

## GenX Frequently Asked Questions

*Note: The following document provides frequently asked questions and answers concerning GenX and other emerging contaminants. Due to inputs from state and federal partners, information about GenX is continually evolving. Updates will be provided as new information becomes available.*

### **What is GenX?**

GenX is a trade name for a man-made and unregulated chemical used in manufacturing nonstick coatings and for other purposes.

Chemours' facility in Fayetteville began producing GenX commercially in 2009 as a replacement for PFOA. The same chemical is also produced as a byproduct during other manufacturing processes and it may have been present in the environment for many years before being produced commercially as GenX.

### **What actions has the state taken to address GenX and other emerging contaminants?**

At Governor Roy Cooper's direction, DEQ and DHHS have deployed all available resources to address the immediate concerns in the Lower Cape Fear region.

The N.C. Department of Environmental Quality and the state Department of Health and Human Services launched an investigation June 14 into the presence of GenX in the Cape Fear River. The river serves as the primary source of drinking water for Bladen, Brunswick, New Hanover and Pender counties.

On June 19, DEQ and DHHS started collecting water samples from multiple sites in the Cape Fear River to test for concentrations of GenX. State officials continue to collect water samples, with samples being tested at an EPA lab in North Carolina and a private lab, Test America, in Colorado.

Here's a [Map and dates of the sampling](#).

On June 27, DEQ conducted an on-site inspection to verify that Chemours is redirecting the wastewater from the GenX process into temporary storage tanks for off-site shipment and incineration.

DEQ released the first state test results July 14. At the same time, DHHS released an updated preliminary health assessment for concentrations of GenX in drinking water. DHHS' updated health goal is conservative and health protective for non-cancer health effects in bottle-fed infants, pregnant women, lactating women, children and adults. The changes to the health goal reflect additional health studies. Detailed information regarding the initial and revised assessments are posted online at: <http://bit.ly/2uutE4z>.

Since the state was successful at getting Chemours to stop the release of GenX into the Cape Fear River, we have seen a precipitous decline in the concentrations of the chemical compound at all sites. Tests continue to show that levels of GenX in finished drinking water are below the state's health goal.

State water quality officials plan to continue water sampling and analysis at the finished water sites for the foreseeable future. The first week of August, DEQ added 16 monitoring wells at the Chemours facility to the sampling plan to investigate groundwater conditions at the facility in Bladen County.

There are numerous other facets to our investigation.

Because of the lack of scientific data on the long-term public health effects of these contaminants, Governor Cooper has expanded the Secretaries' Science Advisory Board to help guide state officials on ways to better protect public health and the environment from new or unregulated chemicals.

Governor Cooper also has directed the State Bureau of Investigation to assess whether a criminal investigation is warranted. The SBI will work with its partners at DEQ and EPA to determine if there is evidence of criminal violations of the permit or any state or federal law or regulation.

DEQ and DHHS are working with the EPA and CDC to obtain more research that can be used to develop regulatory guidance for GenX and other emerging compounds. DEQ is continuing to monitor the facility to ensure releases have stopped. DEQ will deny Chemours' permit request to release GenX and a new permit will be developed. As part of its permit review, DEQ is investigating how and when Chemours disclosed in its wastewater discharge permit the chemicals it was discharging to the Cape Fear River. DEQ will take any appropriate enforcement actions related to its investigation.

During the investigation, DEQ and DHHS are exploring all regulatory options available. DEQ is reviewing the specific identifying information Chemours provided for the chemicals it was discharging into the Cape Fear River and will make public as soon as it is available any appropriate enforcement action.

Recognizing there are no national or state standards for GenX or the other chemicals identified in the 2016 report, DEQ and DHHS are seeking involvement by the EPA on the health effects of these emerging contaminants. This is a national issue and we're making the best use of state resources and working with our federal partners. While the state has the authority to enact regulatory standards, we do not have sufficient resources necessary to make these determinations for GenX or other unregulated compounds on a consistent basis.

All of the state's efforts have been well documented. The state has weekly conference calls to update local officials on the state's investigation and both DEQ and DHHS regularly publish any new information on this topic on our public web page devoted to GenX, <https://deq.nc.gov/news/hot-topics/genx-investigation>.

