposure and release.."[17]

TSCA and the Agency's new chemicals regulations do not require that manufacturers of new chemical substances generate any new data prior to submitting a premanufacture notification to EPA for review. To this point, Section 5 of TSCA provides that, even in the absence of data on a new chemical substance, the Agency must make a regulatory determination concerning whether the new chemical may present an unreasonable risk to health or the environment—the very same finding Petitioners seek to make on EPA's behalf in the context of Petitioners' advocacy for a TSCA Section 4 order or rule. Notwithstanding the Petition, the Agency makes such determinations using "assessment methods, databases, and predictive tools to help evaluate what happens to chemicals when they are used and released to the environment and how workers, citizens, and the environment might be exposed to and affected by them. These tools [are used] when laboratory studies or monitoring data are not available or need to be supplemented."[18]

During the 40-year period following commencement of the TSCA new chemicals program, the Agency has reviewed and reached regulatory determinations concerning the potential entry to US commerce for nearly 60,000 new chemical notifications. The Agency's review process for new chemical notifications involves a "full life-cycle risk assessment of the substance" including "[c]hemistry, environmental fate, exposure and hazard (human and ecological) assessments" that are then "integrated to determine whether the chemical poses an unreasonable risk to human health or the environment under the conditions of use." As a result of such assessments, the Agency has concluded that fewer than 5,000 of such notifications (*i.e.*, less than 10% of the total cases reviewed) described circumstances that, in the absence of sufficient data, could be judged to meet the "may present" an unreasonable risk standard.[19] Moreover, for

[17] https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/epas-review-process-new-chemicals.

[18] *Id*. A detailed description of the Agency's decision making approach when reviewing new chemical notifications and reaching regulatory determinations under TSCA Section 5 (applying the same criteria established for test rules and orders by Section 4(a), is included in the Agency's "Working Approach to Making New Chemical Determinations Under TSCA": https://www.regulations.gov/document?D=EPA-HQ-OPPT-2019-0684-0001.

[19] EPA data indicate that Section 5(e) determinations have been reached and a Consent Order issued by EPA in fewer than 2,500 cases. Another nearly 2,500 cases were voluntarily withdrawn in response to EPA's preliminary

most of those determinations, the Agency also concluded that, under the terms of a Section 5(e) Consent Order specifying the manner in which the substance could be manufactured or processed, any unreasonable risks would be sufficiently mitigated.[20]

The TSCA Section 5 new chemical program demonstrates that, contrary to Petitioners' assertions, the Agency has both the capacity and experience needed to make risk-based determinations even in the absence of substance-specific data and to reach regulatory conclusions (and even establish controls) on the basis of the limited information available.

2. Information

EPA has developed sufficient experience to evaluate risks of chemical substances based even on limited information. However, EPA need not rely solely on that extensive experience here because there is significant existing toxicity and exposure data regarding the Petition Compounds, information that was not included or reasonably addressed in the Petition. As described in the following sections, EPA can draw on significant relevant data to evaluate the potential risks of the Petition Compounds without requiring further action under Section 4 of TSCA.

a. Toxicity

As the D.C. Circuit has described, the "the toxicity of the substance" is one factor for EPA to consider in deciding whether to grant a Section 21 petition seeking a rule or order under Section 4.[21] Here, valuable information exists regarding the toxicity of the Petition Compounds. This information comes in many forms: as whole effluent studies, as specific studies on discrete chemicals, and as information on chemical structure and function. As noted above, EPA has vast experience in evaluating the potential toxicity of chemical substances using this exact type of information. Additionally, much of this data has been generated by regulatory agencies rather than by Chemours, and EPA itself has already collated and is in the process of gathering significant additional data that will be relevant to EPA's evaluation of the potential risks of the Petition Compounds.

The Petition omits from its analysis much of the information described below. Given Petitioners' burden to demonstrate that a Section 4 rule or order is necessary, their failure to account for this relevant information is a critical flaw in their argument that existing information is insufficient. Moreover, where EPA has already embarked on a substantial effort to assess PFAS toxicity using methods entirely distinct from those proposed in the Petition, there is no reason for EPA to abandon its course due to a Section 21 petition based on flawed and incomplete analysis.

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regulatory findings. https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/statistics-new-chemicals-review.

[20] Approximately 2400 Section 5(e) Consent Orders (i.e., fewer than 5% of the total cases) have been issued since 1979, reflecting determinations made to require restrictions pending the development of additional information. https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/statistics-new-chemicals-review.

[21] *Chem. Mfrs. Ass'n v. U.S. E.P.A.*, 859 F.2d 977, 986 (D.C. Cir. 1988).

(i) Whole Effluence Toxicity Study Information

Notable among the Petition's data omissions is its failure to account for whole effluent toxicity studies that are conducted on Fayetteville Works discharges, and which have been occurring for more than 22 years. As Chemours has publicly detailed,[22] Chemours (and DuPont as the prior owner and operator of Fayetteville Works before Chemours came into existence) have conducted acute toxicity studies on daphnia exposed to effluent from Fayetteville Works' process waters. These studies have never indicated that the effluent was causing harmful effects.[23] The results of these bioassays are reported to NC DEQ as part of Discharge Monitoring Reports through Fayetteville Works' National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act. [24]

Similarly, in 2017 Chemours conducted whole-effluent toxicity testing on fathead minnow and published the results of that study online.[25] Like the NPDES whole-effluent toxicity tests, these tests also "indicated no lethal, sublethal, or abnormalities . . . in any of the effluent concentrations." These assays would have identified potential adverse effects on the species tested attributable to any of the Petition Compounds that were present in Fayetteville Works' aqueous discharges.

These whole effluent toxicity tests are highly relevant to the Petition because, according to Petitioners, much of the alleged releases potentially causing exposure would have occurred through wastewater discharges. Thus, most of the Petition Compounds (with the exception of chemicals emitted only through the air)[26] would be accounted for in these whole effluent tests. Moreover, such whole effluent testing would account for "combinations" of these chemicals, which is a key element of Petitioner's proposed study design.

(ii) North Carolina Epidemiological Information

North Carolina has conducted and published preliminary epidemiological studies on the incidence of certain cancers and birth defects in the counties surrounding Fayetteville Works to evaluate whether potential PFAS exposure is correlated with these adverse health effects. Both studies concluded that that data in the Fayetteville Works-adjacent counties did not meaningfully differ from that in the rest of the state.

Specifically, the State examined rates of pancreatic, liver, uterine, testicular and kidney cancers in Bladen, Brunswick, New Hanover, and Pender Counties and determined that

[22] https://www.chemours.com/en/about-chemours/global-reach/fayetteville-works/fayetteville-works-toxicology.
[23] As Chemours notes on its website, there was one sample in 2012 that indicated harmful effects, but it was subsequently re-tested and resulted in no toxic or harmful effect. *See* https://www.chemours.com/en/about-chemours/global-reach/fayetteville-works/fayetteville-works-toxicology.
[24] North Carolina has been delegated authority to administer the NPDES program by EPA.
[25] https://www.chemours.com/en/-/media/files/corporate/chronic-toxicity-test-results-outfall-002-2017.pdf.
[26] Twenty-one of the fifty-four chemicals have only a single source justifying their inclusion in the Petition, a 2019 "Air Quality Permit Application Review" submitted by Chemours to NC DEQ. *See* Petition Attachment 2 at No. 12. Chemours therefore interprets these chemicals as being alleged to have been discharged only through air and not aqueously. All other chemicals are alleged to have been discharged through aqueous pathways or found in surrounding waters, such as the Cape Fear River.

"[o]verall, cancer rates in the four counties were similar to state rates."[27] For birth defects, the State studied the incidence of neural tube defects, brain defects (microcephaly, hydrocephaly, reduction defects), orofacial clefts, conotruncal heart defects, left and right ventricular outflow tract defects (LVOTO & RVOTO), and limb deficiency defects in Bladen, Brunswick, Cumberland, New Hanover and Pender Counties and determined that "[t]he prevalence of most types of birth defects examined in the five counties did not differ from statewide prevalence estimates."[28] The Petition failed to account for either of these studies.

(iii) Existing GenX Information

As Petitioners concede, there are substantial existing data on the potential toxicological and environmental effects of GenX. Much of these data were generated and made available in the context of EPA's TSCA New Chemical Review Program, under which EPA authorized production of GenX at Fayetteville Works pursuant to a 2009 Consent Order under Section 5(e) of TSCA.

With respect to GenX itself, Petitioner's request for additional testing under Section 4 of TSCA is contrary to the structure and administration of TSCA. Specifically, under Section 5(e), EPA has already issued an order which is specifically designed and intended to limit GenX production and use "to the extent necessary to protect against an unreasonable risk of injury to health or the environment."[29] The substantial data originally provided to EPA, and subsequently generated in the context of the 2009 Section 5(e) Consent Order, were determined to be sufficient to create and retain limits on GenX manufacturing that will mitigate any unreasonable risk. As further evidence of the sufficiency of existing knowledge regarding GenX, EPA has already completed and published a draft toxicity assessment for GenX.[30]

(iv) Consent Order Attachment B Information

As Petitioners further concede, through the Consent Order with NC DEQ, Chemours is in the process of conducting extensive toxicological and environmental testing on five PFAS compounds identified by Petitioners. As NC DEQ has explained, these five compounds were selected (in consultation with EPA) for initial testing because they are intended to be representative of PFAS emissions more broadly. Specifically, these compounds were selected because they "represented different categories of short-chain PFAS that are most prevalent in the environment around the Facility."[31] They are representative because they "have different carbon chain lengths, are known to have originated from the Facility, and have been found in quantifiable concentrations in the environment around the Facility."[32]

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[27] https://epi.dph.ncdhhs.gov/oee/pfas/Summary%20of%20Selected%20Cancer%20Rates_all%20counties_7Nov2018.pdf.

[28] https://epi.dph.ncdhhs.gov/oee/pfas/NCDHHS%20Birth%20Defects%20Report%2008Nov2018_Final.pdf.

[29] 15 U.S.C. § 2506(e)(1)(ii).

[30] *See* https://www.epa.gov/pfas/genx-and-pfbs-draft-toxicity-assessments.

[31] https://files.nc.gov/ncdeq/GenX/2019-02-20-FINAL-DEQ-Response-to-Comments-on-Proposed-Consent-Order.pdf.

[32] https://files.nc.gov/ncdeq/GenX/2019-02-20-FINAL-DEQ-Response-to-Comments-on-Proposed-Consent-Order.pdf.

These tests were deemed "important for understanding the health impacts of these newer generation PFAS" more broadly, not just the five specific compounds evaluated.[33] Moreover, the battery of tests run for each compound was carefully considered through discussions between NC DEQ and Chemours, and the Consent Order provides that "DEQ's toxicologists will evaluate the adequacy of [a testing] plan prior to approval."[34]

Such a stepwise approach is consistent with EPA's continuing evaluation of PFAS toxicity, and with standard toxicological practices. EPA should not immediately require numerous studies on 54 substances based on the Petition's broad and unsupported assertions, rather than evaluate data generated through considered processes under the North Carolina Consent Order.

(v) REACH Information

The Petition omits the information on a significant subset of the Petition Compounds gathered by the European Chemicals Agency (ECHA) through its REACH[35] regulations. Specifically, ECHA has identified data on 9 of the 54 substances:

Abbreviation	**CAS**	**Tonnage Band**	**Link to Dossier**
TFE	116-14-3	10000 - 100000 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/15453
HFP	116-15-4	1000 - 10000 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/15192
PMVE	1187-93-5	100 - 1000 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/13408
PPVE	1623-05-8	100 - 1000 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/23696
HFPO	428-59-1	100 - 1000 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/5721
HFPO-DA (ammonium salt)	62037-80-3	10-100 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/2679
PMCP	1805-22-7	0 - 10 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/24156
PEVE	10493-43-3	0 - 10 tonnes per annum	https://echa.europa.eu/registration-dossier/-/registered-dossier/21612
Carbonyl Fluoride	353-50-4	Intermediate Use Only	https://echa.europa.eu/registration-dossier/-/registered-dossier/22114/1

[33] https://files.nc.gov/ncdeq/GenX/2019-02-20-FINAL-DEQ-Response-to-Comments-on-Proposed-Consent-Order.pdf.
[34] https://files.nc.gov/ncdeq/GenX/2019-02-20-FINAL-DEQ-Response-to-Comments-on-Proposed-Consent-Order.pdf.
[35] REACH is the European Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals; the requirements entered into force in 2007.

Some of these substances, such as tetrafluoroethylene (TFE), are well-known commercial products which ECHA reports are produced in quantities of 10,000 - 100,000 tonnes per annum. For products such as TFE, ECHA collects significant toxicology and ecotoxicology data, including repeated dose toxicology studies used to derive no effects levels.

Such data are highly relevant to EPA's ability to assess the potential risks of these substances, and is largely overlapping with the data that would be produced by studies that Petitioners seek to have conducted. Where Petitioners bear the burden of establishing that available information is insufficient, the omission of these relevant data undermines EPA's ability to evaluate the issues raised in the Petition.

(vi) EPA CompTox and ExpoCast Information

A review of the EPA CompTox Chemicals Dashboard indicates that data are currently available for almost all (48 of 54) of the Petition Compounds. This includes physical and chemical (physicochemical) properties predicted via the Open Structure-activity/property Relationship App (OPERA)[36] for all 48 of the chemicals, including the log of the octanol: water partition coefficient (known as log(Kow) or logP), vapor pressure, water solubility, Henry's law constant, and the acid dissociation constant (pKa). Additionally, a subset of experimental (*i.e.*, measured) values are available for specific properties for some of the 48 chemicals. OPERA is an open-source/open-data suite of QSAR models that provide predictions for physicochemical properties, environmental fate parameters, and toxicity endpoints,[37] the results of which are included for many chemicals within the CompTox Dashboard. These physicochemical property data can be used to understand potential toxicological effects, toxicokinetics, and even exposure estimates. The US EPA's Toxicity Estimation Software Tool (TEST) similarly provides *in silico* estimates of both physicochemical properties (*e.g.*, boiling point) and toxicity (*e.g.*, model prediction for oral rat 50 percent lethal dose) of chemicals using mathematical models to predict measures of toxicity from the physical characteristics of the structure of chemicals via Quantitative Structure Activity Relationship (QSAR) methodologies.[38] Various endpoints or characteristics were available via the TEST dataset for the 48 chemicals in the CompTox Dashboard. Together this type of information can be used to help prioritize chemicals for further testing, in lieu of conducting extensive animal testing on all chemicals that would include many that may not present toxicological concern.[39]

In addition to physical and/or chemical properties and toxicity predictions available, the USEPA ExpoCast program[40] includes exposure estimates for 36 of the 54 chemicals.[41] Specifically, estimates of the average (geometric mean) exposure rate (mg/kg body weight/day)

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[36] https://ntp.niehs.nih.gov/whatwestudy/niceatm/comptox/ct-opera/opera.html.

[37] Mansouri K, Grulke CM, Judson RS, Williams AJ. OPERA models for predicting physicochemical properties and environmental fate endpoints. J Cheminform. 2018 Mar 8;10(1):10. doi: 10.1186/s13321-018-0263-1. Available at: https://jcheminf.biomedcentral.com/articles/10.1186/s13321-018-0263-1.

[38] https://www.epa.gov/chemical-research/toxicity-estimation-software-tool-test

[39] Nicolas CI, Mansouri K, Phillips KA, Grulke CM, Richard AM, Williams AJ, Rabinowitz J, Isaacs KK, Yau A, and Wambaugh JF. Rapid Experimental Measurements of Physicochemical Properties to Inform Models and Testing. Sci Total Environ. 2018 September 15; 636: 901-909. Available at: https://doi.org/10.1016/j.scitotenv.2018.04.266.

[40] https://www.epa.gov/chemical-research/rapid-chemical-exposure-and-dose-research.

[41] *See* Appendix 2.

for the U.S. population are predicted based upon consensus exposure model predictions and the similarity of the compound to chemicals monitored by NHANES (National Health and Nutrition Examination Survey).[42] In addition to physicochemical and exposure prediction data, specific toxicological data related to hazard and toxicity are available on the CompTox Dashboard for 5 of the 54 chemicals in the Petition. In summary, publicly available, curated data exist for the majority of the Petition Compounds. Such data would need to be reviewed, analyzed, and integrated to guide decision-making regarding the need for additional testing.

As an example, one possible application of the exposure estimates in the USEPA's ExpoCast database is to compare them to thresholds of toxicological concern as a screening approach to determine the need for further testing. The threshold of toxicological concern (TTC) is a science-based tool that is used for screening level risk-based prioritization of chemicals with low exposure and is used to propose a de minimis exposure value based on chemical structure and toxicity information from similar substances. One recent study found that TTC values for 288 chemicals in EPA's IRIS data base were lower than their corresponding RfD values for the majority of these substances evaluated.[43] As presented at the Toxicology Forum in January of 2020, the researchers demonstrated the applicability of the TTC approach by incorporating a dataset of NOAEL values for 28 PFAS into Cramer Class III based on a lack of statistical difference in cumulative distribution with and without these 28 PFAS. The derived human exposure level for the PFAS enriched Cramer Class III dataset was ~ 0.0014 mg/kg-bw-day. Based on estimates of exposure identified in USEPA's ExpoCast database and presented in Appendix 2, the medium exposure prediction for 46 of the 54 PFAS identified, ranged from 1.57E-7 to 5E-5 mg/kg-bw/day, concentrations that are ~30-8900x lower than the TTC value of 0.0014 mg/kg-bw/day. Application of such an approach into a chemical prioritizing framework can be used to guide decision-making regarding the need for animal testing while ensuring protection of human health.

(vii) EPA PFAS Action Plan Information

The Petition also fails to account for data on PFAS toxicity that EPA is in the process of gathering under comprehensive EPA efforts through its PFAS Action Plan.[44] Current EPA research efforts on PFAS toxicity include, among other things:

- Identification of 40 PFAS of interest, including:[45]
  - Scoping literature search, identifying 4,283 studies for 31 of the PFAS of interest.[46]
  - Review of existing *in vivo* studies

[42] Ring CL, Arnot JA, Bennett DH, Egeghy PP, Fantke P, Huang L, Isaacs KK, Jolliet O, Phillips KA, Price PS, Shin HM, Westgate JN, Setzer RW, and Wambaugh JF. Consensus Modeling of Median Chemical Intake for the U.S. Population Based on Predictions of Exposure Pathways. Environ Sci Technol. 2019, 53, 2, 719–732. Available at: https://pubs.acs.org/doi/10.1021/acs.est.8b04056.

[43] Pham LL, Borghoff SJ, Thompson CM. Comparison of threshold of toxicological concern (TTC) values to oral reference dose (RfD) values. Regul Toxicol Pharmacol. 2020 Jun;113:104651. doi: 10.1016/j.yrtph.2020.104651. Epub 2020 Mar 27.

[44] https://www.epa.gov/chemical-research/research-and-polyfluoroalkyl-substances-pfas.

[45] https://www.epa.gov/sites/production/files/2020-09/documents/epa_pfas_working_list_of_chemicals_09_25_2020.pdf.

[46] https://hero.epa.gov/hero/index.cfm/project/page/project_id/2604.

    - Development of analytical detection methods
    - An evaluation of drinking water treatment technology.
- Evaluation of at least 75 PFAS using read-across and other non-traditional toxicological methodologies.[47]
- Completed draft toxicity assessments of PFBS and HFPO-DA (GenX chemicals).[48]
- In progress toxicity assessments for perfluorodecanoic acid (PFDA), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), perfluorohexanesulfonate (PFHxS), and perfluorobutanoic acid (PFBA)).[49]
- Development of a PFAS library of 430 PFAS reference samples to enable analysis by EPA and other regulators.[50]
- Loading of PFAS studies into the ECOTOX knowledgebase to enable analysis of ecological effects of PFAS. To date, EPA has gathered 20,615 records referencing 467 species exposed to 134 PFAS.[51]

Importantly, these EPA efforts currently specifically name 15 of the 54 chemicals subject to the Petition. *See* Appendix 4.

Further, EPA's approach clearly recognizes that it need not simultaneously conduct extensive *in vivo* testing of all 9,252 PFAS that it has identified to date,[52] because each PFAS does not present the same risk. Instead, EPA is proceeding in a tiered approach, for instance by conducting toxicity assessments initially on seven PFAS, identifying 40 PFAS of interest for further study, and conducting testing on 75 PFAS using new approach methods.

In defining this last category of 75 substances, EPA has described that it was proceeding with non-traditional methods because "[t]raditional approaches to generate toxicity information are resource intensive" and impractical for the broad class of PFAS.[53] This initial set of 75 substances is further intended to be representative of PFAS more broadly, and were selected for analysis with the following criteria in mind:[54]

- maximizing information to support read-across within structure-based groupings
- capturing the structural diversity across all the PFAS of interest to EPA
- interest to EPA scientists and regulators based primarily on incidence and/or magnitude of occurrence or potential exposures across the United States
- membership within targeted PFAS structural categories

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[47] https://www.epa.gov/sciencematters/epa-and-partners-describe-chemical-category-prioritization-approach-select-75-pfas; https://comptox.epa.gov/dashboard/chemical_lists/epapfas75S1.
[48] https://www.epa.gov/pfas/genx-and-pfbs-draft-toxicity-assessments.
[49] *See* 84 FR 60393 (November 8, 2019).
[50] https://www.epa.gov/sites/production/files/2020-09/documents/epa_pfas_rd_overview_complete_2020_09_25.pdf.
[51] https://cfpub.epa.gov/ecotox/explore.cfm?cgid=36.
[52] https://comptox.epa.gov/dashboard/chemical_lists/pfasmaster .
[53] https://www.epa.gov/sciencematters/epa-and-partners-describe-chemical-category-prioritization-approach-select-75-pfas.
[54] https://www.epa.gov/sciencematters/epa-and-partners-describe-chemical-category-prioritization-approach-select-75-pfas.

This approach will help EPA to better characterize potential PFAS toxicological risks generally, including potential risks related to the Petition Compounds. The results obtained in the context of the Action Plan can be considered in combination with the studies of five chemicals already being conducted by Chemours under the Consent Order. Thus, not only does the Petition fail to account for the PFAS data that EPA is in the process of generating, but the methodology proposed by Petitioners of conducting extensive *in vivo* studies on every conceivable PFAS runs directly contrarily to EPA's own research approach and the requirements of TSCA concerning minimizing the use of animal testing.

b. Exposure

Petitioners also assert that there is insufficient information regarding exposure for EPA to evaluate the potential risk of the Petition Compounds. Given this alleged lack of information, Petitioners ask that exposure be *inferred* "from a substance's properties and circumstances of manufacture and use" as well as from the alleged "presence in surface water, stormwater, wastewater, sediment, groundwater, soil, private wells, and/or air emissions."[55] However, Petitioners' assertion of insufficient exposure is contradicted by the actual available information. Chemours has conducted extensive sampling which would identify the presence of many of the Petition Compounds. Moreover, EPA may consider other information in evaluating potential exposure—information such as physical and chemical properties of a chemical which would tend to make exposure more or less likely. Such information is broadly available for many of these substances, yet absent from analysis in the Petition. Petitioners have therefore failed to carry their burden to "set forth the facts which . . . establish that it is necessary" for EPA to take action under Section 4 for the Petition Compounds.