#### **Where are water quality samples being collected?**

DEQ staff are collecting samples at multiple [locations](#) near Fayetteville, where the plant is located, and Wilmington. Sampling began the week of June 19 and has continued in the same locations for the past two months. DEQ staff in the Fayetteville Regional Office have been collecting water samples at the Chemours plant site, the Bladen Bluff intake and their treated water, a water supply well in Bladen County and the Hoffer Water Treatment Plant upstream of Chemours' facility. The Hoffer site was added the week of July 3.

DEQ staff in the Wilmington Regional Office have sampled at the intake site of the Lower Cape Fear Water and Sewer Authority's intake, the International Paper intake, the International Paper finished water, the Cape Fear Public Utility Authority's finished water, the Pender County public utility's finished water, the Brunswick County public utility's finished water, the Cape Fear Public Utility's Aquifer Storage and Recovery Well, and the Wrightsville Beach water supply well.

DEQ has added other locations downstream of the Chemours facility since the investigation began.

Water sampling and analysis will continue at finished drinking water sites for the foreseeable future.

Also, DEQ officials began the week of July 31 conducting groundwater sampling to look for any concentrations of GenX in 16 monitoring wells at the Chemours facility in Fayetteville. The groundwater results will help the state determine whether additional testing is warranted at private wells near the facility

**DEQ prompted Chemours, the chemical's manufacturer, to stop discharging GenX into the Cape Fear River. Can the state take additional actions against Chemours or close the facility?**

The state is investigating to determine if Chemours violated the terms of its permits and the Clean Water Act and will take any appropriate enforcement actions as necessary. In addition, Governor Cooper has directed the State Bureau of Investigation's Diversion and Environmental Crimes Unit to assess whether a criminal investigation is warranted. The SBI will work with its partners at the N.C. Department of Environmental Quality and the EPA to determine if there is evidence of criminal violations of the permit or the federal consent order in place.

**Is GenX regulated under the wastewater permit issued to Chemours?**

Currently, there are no state or federal criteria necessary to establish regulation of the wastewater discharge of GenX.

**Will the state regulate GenX in Chemours' next wastewater permit?**

Chemours has applied for a new National Pollutant Discharge Elimination System permit (its wastewater discharge permit), a federal permit program that controls water pollution and is managed by DEQ. On July 24, Governor Cooper announced that DEQ will deny Chemours' request to release GenX and include that language in the next permit. Acknowledging the potential for other possibly harmful compounds, Chemours' draft permit will include a clause authorizing the state to quickly reopen the permit if needed to regulate and enforce levels of any emerging compounds based on new scientific findings.

**Why are officials waiting three days between sampling in Fayetteville and Wilmington?**

It takes an estimated three days for water to flow the 70 miles down the Cape Fear River from the Chemours plant in Fayetteville to the river intakes near Wilmington. Sampling similar water parcels in the two areas will provide a more consistent and representative analysis.

**Where will the samples be analyzed?**

Water samples from the first six weeks were analyzed by two independent laboratories, a certified facility in Colorado, and an EPA laboratory in the Research Triangle Park near Raleigh. The state is contracting with other laboratories to analyze additional samples.

**Where can I find results of water sampling?**

Results as well as information about GenX and sampling locations can be found online at the web page DEQ developed for GenX at: <https://deq.nc.gov/news/hot-topics/genx-investigation/genx-sampling-sites>.

**Why are you taking multiple rounds of water quality samples?**

Taking multiple samples will give the most accurate data. This will help us to better understand how much GenX was currently in the river at the time of testing and provide more current data to help evaluate potential health impacts.

**Has the federal government published health recommendations for GenX?**

EPA has not published health recommendations for GenX.

**Is it safe to eat fish from the Cape Fear River?**

There are no fish advisories in place related to GenX. A list of statewide and location-specific fish advisories related to other contaminants is available at:

<http://epi.publichealth.nc.gov/oe/fish/advisories.html>.