(i) Offsite Human and Ecological Health Screening Level Exposure Assessments (SLEAs)

The Petition omitted, or failed to consider, the information contained within the human health and ecological Screening Level Exposure Assessments (SLEA) that Chemours conducted in connection to the Consent Order.[56] The "overall goal of the SLEA is . . . quantifying potential human intake and noncarcinogenic human health hazard from assumed exposure to Table 3+ per- and polyfluoroalkyl substances (PFAS) in the vicinity of the [Fayetteville Works] Facility."[57] The human health SLEA considered data from soil, well water, surface water, and fish, characterized exposure and hazard, and assessed uncertainty. This human health SLEA focused most extensively on HFPO-DA, and found that "[c]alculated hazards for HFPO-DA for all receptor-exposure scenarios evaluated in the SLEA are less than 1 which, as defined by USEPA, indicates adverse effects to human receptors are unlikely, including sensitive subpopulations."[58] While there was greater uncertainty concerning other PFAS, the SLEA nevertheless concluded that "when the SLEA accounts for the effectiveness of the Chemours-

[55] Petition at 2.
[56] *See* https://www.chemours.com/en/-/media/files/corporate/fayetteville-works/corrective-action-plan-12312019.pdf at Appendixes F and G.
[57] https://www.chemours.com/en/-/media/files/corporate/fayetteville-works/corrective-action-plan-12312019.pdf, Appendix F at vii.
[58] *Id*.

provided drinking water treatment systems that are currently in-place, PFAS intake via well water consumption and associated hazards are substantially reduced and may be as low as zero."[59]

The ecological SLEA evaluated data from onsite and offsite soils, invertebrates and offsite vegetation, and sediment, vegetation, fish and clams from the Cape Fear River. The SLEA evaluated such data to find that "the sediment in the Cape Fear River and soil in the offsite areas do not appear to have accumulated widely detectable concentrations of Table 3+ PFAS, they are not likely to act as long-term exposure sources for ecological receptors."[60] The SLEA also concluded that "[r]esults indicate that current exposures to ecological receptors from HFPO-DA are not expected to pose a hazard to ecological receptors in the study area."[61]

The SLEAs were submitted in connection with a Corrective Action Plan submitted by Chemours under the Consent Order in December 2019, based on a Site Characterization submitted in September 2019.[62] The Corrective Action Plan and site assessment are subject to ongoing NC DEQ review, following a public comment process during which comments were received from various entities.

(ii) Chemical Property Information

Another significant flaw with Petitioners' approach of naming every PFAS they believe may be associated with Fayetteville Works is that many of these chemicals will not persist in the environment.

Fourteen of these chemicals, for instance, are unstable and will readily transform into a different chemical substance upon contact with water.

Substance	**Reacts with Water to Become**
N1AF	PFO2HxA
PSEPVE	PS Acid
PEPF	PEPA
HFPO-DAF	HFPO-DA
PMPF	PMPA
Carbonyl fluoride	CO2 and HF
PAF	TFA
Diadduct (DA)	Diadduct Acid
PPF	PPA
RSU	DFSA
MMF (acid)	DFMA
MMF (acid fluoride)	DFMA

[59] *Id*. at viii.
[60] https://www.chemours.com/en/-/media/files/corporate/fayetteville-works/corrective-action-plan-12312019.pdf, Appendix G at 1.
[61] *Id*. at 2.
[62] *See* https://www.chemours.com/en/-/media/files/corporate/p18_site_assessment_compiled.pdf; https://www.chemours.com/en/-/media/files/corporate/fayetteville-works/corrective-action-plan-12312019.pdf.

Substance	Reacts with Water to Become
SU	DFSA

Six chemicals are highly volatile and any releases would be expected to be in the form of dispersed gases. These substances would not be expected to be readily available in water under normal environmental conditions due to their very low solubility. Absent exposure through drinking water, Petitioners' have not put forth even a theoretical basis for significant exposure from these diffuse atmospheric constituents.

Substance	Natural Boiling Point
TFE	-76°C
HFP	-28°C
PMVE	-27.4°C
PPVE	35°C
HFPO	-27.4°C
PMCP	-2°C

Finally, six other chemicals are not associated with the chemical processes at Fayetteville Works, and are not believed to be produced in a measurable quantity (even as byproducts) by those processes.[63]

Substance	Justification for Exclusion
PFMOPrA	As Chemours has previously communicated to NC DEQ, Chemours believes any purported detections of PFMOPrA were misidentifications.[64] Specifically, Chemours believes that PFMOPrA, a linear compound, was misidentified as its branched isomer PMPA. The linear compound PFMOPrA would not be expected to be produced at Fayetteville Works.
PFMOBA	As Chemours has previously communicated to NC DEQ, Chemours believes any purported detections of PFMOBA were misidentifications.[65] Specifically, Chemours believes that PFMOBA, a linear compound, was misidentified as its branched isomer PEPA. The linear compound PFMOBA would not be expected to be produced at Fayetteville Works.
NaDONA	This substance is associated with another manufacturer, and is not a substance that is known to be produced by Chemours at Fayetteville Works.[66] Chemours does not have sampling data detecting this substance in

[63] Chemours believes that it is possible that other of the 54 chemical substances may not be produced by Fayetteville Works. Absent the same level of affirmative evidence that is available regarding these six substances, however, Chemours is not asserting at this time that others of the 54 substances are not potentially produced by Fayetteville Works.

[64] https://files.nc.gov/ncdeq/GenX/consentorder/Chemours-PFAS-Isomer-letter.pdf.

[65] https://files.nc.gov/ncdeq/GenX/consentorder/Chemours-PFAS-Isomer-letter.pdf.

[66] *See* https://multimedia.3m.com/mws/media/541624O/emulsifier-eliminates-apfo-from-production-of-fluoropolymers.pdf; https://www.michigan.gov/documents/egle/2-27-20_ERRC_Meeting_Packet_681813_7.pdf.

Substance	Justification for Exclusion
	relevant environmental media surrounding Fayetteville Works, despite testing for it.
PES	Chemours believes this substance has been misidentified in third party publications potentially attributing this chemical substance to Chemours. Consistent with this understanding, this substance has been detected in less than 1% of all samples analyzed for this substance.
PFECA B	Chemours believes this substance has been misidentified in third party publications potentially attributing this chemical substance to Chemours. Consistent with this understanding, this substance has been detected in less than 1% of all samples analyzed for this substance.
PFECA G	Chemours believes this substance has been misidentified in third party publications potentially attributing this chemical substance to Chemours. Consistent with this understanding, this substance has been detected in less than 1% of all samples analyzed for this substance.

This information on physical properties provides EPA with valuable information regarding potential exposures of the Petition Compounds. For each of the 25 substances described above, not only is exposure-relevant information available, but that information also strongly supports the conclusion that exposure creating unreasonable risk is not occurring.

(iii) Sampling Information

Through the Consent Order and other testing conducted in cooperation with NC DEQ, Chemours has developed a substantial data set regarding the environmental occurrence of PFAS compounds around Fayetteville Works.

Based on Chemours' sampling data set, several chemicals should be eliminated by from consideration because they have been analyzed for in at least a thousand samples each but have either never been detected or were detected less than 1% of the time.

Chemical	Times Sampled	Times Detected	Detection Percentage
NaDONA	1257	0	0.00%
PES	2472	17	0.69%
PFECA B	2472	11	0.43%
PFECA G	9880	15	0.15%

To Chemours understanding, twenty-seven other chemical substances have not been sampled for by the company, nor has Chemours been required by any regulator to sample for these substances. Many of these chemicals are simply not expected to exist in the sampling media around Fayetteville Works for some of the reasons discussed in Section IV.C.2.b.ii above. These chemical substances are:

- N1AF2 (Unknown CAS)
- PMCP (CAS 1805-22-7)

- PEVE (CAS 10493-43-3)
- TFE (CAS 116-14-3)
- HFP (CAS 116-15-4)
- PMVE (CAS 1187-93-5)
- PSEPVE (CAS 16090-14-5)
- PPVE (CAS 1623-05-8)
- PEPF (CAS 1682-78-6)
- HFPO-DAF (CAS 2062-98-8
- PMPF (CAS 2927-83-5)
- E2 (CAS 3330-14-1)
- E1 (CAS 3330-15-2)
- E3 (CAS 3330-16-3)
- Carbonyl fluoride (CAS 353-50-4)
- PAF (CAS 354-34-7)
- n-perfluorobutane (CAS 355-25-9)
- MA (CAS 4089-57-0)
- Diadduct (CAS 4089-58-1)
- PPF (CAS 422-61-7)
- HFPO (CAS 428-59-1
- EVE (CAS 63863-43-4)
- RSU (CAS 677-67-8)
- MMF (acid fluoride) (CAS 69116-71-8)
- MAE (CAS 69116-72-9)
- DAE (CAS 69116-73-0)
- SU (CAS 697-18-7)

For another four chemical substances—DFSA (CAS 422-67-3), MMF (acid) (CAS 1514-85-8), MTP (93449-21-9), and PPF Acid (422-64-0)—Chemours has communicated with NC DEQ that it has been unable to develop reliable analytical methods for measuring these substances.[67] Chemours provided analyses to NC DEQ from leading national testing laboratories, TestAmerica and Lancaster Laboratories, explaining the reasons why analyzing for these chemicals was difficult.[68] Accordingly, Chemours halted sampling and analysis of these four compounds until accurate analytical methods can be developed for these substances.

The remaining nineteen chemical substances which are detected in the vicinity of Fayetteville Works generally have very low levels of occurrence that would not be expected to lead to significant human exposure.[69] Those chemicals that are detected the most frequently and

[67] *See* https://www.chemours.com/en/-/media/files/corporate/11-ncdwr-follow-up-letter-mtp-mmf-dfsa-ppf-acid-2019-06-18.pdf.
[68] *See* https://www.chemours.com/en/-/media/files/corporate/11-ncdwr-testamerica-technical-summary-mtp-mmf-dfsa-ppf-acid-2019-06-18.pdf; https://www.chemours.com/en/-/media/files/corporate/11-ncdwr-lancaster-technical-summary-mtp-mmf-dfsa-ppf-acid-2019-06-18.pdf.
[69] The dataset described in the following paragraphs only relates to sampling in the following, exposure-relevant media: Offsite groundwater; Offsite surface waters, including Cape Fear River, Georgia Branch Creek and Willis Creek; Offsite seeps; Private wells and Public Water Treatment Plants.

in the greatest concentrations are those that are already subject to the most study: the substances subject to study under Attachment B of the Consent Order and GenX. For the remaining chemicals, the median detection level is less than 15 parts per trillion. And that median value only represents those samples in which the substance was actually detected. For many of the samples collected, these substances were simply not detected at all, meaning that the median of all samples would be even lower.

Chemical	**Median Offsite Water Concentration for Detections (ppt)**	**Percentage of Non-Detect Samples**
Appendix B Compounds and GenX		
HFPO-DA (Gen X)	22	44.6%
PFMOAA	15	46.3%
PMPA	61.5	26.8%
PFMOPrA	56.5	18.5%
PFO2HxA	15	40.9%
PEPA	36	72.7%
PFMOBA	18.15	36.5%
Hydro-PS Acid	6.2	61.1%
Non-Appendix B Compounds		
PFO4DA	4.7	91.3%
PFO5DoDA (aka TAF)	4.95	98.2%
Hydro-EVE acid	3.8	94.4%
PS Acid	2.8	99.6%
PFO3OA	6.5	78.8%
NVHOS	4.4	49.3%
Byproduct 4 (R-PSDA)	12	40.4%
Byproduct 5 (Hydrolyzed PSDA4	14	25.2%
Byproduct 6 (R-PSDCA)	ND (no detections)	100.0%
EVE Acid	2.4	99.7%
R-EVE	5.6	60.9%

There are also data on the presence of these Petition Compounds in solid media that may have some relevance to offsite exposure to these chemicals. Specifically, Chemours has gathered and reported to NC DEQ data on the following potentially-relevant offsite media:

- Offsite Soil
- Cape Fear River Sediment
- Animal Tissue
- Plant Tissue

Only thirteen of twenty-one substances sampled for in these media have been detected by Chemours. Of those thirteen, only five chemicals are detected in more than 10% of samples, and none in more than 29% of samples. Those five substances represent the chemicals that are among the most well-studied at Fayetteville Works, for example chemicals included on Attachment B

(requiring toxicological studies) and Attachment C (requiring regular sampling) of the Consent Order.

Substance	**Applicable Consent Order Attachment**
HFPO-DA (Gen X)	Attachment C (as well as prior studies required by EPA)
PFO5DoDA (aka TAF)	Attachment C
PFO2HxA	Attachments B and C
PFMOAA	Attachments B and C
PMPA	Attachments B and C

(iv) Control and Abatement Technology Information

As described in Section III.B above, the potential for any exposure to the Petition Compounds is mitigated by the extensive efforts Chemours has made to eliminate or reduce PFAS discharges and emissions from Fayetteville Works and provide replacement drinking water to residents, pursuant to its Consent Order with the State of North Carolina and Cape Fear River Watch. Therefore, while little information exists demonstrating that these substances would be created and released in significant quantities, substantial information exists indicating that any potential releases of these substances are reasonably expected to be minimal and highly-controlled.

(v) EPA Information

Outside of the information that Chemours has already gathered through the Consent Order and otherwise, EPA has been conducting its own efforts to understand PFAS occurrence and potential exposure on a national scale. For instance, EPA has begun requiring reporting of 170 PFAS through the Toxic Release Inventory (TRI).[70] Additionally, EPA has studied the occurrence of six PFAS through the Third Unregulated Contaminants Monitoring Rule (UCMR).[71] Under the Fifth UCMR, EPA will substantially increase its PFAS sampling. Specifically, EPA is required under the 2020 National Defense Authorization Act (NDAA) to monitor through the Fifth UCMR "each . . . perfluoroalkyl and polyfluoroalkyl substances [PFAS] . . . for which a method to measure the level in drinking water has been validated by the Administrator." Under the NDAA, Congress also required EPA to issue a one-time data call-in under Section 8 of TSCA for any PFAS manufactured (including imported) after January 1, 2011.[72]

Further, under its PFAS Action Plan, EPA is conducting a specific PFAS fate and transport study in the vicinity of Fayetteville Works.[73] Other planned exposure-related research activities under the Action Plan include development of an American Healthy Homes Survey

[70] https://www.epa.gov/sites/production/files/2020-04/documents/tri_non-cbi_pfas_list_2_19_2020_final_clean.pdf.
[71] *See* https://www.epa.gov/dwucmr/third-unregulated-contaminant-monitoring-rule
[72] *See* https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202010&RIN=2070-AK67.
[73] https://www.epa.gov/chemical-research/status-epa-research-and-development-pfas.

Dataset on PFAS in Homes, an exposure analysis, and a human exposure model.[74] EPA should continue with its considered, stepwise approach to PFAS research and analysis.

D. The Petition Does Not Demonstrate That the Petition Compounds Present An Unreasonable Risk of Injury to Health or the Environment

In addition to failing to demonstrate that "there is insufficient information and experience" for EPA to evaluate the Petition Compounds, Petitioners have also failed to present facts demonstrating that these 54 substances "may present an unreasonable risk of injury to health or the environment."

To be clear, Petitioners have not presented information that exposure to any one of these substances is occurring at levels which have been demonstrated to create adverse effects. Instead, they rely on layers of assumptions and speculative evidence regarding the potential hazards of and exposure to these substances. Specifically, Petitioners ask EPA to assume the following:

- That each of the Petition Compounds is toxicologically similar to PFOA and PFOS, based on a few paragraphs of argument and assumption, and ignoring (and failing to inform EPA of) significant information to the contrary;
- That there is an unreasonable risk associated with exposure to each of the Petition Compounds, based on the fact that these substances are *mentioned* in various publications, while failing to even attempt to quantify the exposure based on those publications or account for potential exposure data contrary to their theory; and
- Finally, that the unreasonable risk they assert is present is entirely attributable to Chemours at Fayetteville Works, without any analysis of alternative sources or locations.

In other words, Petitioners have alleged a speculative risk that does not rise to the level that would not support a finding by the Administrator that action is required under Section 4 of TSCA in response to the Petition.

1. Toxicity

Petitioners provide no data that any of the Petition Compounds are being found in the environment at levels which any evidence supports adverse effects are occurring. Indeed, they fail to present information quantifying either: (1) the levels at which these substances may cause adverse effects, or (2) the level of exposure for these substances. Absent any data, therefore, Petitioners' "may present an unreasonable risk" assertion for the Petition Compounds is premised entirely on the assumption that these chemicals are analogous to PFOA, PFOS, and an assortment of other PFAS in terms of toxicity simply because the 54 substances are also PFAS.[75]

[74] https://www.epa.gov/chemical-research/status-epa-research-and-development-pfas.
[75] *See* Petition at 18 ("Given the recognition of EPA and other authorities that all PFAS have the potential for causing the adverse health and environmental effects linked to well-characterized substances like PFOS and PFOA because of their common structural characteristics, there is a strong basis to conclude that the 54 PFAS covered by this petition 'may present an unreasonable risk of injury'").

EPA's own assessment activities also contradict Petitioners' assumption. EPA has already established a risk threshold level for PFOA and PFOS in drinking water at 70 ppt, yet EPA has never attempted to apply that threshold level to all PFAS generally, as Petitioners imply should be done here. Instead, EPA is conducting numerous lines of inquiry into the toxicity and exposure of a diverse and representative set of PFAS under its PFAS Action Plan. EPA has thus recognized, in accordance with the available evidence and science, that PFAS are a diverse class of substances such that assuming all will share the same toxicological properties as a handful of individual constituent members is completely unsupportable. Absent the unsupported assumption that all PFAS share the same toxicity traits, Petitioners provide no evidence of the toxicity of the Petition Compounds.

Additionally, what data *do* exist regarding these substance have not indicated that the Petition Compounds would present an unreasonable risk. For example, over 20 years of acute toxicity assays indicate that the effluent containing these compounds in combination has not produced detectable adverse effects. Similarly, two epidemiological studies conducted by North Carolina have detected no differences in the rates of certain cancers and birth defects between the counties where these substances are alleged to cause exposure and counties throughout the rest of the state. Nine of the substances have also undergone evaluation by ECHA, and toxicology data is publicly available for them.

Many of these substances also have already been through some level of screening and scrutiny by EPA. EPA, for instance, already has gathered data on the physical and chemical properties of 46 of these substances. Additionally, twenty-two of the substances are on the TSCA Chemical Inventory as active chemicals that are manufactured or processed in the United States commercially. Still other of these chemicals were initially submitted for review to EPA via premanufacture notices (PMNs) or are subject to orders under Section 5(e) of TSCA. As previously discussed, under its TSCA New Chemical Review program, EPA is statutorily required to evaluate and limit the production of new chemicals to ensure they do not present the same type of "unreasonable risk" that Petitioners assert is present here.

None of this available data supports Petitioners' central assumption—that the Petition Compounds share the same toxicological profile as PFAS such as PFOA and PFOS. The available data, however, goes further to also support the understanding that these substances, at the levels in which they are detected or expected to occur in the environment surrounding Fayetteville Works, do not pose an unreasonable risk to human health or the environment. Petitioners have not demonstrated that these substances, which are only found at very low concentrations, present a greater risk than any of the other approximately 9,000 PFAS for which EPA has not required animal testing, or the 86,000 chemicals on the TSCA Inventory, the vast majority of which similarly have not been subject to EPA-mandated animal testing for that matter. In short, Petitioners' assertions regarding the toxicity of the Petition Compounds fail to meet the relevant legal standard to trigger EPA action under Section 4 of TSCA.

2. Exposure

As with Petitioner's arguments regarding toxicity, Petitioners present little data to support their theoretical assertion that there is significant exposure to the Petition Compounds. The fact that some of these substances are commercial products or have been mentioned in certain

Chemours publications is not evidence of exposure. Instead, the available evidence as discussed above indicates that significant exposure is unlikely.

For example, the SLEAs examined potential exposure and did not determine that an unreasonable risk was presented. This analysis is supported by other available information regarding the compounds, including the chemical properties and release controls for the compounds that would make exposure unlikely.

Moreover, the highest likelihood of exposure is associated with those compounds that are already subject to the most scrutiny. As intended, those compounds detected in sampling with the most frequency and in the highest concentrations are those for which toxicological studies are already required under the Consent Order. The remaining compounds are detected infrequently (over half were detected less than 10% of the time) and at very low concentrations (median detected concentration of less than 15ppt).The simple fact that *some* exposure could be occurring is insufficient to support the Petitioners' allegation, much less an affirmative finding by EPA, that all 54 Petition Compounds "may present" an unreasonable risk.

In sum, not only is Petitioners' exposure assumption unfounded, but it is contradicted by multiple lines of available evidence.

E. Petitioners Have Not Demonstrated That Their Proposed Testing Is Necessary

In addition to demonstrating the insufficiency of information on which EPA might base a risk assessment and the presence of an unreasonable risk from the Petition Compounds, Petitioners must provide information to allow EPA to conclude that Petitioners' proposed testing—including extensive *in vivo* vertebrate testing—is "necessary" to provide EPA with needed information.

For at least three reasons, Petitioners' proposed testing is not "necessary." First, EPA's PFAS Action Plan, as discussed above, is already providing EPA with its required information on PFAS. It does not make sense to deviate from that plan to conduct piecemeal intensive study on a subset of PFAS that lack evidence of risk and are not representative. Second, even if studies were appropriate for the Petition Compounds, Petitioners' proposed methodology is inappropriate. It would, among other things, cause unnecessary animal death, face significant logistical hurdles, and would not meaningfully inform current remediation efforts. Third, to the extent more information on the Petition Compounds is required, EPA has several TSCA information gathering tools it can and should use before ordering extensive animal testing. Such tools will help EPA comprehensively gather information, evaluate risk, and target resources where they are most needed.

1. PFAS Action Plan

As discussed above, in 2019, EPA released its Per- and Poly-Fluoroalkyl Substances (PFAS) Action Plan.[76] This Action Plan outlines steps the Agency is taking to address PFAS and to ensure protection of public health. As a part of this Action Plan, the Agency has undertaken a

[76] https://www.epa.gov/pfas/epas-pfas-action-plan; *see also* Section III.C.2.a.vii.

comprehensive research program which is predicated on a tiered-testing framework and involves the application of computational and high throughput toxicology tools for toxicity testing on a large scale to enable faster understanding of potential toxicity of larger numbers of PFAS. Such a testing paradigm not only ensures protection of public health but is consistent with TSCA's Section 4 mandates to both consider tiered testing and to reduce animal testing.

In accordance with this tiered testing framework, EPA conducted comprehensive systematic review/evidence mapping of the PFAS toxicology literature and identified those PFAS chemicals that are lacking toxicity information. EPA researchers are in the process of working in collaboration with scientists from NIH to use a combination of innovative methods and high-throughput in vitro assays to test 150 PFAS chemicals. The new approach methods being utilized by the researchers will screen for liver, developmental neurotoxicity, developmental toxicity, immunotoxicity, and mitochondrial toxicity as well as better predicting the disposition and excretion of PFAS from the body. The specific assays being used to assess each of these endpoints are outlined in Appendix 5. Results from the new approach methods testing will be used to help support prioritization, chemical grouping, read across, relative toxicity and mixtures assessment, as well as to inform hazard characterization and prioritization for targeted *in vivo* testing. As such, extensive testing involving very large numbers of vertebrate animals as requested in the Petition is premature and unnecessary.

2. Flawed Study Design

Even if EPA were to determine that insufficient information existed regarding the Petition Compounds and that they could present an unreasonable risk, the extensive studies proposed by Petitioners are unnecessary and run counter to current EPA and toxicological best practices.

a. Animal Testing

TSCA requires EPA to reduce and replace the use of vertebrate animals in the testing of chemicals or mixtures and to promote development and timely incorporation of alternative test methods or strategies that do not require testing in vertebrate animals.[77] In 2018, in response to these requirements, which are outlined in Section 4(h) of TSCA, EPA published its strategic plan to promote development and implementation of alternative test methods within the TSCA program.[78] This was subsequently followed in September 2019 by the issuance of a directive by the EPA administrator that called for a 30% reduction in requests for, and funding of, mammal studies by 2025, and elimination of mammalian testing by 2035.[79]

The Petition's call for extensive health and environmental testing for 54 PFAS chemicals is at odds with the requirements outlined in Section 4(h) of TSCA, as well as the associated strategic plan and directive issued by EPA. The Petition seeks to require testing to gather data related to chemistry, physical-chemical properties, fate and transport, and an extensive battery of toxicological and epidemiological studies. More specifically, as outlined in Table 4A of the

[77] 15 U.S.C. § 2603(h).
[78] https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/strategic-plan-reduce-use-vertebrate-animals-chemical.
[79] https://www.epa.gov/sites/production/files/2019-09/documents/image2019-09-09-231249.pdf.