### **How are drinking water standards developed?**

Like other states nationwide, North Carolina has adopted and implements federal drinking water standards established by the EPA. The standards take into account several factors, including the health benefits, efficiency and cost of removing waste from a drinking water system.

### **GenX has been described as an “emerging contaminant” or compound. What does that mean?**

Under the Unregulated Contaminant Monitoring Rule, the EPA gathers data about select unregulated contaminants to determine how often they appear in drinking water and at what levels. The EPA uses that data along with relevant health effect studies to determine if regulation is necessary, and if so, at what levels. For information on the Unregulated Contaminant Monitoring Rule, please visit:

<https://www.epa.gov/dwucmr/learn-about-unregulated-contaminant-monitoring-rule>.

### **How did the state learn that GenX is in the Cape Fear River?**

The EPA and Detlef Knappe, professor of Civil, Construction and Environmental Engineering at N.C State University, conducted a study that identified the presence of GenX in the Cape Fear River. The report was produced in conjunction with EPA and reflects the importance of emerging technologies being used to detect unregulated contaminants. It is not unusual for unregulated contaminants to come to light as technology gets better at detecting them.

### **What about other related chemicals that might be in the water?**

The same report from Knappe included results for several other chemicals in the same fluorinated family of compounds. Concentrations of older “legacy” chemicals (PFOA and PFOS) did not exceed the EPA Health Advisory level of 70 ng/L in the lower section of the river near Wilmington. For some newer or “emerging” chemicals, specific levels could not be measured due to limitations of current laboratory testing.

### **What do you know about the health effects of these other chemicals?**

Limited information is available about the potential health effects of these newer emerging chemicals.

### **What is the state doing to address the limited amount of information about GenX and the other chemicals?**

DHHS is reviewing all available health data to better understand and communicate possible health risks for the other related chemicals.

Also, Governor Cooper on Aug. 1 expanded a state science panel to help guide state officials on ways to better protect public health and the environment from new or unregulated chemicals. A new charter for the panel was drawn up and signed by secretaries for DHHS and DEQ. The panel’s new charter expands the scope of the Secretary’s Science Advisory Board on Toxic Air Pollutants and changes its name to the Secretaries’ Science Advisory Board.

Among its new duties, the panel will perform or recommend reviews and evaluations of contaminants released to the environment; act as consultants on DEQ’s determinations to regulate releases of contaminants; assist both agencies in identifying contaminants of emerging concern and help determine whether the contaminants should be studied further; assist the secretaries in providing expertise to evaluate the human and environmental impacts of exposure to hazardous contaminants; and provide input to DHHS as the agency establishes health goals for emerging contaminants.

### **Is DEQ testing for these other chemicals?**

DEQ is testing for the other unregulated chemicals that Knappe identified in his report. The agency has met with Knappe to discuss his research and is working with the EPA's lab in Research Triangle Park and others to replicate his team's analysis using current water samples.

### **How can GenX affect my health?**

There is some information available about the health effects of GenX, but it is limited. Laboratory studies in which animals were exposed to different levels of GenX did show adverse effects to the liver and blood, along with liver, pancreatic, testicular and uterine cancers, but there is no information about whether these or other health effects would be seen in humans. A recent review of cancer rates over the last 20 years in Bladen, Brunswick, New Hanover and Pender counties indicated that the rates in those counties were generally similar to the statewide rates of pancreatic, liver, uterine, testicular and kidney cancers. However, no conclusions can be drawn as to whether GenX or any other specific exposures contributed to cancer rates that were examined.

At the request of Governor Cooper, the CDC has committed to doing an assessment on the possible long-term health effects of GenX. DHHS has reviewed existing research studies and is working with the EPA, CDC and academic researchers to gather more health information about GenX and related chemicals.

### **What is the DHHS health goal and what does it mean?**

When there is not a federal standard and sufficient scientific information is available, DHHS can develop and issue a health goal that is non-regulatory and non-enforceable.

Health goals are based on evolving toxicological data and, as such, are considered provisional. It is subject to further refinement based on consultation with federal agencies and other partners, and the introduction of new research and scientific information, or new standards or levels from the EPA.

The DHHS health goal for GenX is 140 parts per trillion. Recent testing shows that levels of GenX in finished water samples in the lower Cape Fear region are below the health goal and trending down. This health goal not a boundary line between a "safe" and "dangerous" level of a chemical. Rather, it represents the concentration of GenX at which no adverse non-cancer health effects would be anticipated in the most sensitive population over an entire lifetime of exposure.

More information about the health goal is available at: <https://ncdenr.s3.amazonaws.com/s3fs-public/GenX/NC%20DHHS%20Risk%20Assessment%20FAQ%20Final%20Clean%20071417%20PM.pdf>.

### **Are there home water filtration systems that can remove GenX?**

There is not enough information to support the recommendation of any specific filtration method (e.g. reverse osmosis, granular activated carbon, etc.) to remove GenX from water. Research into filtration methods is ongoing and new information will be shared as it becomes available.

### **Has the federal government published health recommendations for GenX?**

EPA has not published health recommendations for GenX, but they are currently working on their own health assessment for GenX. Should the EPA release a recommended level for GenX, DHHS would withdraw its health goal.

**Is it safe to eat fish from the Cape Fear River?**

There are no fish advisories in place related to GenX. A list of statewide and location-specific fish advisories related to other contaminants is available at:

<http://epi.publichealth.nc.gov/oeefish/advisories.html>.

**Is there a blood test or body scan to determine if I have GenX in my body?**

We are not aware of any lab that is currently conducting blood tests or other types of tests for GenX. Even if such tests were available, the significance of the results for a person's health are not known.

**I understand DEQ is also investigating for any impacts near the Chemours facility. Did the state look at demographic data for the residents living near the facility?**

Yes. The state used the U.S. EPA's Environmental Justice Screening Tool and additional U.S. Census data to review the demographics for people living near the facility. A copy of the state's Environmental Justice Screening documents can be found at:

[https://files.nc.gov/ncdeq/GenX/Chemours%20EJ%20screening%20info\\_2017.pdf](https://files.nc.gov/ncdeq/GenX/Chemours%20EJ%20screening%20info_2017.pdf).

**Questions and Answers Regarding North Carolina Department of Health and Human Services  
Updated**

**Risk Assessment for GenX (Perfluoro-2-propoxypropanoic acid)**

*This document contains a summary of preliminary information and is shared with local health departments as a means of providing awareness of currently available information, and as a tool to maintain consistency in communicating.*

## **1. Why is N.C. DHHS updating its GenX risk assessment?**

The goal of the North Carolina Department of Health and Human Services (NC DHHS) is to provide timely health information to residents and others who are concerned about potential health effects of GenX. When there is not a federal standard and sufficient scientific information available, the NC DHHS can develop and issue a health assessment. This assessment can include establishing a health goal, sometimes referred to as a health screening goal. A health goal is a non-regulatory, non-enforceable level of contamination below which no adverse health effects would be expected over a lifetime of exposure.

The NC DHHS shared a preliminary assessment for GenX with local partners on June 8, 2017 in an attempt to provide some context for understanding the health risks that could be associated with levels found in the Cape Fear River during 2013-2014.

Since sharing the preliminary health assessment, NC DHHS has continued to review all available health information about GenX. Based on this review, continuing discussions, and consensus with EPA, NC DHHS has determined that sufficient data are available to make changes to the preliminary assessment.

The updated health goal is 140 ng/L for the most vulnerable population- i.e. bottle-fed infants, the population that drinks the largest volume of water per body weight.

This updated level is lower than the level in the preliminary assessment for several reasons, including the following:

- After consultation with EPA, a different set of animal studies was identified as an appropriate starting point for the assessment. This change lowered the health goal by 10-fold.
- Since the new starting point was based on intermediate (sub-chronic) rather than long-term (chronic) animal studies, an additional uncertainty factor was added, which lowered the level by another 10-fold.
- While the preliminary assessment assumed that drinking water was the only source of exposure, the updated value includes an assumption that only 20% of a person's GenX exposure comes from drinking water, lowering the level another 5-fold. EPA's practice is to use this 20% default factor as a generic assumption when information is lacking about other sources of exposure in the environment, as is currently the case with GenX. NC DHHS's use of the 20% factor was included based on additional review and consultation with EPA.