Petition, the petitioners are calling for toxicokinetic testing along with toxicity testing to address reproductive/developmental (including mammary gland development), immunotoxicity, developmental neurotoxicity, and cancer. As outlined in Appendix 6, the study types and guidelines identified in the Petition (Testing Petition, Table 4A) would result in euthanizing an estimated 266,876 rodents (121,020 mice and 145,856 rats) to satisfy these testing requirements. This number would approximately double to 521,436 rodents if all Tier 1 and 2 PFAS chemicals were studied in the extended one generation and developmental neurotoxicity tests.

b. Unnecessary Testing

The Petition's proposed huge animal cost is particularly inappropriate because the test battery outlined in the Petition ignores numerous refinements in toxicity study design that reduce the need for animal studies. For example, Petitioners request both an extended one-generation study with developmental immunotoxicity and reproductive toxicity in rats and a developmental neurotoxicity study in mice. While this approach would lead to some reduction in the number of animals in the rat one-generation study (owing to removal of one of the experimental "cassettes"), the number of the mice required for a developmental neurotoxicity study is much greater than this reduction (Tier 1 chemicals would require 16,240 mice). Further, the selection of mice as the preferred test species for developmental neurotoxicity testing was not clearly defined in the Petition. The US EPA OPPTS 870.6300 developmental neurotoxicity guideline (USEPA, 1998) and NTP's modified one generation study design (NTP, 2020) both designate the rat as the preferred species for neurotoxicity testing. In the OECD 443 guideline (OECD, 2018), rats are also identified the preferred species, although justification for other species can be provided. Given that rats are the preferred species, most of the available historical control data is based on rats. As such, performing developmental neurotoxicity studies in mice will reduce the ability to make comparisons to guideline study historical control data and hinder the unambiguous interpretation of treatment effects.

A recent publication has also cast some doubt on the relevance of rodent developmental neurotoxicity testing to humans.[80] Limitations have been cited with respect to system sensitivity and finding reproducibility due primarily to species differences in toxicokinetics and timing of exposure in brain development. In a recent publication, the NTP described an alternative approach under development that is being designed to screen and identify compounds with a potential for DNT. The approach uses cell based and alternative animal models (zebrafish and planaria) to describe the underlying biochemical or behavioral trait that are not captured in rodent studies and has the potential to reduce the number of chemicals tested and the total number of rodents used.

The petition also requests that a number of long-term cancer bioassays be conducted to assess the carcinogenic potential of PFAS. Aside from the use of a large number of animals (as outlined above), there is a growing recognition in the toxicology community of the need to alter the paradigm for carcinogenicity testing.[81]

[80] Behl, M., et al. (2019). Screening for Developmental Neurotoxicity at the National Toxicology Program: The Future Is Here, *Toxicol. Sci* 167(1); 6–14, https://doi.org/10.1093/toxsci/kfy278

[81] Cohen, S. M., Boobis, A. R., Dellarco, V. L., Doe, J. E., Fenner-Crisp, P. A., Moretto, A., Pastoor, T. P., Schoeny, R. S., Seed, J. G. and Wolf, D. C. (2019). Chemical carcinogenicity revisited 3: Risk assessment of

Recognizing that direct DNA damage and cell proliferation have emerged as the primary drivers of cancer risk based on the past few decades of research, alternatives to the traditional 2-year cancer bioassay (established in the 1960s) have been proposed[82] and more recently advocated by a larger group of experts.[83] The new paradigm argues that short-term bioassays assessing genotoxicity and cell proliferation can be used to assess carcinogenic potential. Importantly, reviews of PFAS such as PFOA and GenX indicate little experimental or in silico evidence of genotoxicity;[84] as such, the carcinogenic potential of these and similar PFAS could therefore be amenable to assessment by short-term mechanistic bioassays (see below) as opposed to chronic bioassays.

The short-term mechanistic bioassays[85] outlined in Cohen et al. (2019) focus on assessing the potential for increased cell proliferation, which can arise through receptor-mediated or cytotoxic mechanisms. These assays could employ traditional histopathological techniques as well as include quantitative measures of cell proliferation and/or collection of high content data such as transcriptomics that are capable of informing receptor activation. One example of a receptor-mediated mode of action (MOA) listed in Cohen et al. (2019) is peroxisome proliferator-activated receptor alpha (PPARα) activation. In rodents, PPARα activation can lead to mitogenic cell proliferation in the liver via signaling pathways not potently activated by stimulation of PPARα in humans.

For PFAS with limited toxicity data, short-term assays on genotoxicity and cell proliferation (as well as endocrine and immunosuppression activity) can greatly inform the potential for carcinogenicity. If specific PFAS are active in these assays and the mechanism of action is deemed relevant to humans, then safety criteria protective of cancer could be developed without the need for chronic bioassays. Read across methods could be developed, refined, and

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carcinogenic poten-tial based on the current state of knowledge of carcinogenesis in humans. Regul Toxicol Pharmacol 103, 100-105.; Doe, J. E., Boobis, A. R., Dellarco, V., Fenner-Crisp, P. A., Moretto, A., Pastoor, T. P., Schoeny, R. S., Seed, J. G. and Wolf, D. C. (2019). Chemical carcinogenicity revisited 2: Current knowledge of carcinogenesis shows that categori-zation as a carcinogen or non-carcinogen is not scientifically credible. Regul Toxicol Pharmacol 103, 124-129.; Wolf, D. C., Cohen, S. M., Boobis, A. R., Dellarco, V. L., Fenner-Crisp, P. A., Moretto, A., Pastoor, T. P., Schoeny, R. S., Seed, J. G. and Doe, J. E. (2019). Chemical carcinogenicity revisited 1: A unified theory of carcinogenicity based on contemporary knowledge. Regul Toxicol Pharmacol 103, 86-92.

[82]Cohen, S. M. (2010a). An enhanced 13-week bioassay: an alternative to the 2-year bioassay to screen for human carcinogenesis. Experimental and toxicologic pathology : official journal of the Gesellschaft fur Toxikologische Pathologie 62, 497-502.; Cohen, S. M. (2010b). An enhanced thirteen-week bioassay as an alternative for screening for carcinogenesis factors. Asian Pacific journal of cancer prevention : APJCP 11, 15-7.

[83] Cohen et al., 2019.

[84] Beekman, M., Zweers, P., de Vries, W., Janssen, P. and Zeilmaker, M. (2016). Evaluation of substances used in the GenX technology by Chemours, Dordrecht. National Institute for Public Health and the Environment RIVM Letter Report 2016-0174.; Thompson, C. M., Fitch, S. E., Ring, C., Rish, W., Cullen, J. M. and Haws, L. C. (2019). Development of an oral reference dose for the perfluorinated compound GenX. J Appl Toxicol 39, 1267-1282.; U.S.EPA (2016). Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA). U.S. Environmental Protection Agency Office of Water EPA 822–R-16-005.; U.S.EPA (2018). DRAFT - Human Health Toxicity Values for Hexafluoropropylene Oxide (HFPO) Dimer Acid and Its Ammonium Salt (CASRN 13252-13-6 and CASRN 62037-80-3) Also Known as "GenX Chemicals". U.S. Environmental Protection Agency Office of Water EPA-823-P-18-001.

[85] In addition to genotoxicity and cell proliferation, Cohen *et al.* (2019) also include screening assays for endocrine and immunosuppression activity to assess carcinogenic potential.

used to obviate the need for testing all PFAS. This paradigm is consistent with the tiered testing approach currently being applied by EPA as a part of its comprehensive PFAS research program.

c. Practical Considerations

It is incumbent on EPA in implementing Section 4 testing rules or orders to consider the "relative costs of the various test protocols and methodologies that may be required" and the "reasonably foreseeable availability of the facilities and personnel needed to perform the testing." [86] Thus, it is appropriate for EPA to consider that a number of practical impediments arise under the Petitioners' proposal.

For example, to conduct animal testing on each of the Petition Compounds might present an overwhelming challenge because most of the substances identified are not commercially available and will take substantial time and cost to formulate in the sufficient quantities that would be necessary to conduct such extensive testing. Indeed, to Chemours understanding, only 8 of the 54 substances (GenX, EVE, TFE, HFP, PMVE, PPVE, E2, and HFPO) are currently readily available in sufficient quantities—the remainder would have to be specially formulated. As Chemours experience with the Consent Order studies has demonstrated, formulating significant amounts of trace byproducts for the first time can be very difficult, even for the sophisticated commercial laboratories that Chemours would have to hire for such work. In the case of the five Consent Order substances, it took more than a year to generate sufficient quantities of four of the five substances, and Chemours is still working with its third-party laboratories to generate quantities of the fifth substance that are sufficiently free of impurities. The complexity, difficulty, and cost to commercially produce significant quantities of 46 chemicals for the first time would be enormous. As such, any results from the proposed studies might take years to materialize. Section 4 of TSCA requires EPA to responsibly consider these practical issues

Moreover, Petitioners do not explain what concrete actions would follow their proposed studies. As discussed throughout this document, robust pollution control technology already eliminates the vast majority of potential PFAS emission from Fayetteville Works. Further, for potential emissions attributable to legacy operations, Chemours is already taking extensive actions to remediate PFAS present at Fayetteville Works and provide alternative water supplies as provided in the Consent Order and overseen by NC DEQ.

3. Alternative TSCA Authority

The proposed action under Section 4 is also unnecessary because EPA has the ability to gather information using other, less resource-intensive authorities under TSCA.

For example, the petition focuses entirely on Chemours, while the standard under Section 4(b)(3) specifies that the Agency should impose testing requirements on "each person" who manufacturers or processes a chemical substance that is subject to a rule or order. Petitioners assume, without data, that Chemours is the only entity responsible for the Petition Compounds and that there are no existing data on any of the 54 substances that could be gathered and submitted to EPA. Since its enactment, TSCA has always provided an organized framework for

[86] TSCA Section 4(b)(1)(C).

EPA to first gather and assess existing data and information *before* determining that existing information and data are insufficient. The statute enables EPA to engage in the kind of step-wise data-gathering process Congress envisioned by first using its Section 8 authority to call in information under Sections 8(a) to determine which entities in the US manufacture or process the chemicals in question[87] and to use its Section 8(d) authority to request the submission of information on existing health or environmental fate and effects data. If the Agency were to require new testing in these circumstances under a Section 4 rule or order, without first using its authority under Section 8 of TSCA, the Agency would fail to meet its burden under Section 4 to first determine the "need" and the "necessity" for the requested testing.

In addition, several of the substances which Petitioners have identified have been the subject of premanufacture notifications (PMNs) have undergone and completed review by EPA. For these substances, the Agency has already reviewed the data which exist[88] and concluded that the substance under review would not present an unreasonable risk[89]

IV. Conclusion

Petitioners have not met their burden of showing that the statutorily-required factors have been met. As described above, there is sufficient information on both toxicity and exposure for the Petition Compounds for the Agency to reasonably determine or predict that these substances do not present an unreasonable risk under current circumstances. Moreover, Petitioners' have not demonstrated that the extensive testing program proposed is necessary, particularly in light of the alternative means available to EPA for obtaining additional information, its ongoing efforts under the PFAS Action Plan, as well as the ongoing toxicological studies that Chemours is conducting under the NC DEQ Consent Order.

Indeed, there are multiple independent lines of evidence which support denying this Section 21 petition request for each of the Petition Compounds. As summarized in Appendix 7, at least one, and in most cases, many of the following points applies to each of the Petition Compounds:

- Technology at Fayetteville Works controls emissions by at least 99%
- The substances are present in aqueous discharges which would have been tested with 20+ years of bioassays
- Epidemiological studies around Fayetteville Works do not show differences in adverse effects in comparison to the rest of the state
- The substances are subject to testing under the North Carolina Consent Order
- The substances have been analyzed by ECHA under REACH
- The substances have CompTox and ExpoCast data on physical and chemical properties from which EPA may evaluate the potential risk

[87] This can include substances produced as commercial substances, byproducts, or impurities.
[88] When such notifications are provided to EPA, all health and safety studies in the submitters possession and control must be provided to EPA.
[89] Alternatively, EPA may have concluded that that any risks that might be presented by the substance would be mitigated by issuing a section 5(e) Consent Order to control the manner in which the substance will be manufactured and processed.

- The substances are currently subject to study under specific portions of EPA's PFAS Action Plan
- The substances would not be found in water because they react in water to form a different substances
- The substances would not be found in water because they are highly insoluble and volatile
- The substances are not produced by Chemours at Fayetteville Works
- The substances have never or only very rarely been detected around Fayetteville Works, despite extensive sampling
- The substances have not been evaluated in samples collected around Fayetteville Works or cannot be tested for, and thus no data exists to indicate their presence there
- The substances are sampled for and found at very low concentrations

For the reasons stated in this response, the Agency should conclude that petitioners have not met their statutory burden and the Petition should be denied.

Appendix 1 - Chemical List

Common Name	Chemical Name	CAS Number	Relationship to Fayetteville Works[90]
HFPO-DA (GenX)	perfluoro-2-methyl-3-oxahexanoate	13252-13-6	Product and Byproduct
PFO4DA	perfluoro(3,5,7,9-tetraoxadecanoic)acid	39492-90-5	Byproduct
PFO5DoDA	perfluoro(3,5,7,9,11-pentoxadodecanoic)acid	39492-91-6	Byproduct
Nafion byproduct 2 (Hydro-PS Acid)	2-[1-[difluoro(1,2,2,2-tetrafluoroethoxy)methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonic acid	749836-20-2	Byproduct
Hydro-EVE acid	3-[1-[difluoro(1,2,2,2-tetrafluoroethoxy)methyl-1,2,2,2-tetrafluoroethoxy]-2,2,3,3-tetrafluoropropanoic acid	773804-62-9	Byproduct
Nafion byproduct 1 (PS Acid)	1,1,2,2-tetrafluoro-2-({1,1,1,2,3,3-hexafluoro-3-[(1,2,2-trifluoroethenyl)oxy]propan-2-yl}oxy)ethane-1-sulfonic acid	29311-67-9	Byproduct
PFO2HxA	perfluoro(3,5-dioxahexanoic) acid	39492-88-1	Byproduct
PFO3OA	perfluoro(3,5,7-trioxaoctanoic) acid	39492-89-2	Byproduct
PFMOAA	perfluoro-2-methoxyacetic acid	674-13-5	Byproduct
PFMOPrA	perfluoromethoxypropionic acid	377-73-1	Not associated with Fayetteville Works
NaDONA	sodium dodecafluoro-3H-4,8-dioxanonanoate	958445-44-8	Not associated with Fayetteville Works
PFMOBA	perfluoro(4-methoxybutanoic) acid	863090-89-5	Not associated with Fayetteville Works
PEPA	perfluoroethoxypropyl carboxylic acid	267239-61-2	Byproduct

[90] Some of the Petition Compounds may be substances that are not intentionally manufactured at Fayetteville Works for commercial purposes as chemical substances *per se*, but may have been unintentionally generated or formed upon contact with other chemicals that may have been present during disposal or already in the environment.

PMPA	perfluoromethoxypropyl carboxylic acid	13140-29-9	Byproduct
N1AF	N1AF	N/A	Byproduct
PMCP	perfluoromethylcyclopentane	1805-22-7	Not associated with Fayetteville Works [91]
PEVE	pentafluoroethyl trifluorovinyl ether	10493-43-3	Product
PES	perfluoro(2-ethoxyethane)sulphonic acid	113507-82-7	Not associated with Fayetteville Works
TFE	tetrafluoroethylene	116-14-3	Raw material
HFP	hexafluoropropylene	116-15-4	Raw material
PMVE	perfluoromethylperfluorovinyl ether	1187-93-5	Product
MMF (acid)[92]	difluoropropanedioicacid	1514-85-8	Intermediate
PSEPVE	perfluoro (4-methyl-3, 6- dioxaoct-7-ene)sulfonyl fluoride	16090-14-5	Product and intermediate
PPVE	heptafluoropropyl trifluorovinyl ether	1623-05-8	Product
PEPF	2,3,3,3-tetrafluoro-2-(1,1,2,2,2-pentafluoroethoxy)propanoyl fluoride (aka pentafluoroethoxypropionyl fluoride)	1682-78-6	Product and intermediate
HFPO-DAF	2,3,3,3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)propanoyl fluoride	2062-98-8	Product, intermediate and byproduct
PMPF	2,3,3,3-tetrafluoro-2-(trifluoromethoxy)propanoyl fluoride (aka perfluoromethoxypropionyl fluoride)	2927-83-5	Product and intermediate
E2	fluoroether E2	3330-14-1	Product
E1	heptafluoropropyl 1,2,2,2-tetrafluoroether	3330-15-2	Byproduct
E3	fluoroether E3	3330-16-3	Byproduct
carbonyl fluoride	carbonyl fluoride	353-50-4	Byproduct and raw material
PAF	perfluoroacetyl fluoride	354-34-7	Byproduct and raw material

[91] The chemical substance perfluoromethycyclo***propane*** (CAS 379-16-8) is associated with Fayetteville Works as a byproduct. Chemours does not believe perfluoromethycyclo***pentane***, however, is a byproduct from its processes.

[92] Both CAS 1514-85-8 and CAS 4089-57-0 can be referred to by the common name "MMF." Additionally, both react with water to form the same substance, DFMA (Difluoromalonic acid). Solely for purposes of clarity and ease of identification in this document, we refer to CAS 1514-85-8 as the "(acid)" and CAS 4089-57-0 as the "(acid fluoride)."

n-perfluorobutane	n-perfluorobutane	355-25-9	Byproduct
MA	tetrafluoro-2-[tetrafluoro-2-(fluorosulfonyl)ethoxy]propanoyl fluoride	4089-57-0	Intermediate
Diadduct (DA)	8-fluorosulfonylperfluoro(2,5-dimethyl-3,6-dioxaoctanoyl) fluoride	4089-58-1	Intermediate
PPF	perfluoropropionyl fluoride	422-61-7	Byproduct
PPF Acid	perfluoropropionic acid	422-64-0	Byproduct
DFSA	difluorosulfoacetic acid	422-67-3	Byproduct
HFPO	hexafluoropropylene oxide	428-59-1	Product
EVE	methyl perfluoro(3-(1-ethenyloxypropan-2-yloxy)propanoate	63863-43-4	Product and intermediate
RSU	2,2-difluoro-2-(fluorosulfonyl)acetyl fluoride	677-67-8	Intermediate
MMF (acid fluoride) [93]	2-fluoro-2-methylpropanedioyl difluoride (aka methyl-2,2-difluoromalonyl fluoride or 2-fluoro-2-methylpropanedioyl difluoride)	69116-71-8	Intermediate
MAE	methylperfluoro(5-(fIuoroformyI)-4-oxahexanoate	69116-72-9	Intermediate
DAE	methyl perfluoro(8-(fluoroformyl)-5-methyl-4,7-dioxanonanoate	69116-73-0	Intermediate
SU	2- hydroxytetrafluoroethanesulfonic acid sulfone	697-18-7	Intermediate
NVHOS	1,1,2,2-tetrafluoro-2-(1,2,2,2-tetrafluoroethoxy)ethane sulfonate	1132933-86-8	Byproduct
MTP	2,2,3,3-tetrafluoro-3-methoxypropanoic acid	93449-21-9	Intermediate
Byproduct 4 (R-PSDA)	2,2,3,3,4,5,5,5-4-(1,1,2,2-tetrafluoro-2-sulfoethoxy)pentanoate	2416366-18-0	Byproduct
Byproduct 5 (Hydrolyzed PSDA)	2-fluoro-2-[1,1,2,3,3,3-hexafluoro-2-(1,1,2,2-tetrafluoro-2-sulfoethoxy)propoxyl]acetic acid	2416366-19-1	Byproduct
Byproduct 6 (R-PSDCA)	1,1,2,2-tetrafluoro-2-[(1,1,1,2,3,3,4,4-octafluorobutan-2-yl)oxyethane-1-sulfonic acid1,1,2,2-tetrafluoro-2-[(1,1,1,2,3,3,4,4-octafluorobutan-2-yl)oxy]ethane-1-sulfonic acid	2416366-21-5	Byproduct
EVE Acid	2,2,3,3-tetrafluoro-3-[1,1,1,2,3,3-hexafluoro-3-(1,2,2-	69087-46-3	Byproduct

[93] Both CAS 1514-85-8 and CAS 4089-57-0 can be referred to by the common name "MMF." Additionally, both react with water to form the same substance, DFMA (Difluoromalonic acid). Solely for purposes of clarity and ease of identification in this document, we refer to CAS 1514-85-8 as the "(acid)" and CAS 4089-57-0 as the "(acid fluoride)."

	trifluoroethenoxy)propan-2-yl]oxypropanoic acid		
R-EVE	5-(2-carboxy-1,1,2,2-tetrafluoroethoxy)-2,2,3,3,5,7,7,7-octafluoroheptanoic acid	2416366-22-6	Byproduct
PFECA B	Perfluoro-3,6-dioxaheptanoic acid	151772-58-6	Not associated with Fayetteville Works
PFECA G	4-Heptafluoroisopropoxy)hexafluorobutanoic acid	801212-59-9	Not associated with Fayetteville Works

Appendix 2 - Expocast and Hazard Information

CASRN	EXPOCAST MEDIAN EXPOSURE PREDICTION MG/KG-BW/DAY	EXPOCAST DATA?	HAZARD DATA?	TOXVAL DATA?
674-13-5	1.02E-06	Y	-	-
677-67-8	2.74E-06	Y	-	-
1623-05-8	3.58E-06	Y	-	-
10493-43-3	1.24E-06	Y	-	-
116-15-4	3.97E-06	Y	Y	Y - POD, lethality, inhalation tox, genotoxicity
151772-58-6	1.61E-06	Y	-	-
16090-14-5	4.09E-07	Y	-	-
1187-93-5	2.20E-05	Y	Y	Y - POD, lethality, genotoxicity
422-61-7	1.57E-07	Y	-	-
4089-58-1	3.00E-07	Y	-	-
113507-82-7	2.32E-06	Y	-	-
355-25-9	1.74E-07	Y	-	-
39492-91-6	1.38E-06	Y	-	-
1682-78-6	2.87E-07	Y	-	-
3330-14-1	3.97E-07	Y	-	-
116-14-3	5.01E-05	Y	Y	Y - POD, lethality, inhalation tox, genotoxicity
428-59-1	4.61E-07	Y	Y	Y - lethality, genotoxicity
1514-85-8	2.77E-07	Y	-	-
863090-89-5	1.17E-06	Y	-	-
354-34-7	1.43E-06	Y	-	-
801212-59-9	2.41E-06	Y	-	-
2062-98-8	2.84E-07	Y	-	-
377-73-1	1.70E-06	Y	-	-
353-50-4	1.83E-06	Y	Y	Y - inhalation tox

697-18-7	8.61E-07	Y	-	-
1805-22-7	1.58E-07	Y	-	-
13252-13-6	6.04E-07	Y	-	-
63863-43-4	1.26E-06	Y	-	-
3330-15-2	3.98E-07	Y	-	-
13140-29-9	1.86E-06	Y	-	-
422-64-0	1.07E-06	Y	Y (Eco only)	-
2927-83-5	8.82E-07	Y	-	-
801209-99-4	-	-	-	-
422-67-3	1.96E-07	Y	-	-
39492-90-5	1.12E-06	Y	-	-
69116-73-0	6.45E-07	Y	-	-