Details of the specific updates and calculations for the updated health screening goal are presented in Appendix 3.

As with the preliminary assessment, it is important to note that this updated risk assessment is not final and is likely to be updated as new information becomes available or when standards are made available by the EPA.

## **2. What does the updated assessment for GenX mean?**

For the most vulnerable population (bottle-fed infants) the updated health risk assessment means that there could be an increased risk of adverse health effects over a lifetime of consuming water with levels greater than 140 ng/L.

Because this goal/level is calculated based on the most vulnerable population, it is the most conservative and is protective of other groups, including pregnant women, nursing mothers, children, as well as other adults.

This updated health assessment is based on evolving toxicological data; therefore it is still considered provisional and is subject to further updates based on an ongoing review, consultation with federal agencies and other partners, and the introduction of new research and scientific information.

Although the preliminary assessment was based upon a study with combined cancer and non-cancer endpoints, the updated health goal considers non-cancer endpoints only. There are no studies in humans on cancer related to GenX. Only one animal study is available for cancer analysis, and it has shown increases in certain cancers. Based on conversations with EPA, there is not enough information at this time to identify a specific level of GenX that might be associated with an increased risk for cancer.

## **3. Does NC DHHS recommend that people stop using the municipal water for drinking or other purposes if levels are above 140 ng/L ?**

NC DHHS will not be making a blanket recommendations about water use, but will work with local partners about health risks and messaging regarding sampling results. Individuals are encouraged to consider information in the health risk assessment when making decisions about water use.

The potential health effects from these chemicals should be balanced against the health benefits of municipal water, including routine monitoring for a variety of microbial and known chemical contaminants that could be present in private wells or other unregulated sources. There are many sources of contamination of groundwater, including naturally-occurring chemicals and minerals (for example, arsenic, radon, and uranium), local land use practices (fertilizers, pesticides, livestock, animal feeding operations, biosolids applications), manufacturing processes, and sewer overflows. Studies to determine if any filtration systems could remove GenX and other perfluorinated chemicals are underway and DHHS will share new information as it becomes available.

## **4. Does this mean my water is unsafe if levels are over 140ng/L?**

This health assessment is not a boundary line between a “safe” and “dangerous” level of a chemical. Rather, it is a level that represents the concentration of GenX at which no adverse non-cancer health effects would be anticipated over an entire lifetime to the most sensitive population.

## **5. Why is North Carolina providing an updated health assessment?**

Although health information is limited for many of the newer or “emerging” perfluorinated compounds, NC DHHS has determined that there is sufficient scientific information to provide a preliminary health assessment for GenX.

The U.S. Environmental Protection Agency (EPA) is working to provide more health risk information for this chemical. However, the timeliness of that process is not sufficient to address the urgent public concerns raised by identification of GenX in the public drinking water supply.

#### **6. What information did NC DHHS use in their preliminary assessment?**

In the absence of health guidance values published by U.S. federal agencies, NC DHHS used GenX toxicity information available from the European Chemicals Agency (ECHA) to calculate a provisional health protective level of 71,000 nanograms per liter (ng/L, also referred to as parts per trillion). See Appendix 1 for the calculation of the preliminary assessment using the information from ECHA.

#### **7. What are the potential health effects from exposure to GenX?**

There are no studies regarding human health effects of GenX. However, animal studies demonstrate liver and red blood cell non-cancer effects and pancreas, liver, and testicular cancer effects. Whether or not animal effects will be the same in humans is not known. There is no health information about other perfluorinated chemicals.

#### **8. Is it safe to eat fish from the Cape Fear River?**

There are no fish advisories related to GenX. Preliminary information from EPA suggests that GenX is not anticipated to bioaccumulate in fish. A list of statewide and location-specific fish advisories related to other contaminants is available at <http://epi.publichealth.nc.gov/oeefish/advisories.html>.