Appendix 3 - ToxCast Data

CASRN	ATMOSPHERIC HYDROXYLATION RATE (AOH) CM3/MOLECULE*SEC OPERA PRED	BIOCONCENTRATION FACTOR OPERA PRED	BIODEGRADATION HALF LIFE DAYS DAYS OPERA PRED	BOILING POINT DEGC OPERA PRED	HENRYS LAW ATM-M3/MOLE OPERA PRED	OPERA KM DAYS OPERA PRED	OCTANOL AIR PARTITION COEFF LOGKOA OPERA PRED	SOIL ADSORPTION COEFFICIENT KOC L/KG OPERA PRED	OCTANOL WATER PARTITION LOGP OPERA PRED	MELTING POINT DEGC OPERA PRED	VAPOR PRESSURE MMHG OPERA PRED	WATER SOLUBILITY MOL/L OPERA PRED
674-13-5	8.18458E-13	4.57706	3.67634	109.309	3.71539E-06	0.0857891	2.99895	4.80727	1.8795	-15.9717	3.08223	1.18809
677-67-8	8.51973E-13	2.33465	4.13303	65.0709	0.000696731	0.107008	2.79592	24.3997	2.02665	38.379	643.145	0.00782792
1623-05-8	2.10412E-12	37.5079	4.44296	53.5783	0.00491094	0.147778	1.95762	1655.7	2.80446	-64.0753	213.042	0.000581993
958445-44-8	4.23729E-13	5.40308	4.45547	182.583	1.80448E-10	0.509484	4.2503	967.289	2.21026	64.1244	6.83774E-06	0.00113699
69087-46-3	8.9347E-13	5.41672	4.62599	182.645	1.49834E-09	0.519475	4.77327	1739.34	4.44748	60.7585	8.02837E-06	0.00160817
10493-43-3	2.11791E-12	30.8881	3.67627	2.15945	0.00143432	0.146062	1.57573	584.349	2.43189	-109.802	882.246	0.00433934
3330-16-3	1.43471E-15	69.989	3.67908	188.265	5.69009E-06	3.09731	2.26132	83653.2	4.9419	-14.1608	1.07195	5.50779E-07
749836-20-2	6.07602E-15	4.31656	4.4527	220.6	2.28498E-08	2.65225	4.78118	792.455	3.87036	169.801	2.6613E-06	3.07817E-05
116-15-4	2.19769E-12	12.9838	4.91404	-29.5901	0.000658973	0.114875	0.555885	184.912	1.63153	-156.604	4891.76	0.00014462
39492-89-2	8.42893E-13	2.86496	3.67798	179.327	0.000499484	0.613475	3.94787	34.3691	2.76062	55.6638	0.0263837	0.00162885
151772-58-6	8.57303E-13	4.96348	3.67708	160.799	1.05762E-10	0.312514	3.79783	33.8412	1.84476	17.0389	0.000689778	0.00149381
16090-14-5	8.67721E-13	4.30944	3.81464	157.087	4.67239E-06	3.82257	3.47373	750.145	5.97858	-4.55783	0.0624405	5.3731E-06
1187-93-5	3.57753E-12	4.8762	4.5808	-17.7612	0.00106008	0.154364	1.34117	164.681	1.93579	-120.567	1324.35	0.00481185
29311-67-9	8.42547E-13	5.39244	4.61898	216.402	1.50246E-08	2.5238	5.87443	838.533	5.83953	189.597	5.07355E-07	0.000111482
422-61-7	1.40521E-12	6.15719	3.68285	-19.0142	0.0166075	0.10539	1.28704	21.4942	1.6609	-123.165	3785.47	0.000204834
4089-58-1	8.20021E-13	4.36073	3.81483	157.118	3.18662E-08	2.42583	3.95741	203.472	6.10106	20.6078	0.00213095	4.6339E-06
113507-82-7	1.97724E-15	4.97294	3.67656	214.932	2.22622E-10	0.23629	4.20342	352.286	2.98487	112.106	1.24992E-06	0.000805665
355-25-9	4.35747E-16	47.8537	7.57021	-1.89695	0.0310702	0.147617	0.306967	1691.56	2.74245	-128.117	2063.93	8.29129E-05
39492-91-6	1.25099E-13	2.50676	4.13712	203.91	3.8594E-08	2.56905	4.28856	559.908	5.16107	172.312	0.00174606	0.000271319
1682-78-6	9.19626E-13	2.50148	3.67642	58.9408	0.0202355	0.175401	1.60512	119.274	2.75785	-59.3542	501.262	0.00611375
3330-14-1	4.03961E-16	92.8871	3.67801	116.089	0.000938695	4.25281	1.77242	3544.86	4.38915	-9.58639	95.3445	2.14196E-06
39492-88-1	8.41627E-13	4.18578	3.67701	139.343	5.44016E-05	0.0661217	3.6847	48.5873	2.11126	13.7193	0.0435243	0.147458
116-14-3	2.32568E-12	11.0815	9.89616	-75.7579	0.00017557	0.143152	1.01186	52.7048	1.45033	-142.646	24261.7	0.00159972
428-59-1	4.28264E-16	12.3974	3.68298	-27.366	0.113358	0.0950205	0.967128	82.2213	1.24007	-120.704	1301.43	0.00511536
1514-85-8	1.65105E-12	4.41408	5.08012	318.369	1.17833E-08	0.104228	6.89701	13.2622	0.287941	119.282	0.000107296	4.21881
863090-89-5	8.53318E-13	5.46446	4.45654	156.502	0.000435924	0.0799007	3.66481	22.8757	2.08915	15.7329	1.7468	0.00105891
354-34-7	1.20411E-12	3.92846	7.57342	-58.9548	0.000334682	0.146266	0.975097	40.7195	0.803498	-133.321	6208.95	0.00277373
801212-59-9	8.3507E-13	5.4727	4.46329	183.451	0.000625839	0.639012	4.07599	1146.88	3.38494	45.7627	0.0435322	0.0016943
2062-98-8	8.99872E-13	14.0095	4.44622	68.2517	0.0200986	0.272033	2.28631	478.819	3.37203	-53.3135	40.9855	0.00480925
267239-61-2	8.62356E-13	6.27089	4.44266	156.559	2.87185E-10	0.0884384	3.39771	26.8376	2.51602	15.8141	0.892022	0.00105629
773804-62-9	7.88524E-13	5.41161	4.45731	186.989	2.5809E-07	2.57344	4.2387	2482.36	3.54163	78.7362	0.00904544	0.0056122
377-73-1	8.53642E-13	5.46296	4.44718	121.906	3.03004E-10	0.0636774	3.70252	45.3247	1.74467	-4.66267	0.0693027	0.138329
353-50-4	4.21643E-16	4.22221	8.20812	-84.4245	0.0147282	0.165369	1.31592	43.6809	0.989691	-111.272	44186	0.0418099
697-18-7	8.66704E-16	2.6132	3.6772	56.3393	0.0873489	0.104702	2.20202	15.0738	2.21573	-12.3748	433.169	0.309742
1805-22-7	3.46754E-15	93.5175	5.43594	55.6203	0.0127703	0.149517	1.8024	939.844	4.68483	-65.0903	258.065	9.89867E-05
13252-13-6	8.49533E-13	6.27194	4.45625	172.576	2.21831E-10	0.646109	3.74477	409.56	3.00331	27.772	0.241198	0.00111272
69116-72-9	7.89633E-13	2.12795	4.45239	91.8869	6.06445E-06	0.372166	3.74525	367.978	2.99112	-19.2285	0.430017	0.175246
63863-43-4	8.35449E-13	4.23498	4.61623	137.729	2.32081E-07	4.1205	3.47056	1204.93	4.47966	-40.5156	0.112376	0.000453773
3330-15-2	3.13554E-15	39.1041	3.6767	41.022	0.0126954	0.148976	0.964195	618.233	2.89294	-48.1602	361.243	0.000429259
13140-29-9	8.39791E-13	5.47061	4.44303	121.552	5.18897E-05	0.0803678	2.97418	33.5091	1.73715	-5.14285	3.29524	0.0149544
422-64-0	8.44226E-13	5.47706	4.44365	96.527	3.64427E-06	0.0835647	2.58721	5.8902	1.41593	-15.9292	10.3356	0.147071
2927-83-5	9.29285E-13	2.21748	3.6761	31.0189	0.00553101	0.170673	1.61676	202.177	1.93125	-91.9781	540.075	0.00645838
801209-99-4	7.58516E-15	4.9918	4.45133	210.982	1.17764E-06	0.144485	4.19743	60.9657	2.59377	96.8841	1.60081E-06	0.00788323
422-67-3	3.28819E-13	3.02748	4.98506	296.184	1.12724E-08	0.0711283	7.16628	5.45476	0.876571	174.37	4.04809E-06	1.42571
39492-90-5	8.36814E-13	2.67535	4.1362	181.883	5.46055E-05	0.463958	4.09576	868.679	4.8336	89.4452	0.0018273	0.00112279
69116-73-0	8.05727E-13	3.48027	4.61659	142.351	3.39161E-08	6.74996	3.95416	285.643	4.52826	-9.30965	0.00772507	5.48226E-06
4089-57-0	8.38711E-13	2.15965	4.1341	119.325	7.93753E-06	0.271995	3.74296	569.014	3.93284	-47.1014	0.174319	0.00711425
69116-71-8	1.53029E-13	5.65213	4.46386	108.021	5.069E-08	0.247461	3.11957	30.0098	1.75496	-51.9109	25.594	0.0515178

Appendix 4 - EPA PFAS Action Plan Applicability

Abbreviation	CAS	PFAS of Interest[94]	75 PFAS[95]	PFAS Library[96]	ECOTOX[97]
HFPO-DA (GenX)	13252-13-6 62037-80-3	Y	Y	Y	Y
PFO4DA	39492-90-5				Y
PFMOPrA	377-73-1	Y		Y	Y
PFMOBA	863090-89-5	Y	Y	Y	Y
PMCP	1805-22-7			Y	
PES	113507-82-7	Y		Y	
PSEPVE	16090-14-5			Y	
PPVE	1623-05-8		Y	Y	
HFPO-DAF	2062-98-8			Y	
E2	3330-14-1			Y	
E1	3330-15-2			Y	
PPF Acid	422-64-0			Y	Y
EVE	63863-43-4			Y	
PFECA B	151772-58-6	Y	Y	Y	Y
PFECA G	801212-59-9			Y	

[94] https://www.epa.gov/sites/production/files/2020-09/documents/epa_pfas_working_list_of_chemicals_09_25_2020.pdf.
[95] https://www.epa.gov/sciencematters/epa-and-partners-describe-chemical-category-prioritization-approach-select-75-pfas; https://comptox.epa.gov/dashboard/chemical_lists/epapfas75S1.
[96] https://www.epa.gov/sites/production/files/2020-09/documents/epa_pfas_rd_overview_complete_2020_09_25.pdf.
[97] https://www.epa.gov/sites/production/files/2020-09/documents/epa_pfas_rd_overview_complete_2020_09_25.pdf.