#### **9. Is health information available for other emerging perfluorinated compounds found in the Cape Fear River?**

In discussions with EPA and other partners, there is not sufficient identified data that can be used to develop a preliminary health risk assessment for the other newer or “emerging” perfluorinated compounds mentioned in the 2016 paper by Sun et al (PFO2HxA, PFMOAA, PFMOBA, PFO3OA, PFMOPrA and PFO4PA). This applies for exposure to these compounds individually and in combination. Scientific information such as animal toxicology studies and laboratory testing standards are needed by these agencies to conduct further health assessment on the other perfluorinated compounds. NC DHHS will continue to work with the EPA and CDC to identify and share any health risk information about these compounds as it becomes available.

#### **10. Is health information available for 1,4-dioxane?**

Health information about 1,4-dioxane is available at <http://deq.nc.gov/about/divisions/waterresources/water-resources-data/water-sciences-home-page/1-4-dioxane>.

## 11. Is NC DHHS working with NC DEQ, other agencies, or researchers?

Yes. NC DHHS, along with NC DEQ, has been in close contact with officials at EPA and the CDC to gather and review all health information related to GenX. EPA is working to develop a health risk assessment for GenX; however, the timeframe for that assessment is not known. NC DHHS staff are also in contact with academic researchers with knowledge and experience with these compounds.

### Appendix 1: Calculation of the Preliminary Assessment

The European Chemical Agency (ECHA) information included a Derived No Effect Level (DNEL) of 0.01 mg/kg body weight (bw)/day for oral exposures. The DNEL reported by ECHA was calculated using a noobserved-adverse-effect-level (NOAEL) from a 2-year rat chronic toxicity/carcinogenicity study as the point of departure (POD) and applying default uncertainty factors, as described below:

- No-observed-adverse-effect-level (NOAEL) = 1.0 mg/kg body weight (bw)/day
- Total default uncertainty factors (UF) = 100 (interspecies variability = 10; intraspecies variability = 10)
- Formula:  $NOAEL/UF = DNEL$

$$(1.0 \text{ mg/kg bw/day})/100 = 0.01 \text{ mg/kg/day}$$

NC DHHS calculated a drinking water equivalent level (DWEL) for GenX as follows:

- Dose (DNEL) = 0.01 mg/kg bw/day
- Body Weight = 7.8 kg (infant)
- Intake = 1.1 L/day (infant)
- Relative Source Contribution (RSC) = 1.0
- Unit Conversion =  $10^6$  ng/mg
- Formula:  $\text{dose (mg/kg bw/day)} \times \text{body weight (kg)/intake (L/day)} \times \text{RSC} \times \text{Unit Conversion} = \text{DWEL}$

$$(0.01 \text{ mg/kg/day}) \times 7.8 \text{ kg} / (1.1 \text{ L/day}) \times 1.0 \times 10^6 \text{ ng/mg} = 71,000 \text{ ng/L}$$

NOTE: nanograms per liter (ng/L) can also be expressed as parts per trillion or ppt

The values used for body weight and drinking water intake were based on infants (in order to be maximally protective) since they consume the highest amount of water in relation to their body weight. The preliminary calculation assumed that 100% of GenX exposure (relative source contribution) was from water consumption. The DWEL was used as our preliminary assessment.

## Appendix 2: Calculation of the updated Health Assessment

After consultation with EPA, the following were updated:

- Sufficient data are available to support the use a lower no-observed-adverse-effect-level (NOAEL) as a point of departure for the assessment. This NOAEL (0.1 mg/kg/day) is 10-fold lower than the NOAEL used in the preliminary assessment and is based on effects on the liver in mice.
- Since this point of departure is based on a subchronic toxicity study rather than a chronic toxicity study, an additional uncertainty factor of 10 is included in the calculations.
- A relative source contribution (RSC) of 20% is used to account for potential exposure to GenX from other routes like air, soil, dust, and food. The RSC lowers the acceptable concentration in water due to the potential for other exposure routes.