Appendix 5 - USEPA Tiered Testing Methods

Toxicological Response	Assay	Assay Endpoints	Purpose
Hepatotoxicity	3D HepaRG assay	Cell death and transcriptomics	Measure cell death and changes in important biological pathways
Developmental Toxicity	Zebrafish embryo assay	Lethality, hatching status and structural defects	Assess potential teratogenicity
Immunotoxicity	Bioseek Diversity Plus	Protein biomarkers across multiple primary cell types	Measure potential disease and immune responses
Mitochondrial Toxicity	Mitochondrial membrane potential and respiration (HepaRG)	Mitochondrial membrane potential and oxygen consumption	Measure mitochondrial health and function
Developmental Neurotoxicity	Microelectrode array assay (rat primary neurons)	Neuronal electrical activity	Impacts on neuron function
Endocrine Disruption	ACEA real-time cell proliferation assay (T47D)	Cell proliferation	Measure ER activity
General Toxicity	Attagene cis- and trans- Factorial assay (HepG2)	Nuclear receptor and transcription factor activation	Activation of key receptors and transcription factors involved in hepatotoxicity
	High-throughput transcriptomic assay (multiple cell types)	Cellular mRNA	Measures changes in important biological pathways
	High-throughput phenotypic profiling (multiple cell types)	Nuclear, endoplasmic reticulum, nucleoli, golgi, plasma membrane, cytoskeleton, and mitochondria morphology	Changes in cellular organelles and general morphology
Intrinsic hepatic clearance	Hepatocyte stability assay (primary human hepatocytes)	Time course metabolism of parent chemical	Measure metabolic breakdown by the liver
Plasma protein binding	Ultracentrifugation assay	Fraction of chemical not bound to plasma protein	Measure amount of free chemical in the blood

Appendix 6 - Estimated number of rodents euthanized based on recommended toxicity testing for PFAS compounds.

Toxicity Test	Health Effects Test Guidelines	Number of Mice Euthanized per Test[1]	Number of Rats Euthanized per Test[2]	Number of Chemicals/Mixtures	Total Number of Rodents Euthanized per Toxicity Test
Combined repeated dose toxicity study with reproduction/developmental toxicity screening test	EPA 870.3650[3] Lau et al. 2006[4]	45 control dams + 25 dams per test group (3 doses) x 12 pups/dam = 1,440 mice	45 control dams+ 25 dams per test group (3 doses) x 11 pups/dam = 1,320 rats	54 chemicals + 3 mixtures	82,080 mice 75,240 rats Total = 157,320 rodents
Immunotoxicity	EPA 870.7800[5] Dong et al. 2009[6]	60 male and 60 females = 120 mice[6]	—	54 chemicals + 3 mixtures	6,840 mice
Toxicokinetics	EPA 870.7485[7] tier 1, with modification to include pregnant animals	4 males and 4 females, plus 4 dams x 12 pups/dam; 3 routes of exposure = 180 mice	4 males and 4 females, plus 4 dams x 11 pups/dam; 3 routes of exposure = 168 rats	54 chemicals + 3 mixtures	10,260 mice 9,576 rats Total = 19,836 rodents
Extended one-generation with developmental immunotoxicity and reproductive toxicity	OECD 443[8]	—	200 rats (F_0); 20 litters/test group (3 doses, 1 control) x 11 pups/dam (F_1 generation); 11 pups/dam x 20 litters/test group (F_2 generation) = 1,960 rats	14 chemicals (Tier 1)	27,440 rats
				54 chemicals + 3 mixtures	111,720 rats
Developmental neurotoxicity	NTP multigeneration[9]	200 rats (F_0); 20 litters/test group (3 doses, 1 control) x 12 pups/dam = 1,160 mice	—	14 chemicals (Tier 1)	16,240 mice
				54 chemicals + 3 mixtures	66,120 mice
Carcinogenesis	Two-year cancer bioassay[10] with *in utero* (developmental) exposure in rats[11]	50/sex/test group (3 doses, 1 control) = 400 mice	50 dams/test group (3 doses, 1 control) x 11 pups/dam = 2,400 rats	14 chemicals (Tier 1)	5,600 mice 33,600 rats Total = 39,200 rodents
				54 chemicals + 3 mixtures	22,800 mice 136,800 rats Total = 159,600 rodents
Estimated total number of rodents euthanized for toxicity studies					**266,876* (521,436**)**

* Total number of euthanized rodents if only 14 chemicals (Tier 1) are tested in the extended one-generation, developmental neurotoxicity, and carcinogenesis tests.

** Total number of euthanized rodents if 54 chemicals + 3 mixtures were tested in all toxicity tests listed.

[1] Litter size based on average litter size for CD-1 mice (https://www.envigo.com/model/hsd-icr-cd-1); not all mice are placed in study.

[2] Litter size based on average litter size for Sprague Dawley rats (https://www.envigo.com/model/hsd-sprague-dawley-sd); not all rats are placed in study.

[3] EPA Health Effects Test Guidelines, OPPTS 870.3650. Combined repeated dose toxicity study with the reproduction/developmental toxicity screening test. Available at: https://ntp.niehs.nih.gov/iccvam/suppdocs/feddocs/epa/epa_870_3650.pdf.

[4] Lau C, Thibodeaux JR, Hanson RG, Narotsky MG, Rogers JM, Lindstrom AB, Strynar MJ. Effects of perfluorooctanoic acid exposure during pregnancy in the mouse. Toxicol Sci. 2006 Apr;90(2):510-8. doi: 10.1093/toxsci/kfj105.

[5] EPA Health Effects Test Guidelines, OPPTS 870.7800. Immunotoxicity. https://nepis.epa.gov/Exe/ZyPDF.cgi/P100IRS7.PDF?Dockey=P100IRS7.PDF.

[6] Dong GH, Zhang YH, Zheng L, Liu W, Jin YH, He QC. Chronic effects of perfluorooctanesulfonate exposure on immunotoxicity in adult male C57BL/6 mice. Arch Toxicol. 2009 Sep;83(9):805-15.

[7] EPA Health Effects Test Guidelines, OPPTS 870.7485. Metabolism and pharmacokinetics. https://nepis.epa.gov/Exe/ZyPDF.cgi/P100IRXG.PDF?Dockey=P100IRXG.PDF.

[8] OECD Test No. 443: Extended one-generation reproductive toxicity study. https://www.oecd-ilibrary.org/environment/test-no-443-extended-one-generation-reproductive-toxicity-study_9789264185371-en.

[9] Foster, P. M. Influence of Study Design on Developmental and Reproductive Toxicology Study Outcomes. Toxicol Pathol 45, 107-113, doi:10.1177/0192623316671608 (2017).

[10] EPA Health Effects Test Guidelines, OPPTS 870.4200. Carcinogenicity. https://nepis.epa.gov/Exe/ZyPDF.cgi/901B0A00.PDF?Dockey=901B0A00.PDF

[11] https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr459.pdf.

Appendix 7 - Summary of Information

Common Name	CAS	Impacted By Consent Order Emission Controls	Potentially Subject to Whole-Effluent Studies	Potentially Subject to Epidemiological Studies	Subject to Specific Consent Order Study	REACH Dossier	EPA CompTox Data	EPA ExpoCast Data	Specifically mentioned in EPA PFAS Action Plan	Reacts with Water to Form New Substance	Volatile/Insoluble	Not Chemours Chemical	Rarely/Never Detected	No Reliable Sampling Data Exists	On TSCA Active Inventory
HFPO-DA (GenX)	13252-13-6 62037-80-3	Y	Y	Y		Y	Y	Y	Y						Y
PFO4DA	39492-90-5	Y	Y	Y			Y	Y	Y						
PFO5DoDA	39492-91-6	Y	Y	Y			Y	Y							
Hydro-PS Acid	749836-20-2	Y	Y	Y	Y		Y								
Hydro-EVE acid	773804-62-9	Y	Y	Y			Y								
PS Acid	29311-67-9	Y	Y	Y			Y								
PFO2HxA	39492-88-1	Y	Y	Y	Y		Y								
PFO3OA	39492-89-2	Y	Y	Y			Y								
PFMOAA	674-13-5	Y	Y	Y	Y		Y	Y							
PFMOPrA	377-73-1	Y	Y	Y			Y	Y	Y			Y			
NaDONA	958445-44-8	Y	Y	Y			Y					Y	Y		
PFMOBA	863090-89-5	Y	Y	Y			Y	Y	Y			Y			
PEPA	267239-61-2	Y	Y	Y	Y		Y								
PMPA	13140-29-9	Y	Y	Y	Y		Y	Y							
N1AF		Y		Y						Y				Y	
PMCP	1805-22-7	Y		Y		Y	Y	Y	Y		Y			Y	
PEVE	10493-43-3	Y	Y	Y		Y	Y	Y						Y	Y
PES	113507-82-7	Y	Y	Y			Y	Y	Y			Y	Y		
TFE	116-14-3	Y		Y		Y	Y	Y			Y			Y	Y
HFP	116-15-4	Y		Y		Y	Y	Y			Y			Y	Y
PMVE	1187-93-5	Y	Y	Y		Y	Y	Y			Y			Y	Y
MMF (acid)	1514-85-8	Y	Y	Y			Y	Y		Y				Y	
PSEPVE	16090-14-5	Y	Y	Y			Y	Y	Y	Y				Y	Y

Common Name	CAS	Impacted By Consent Order Emission Controls	Potentially Subject to Whole-Effluent Studies	Potentially Subject to Epidemiological Studies	Subject to Specific Consent Order Study	REACH Dossier	EPA CompTox Data	EPA ExpoCast Data	Specifically mentioned in EPA PFAS Action Plan	Reacts with Water to Form New Substance	Volatile/Insoluble	Not Chemours Chemical	Rarely/Never Detected	No Reliable Sampling Data Exists	On TSCA Active Inventory
PPVE	1623-05-8	Y	Y	Y		Y	Y	Y	Y		Y			Y	Y
PEPF	1682-78-6	Y	Y	Y			Y	Y		Y				Y	Y
HFPO-DAF	2062-98-8	Y	Y	Y			Y	Y	Y	Y				Y	Y
PMPF	2927-83-5	Y	Y	Y			Y	Y		Y				Y	Y
E2	3330-14-1	Y	Y	Y			Y	Y	Y					Y	Y
E1	3330-15-2	Y		Y			Y	Y	Y					Y	
E3	3330-16-3	Y		Y			Y							Y	
carbonyl fluoride	353-50-4	Y		Y		Y	Y	Y		Y				Y	Y
PAF	354-34-7	Y		Y			Y	Y		Y				Y	Y
n-perfluorobutane	355-25-9	Y		Y			Y	Y						Y	
MA	4089-57-0	Y		Y										Y	
Diadduct (DA)	4089-58-1	Y	Y	Y			Y	Y		Y				Y	Y
PPF	422-61-7	Y		Y			Y	Y	Y	Y				Y	Y
PPF Acid	422-64-0	Y	Y	Y			Y	Y						Y	Y
DFSA	422-67-3	Y	Y	Y			Y	Y						Y	
HFPO	428-59-1	Y		Y		Y	Y	Y		Y	Y			Y	Y
EVE	63863-43-4	Y		Y			Y	Y	Y					Y	Y
RSU	677-67-8	Y		Y			Y	Y		Y				Y	Y
MMF (acid fluoride)	69116-71-8	Y		Y						Y				Y	
MAE	69116-72-9	Y		Y			Y							Y	
DAE	69116-73-0	Y		Y			Y	Y						Y	Y
SU	697-18-7	Y		Y			Y	Y		Y				Y	Y
NVHOS	1132933-86-8	Y	Y	Y			Y								
MTP	93449-21-9	Y	Y	Y										Y	

Common Name	CAS	Impacted By Consent Order Emission Controls	Potentially Subject to Whole-Effluent Studies	Potentially Subject to Epidemiological Studies	Subject to Specific Consent Order Study	REACH Dossier	EPA CompTox Data	EPA ExpoCast Data	Specifically mentioned in EPA PFAS Action Plan	Reacts with Water to Form New Substance	Volatile/Insoluble	Not Chemours Chemical	Rarely/Never Detected	No Reliable Sampling Data Exists	On TSCA Active Inventory
R-PSDA	2416366-18-0	Y	Y	Y											
Hydrolyzed PSDA	2416366-19-1	Y	Y	Y											
R-PSDCA	2416366-21-5	Y	Y	Y											
EVE Acid	69087-46-3	Y	Y	Y			Y								
R-EVE	2416366-22-6	Y		Y											
PFECA B	151772-58-6	Y		Y			Y		Y			Y	Y		
PFECA G	801212-59-9	Y		Y			Y		Y			Y	Y		