Updated calculation:

- No-observed-adverse-effect-level (NOAEL) = 0.1 mg/kg body weight (bw)/day
- Total default uncertainty factors (UF) = 1000 (interspecies variability = 10; intraspecies variability = 10; and subchronic to chronic extrapolation = 10)
- Formula:  $\text{NOAEL}/\text{UF} = \text{Reference Dose (RfD)}$

$$(0.1 \text{ mg/kg bw/day})/1000 = 0.0001 \text{ mg/kg/day}$$

NC DHHS calculated a drinking water equivalent level (DWEL) for GenX as follows:

- Dose (RfD) = 0.0001 mg/kg bw/day
- Body Weight = 7.8 kg (bottle-fed infant)
- Intake = 1.1 L/day (bottle-fed infant)
- Relative Source Contribution = 0.2
- Unit Conversion =  $10^6$  ng/mg
- Formula:  $\text{dose (mg/kg bw/day)} \times \text{body weight (kg)}/\text{intake (L/day)} \times \text{RSC} \times \text{Unit Conversion} = \text{DWEL}$

$$(0.0001 \text{ mg/kg/day}) \times 7.8 \text{ kg}/(1.1 \text{ L/day}) \times 0.2 \times 10^6 \text{ ng/mg} = 140 \text{ ng/L}$$

NOTE: nanograms per liter (ng/L) can also be expressed as parts per trillion or ppt

The values used for body weight and drinking water intake were based on bottle-fed infants (in order to be maximally protective) since infants consume the highest amount of water in relation to their body weight. The DWEL was used to set a provisional health goal for the most sensitive population (bottlefed infants).

### Appendix 3: References

Beekman M, Zweers P, Muller A, de Vries W, Janssen P, Zeilmaker M. 2016. RIVM Report 2016-0174: Evaluation of substances used in the GenX technology by Chemours, Dordrecht.

[http://www.rivm.nl/Documenten\\_en\\_publicaties/Wetenschappelijk/Rapporten/2016/december/Evaluation\\_of\\_substances\\_used\\_in\\_the\\_GenX\\_technology\\_by\\_Chemours\\_Dordrecht](http://www.rivm.nl/Documenten_en_publicaties/Wetenschappelijk/Rapporten/2016/december/Evaluation_of_substances_used_in_the_GenX_technology_by_Chemours_Dordrecht).

ECHA Toxicological Summary for Ammonium 2,3,3,3-Tetrafluoro-2-(Heptafluoropropoxy)Propanoate.

<https://echa.europa.eu/registration-dossier/-/registered-dossier/2679/7/1>

Ferreira et al. Comparing the potency in vivo of PFAS alternatives and their predecessors. Abstract.

March 2017. [http://su.diva-](http://su.diva-portal.org/smash/record.jsf?pid=diva2%3A1085755&dswid=5295#sthash.Iofa5rDn.dpbs)

[portal.org/smash/record.jsf?pid=diva2%3A1085755&dswid=5295#sthash.Iofa5rDn.dpbs](http://su.diva-portal.org/smash/record.jsf?pid=diva2%3A1085755&dswid=5295#sthash.Iofa5rDn.dpbs)

Gannon et al. Absorption, distribution, metabolism, excretion, and kinetics of 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)propanoic acid ammonium salt following a single dose in rat, mouse, and cynomolgus monkey. Toxicology 340 (2016) 1–9. <http://dx.doi.org/10.1016/j.tox.2015.12.006>

Hoke et al. Aquatic hazard, bioaccumulation and screening risk assessment for ammonium 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)-propanoate. Chemosphere 149 (2016) 336-342.

<http://dx.doi.org/10.1016/j.chemosphere.2016.01.009>

Rae et al. Evaluation of chronic toxicity and carcinogenicity of ammonium 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy)-propanoate in Sprague–Dawley rats. Toxicology Reports. June 2015.

<https://doi.org/10.1016/j.toxrep.2015.06.001>

Sun et al. Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina. Environmental Science & Technology Letters. Nov 2016. DOI: 10.1021/acs.estlett.6b00398.

USEPA. Drinking Water Health Advisories for PFOA and PFOS. <https://www.epa.gov/ground-water-anddrinking-water/drinking-water-health-advisories-pfoa-and-pfos>

USEPA. TSCA Non-Confidential Business Information for 8EHQ-06-16478.

<https://assets.documentcloud.org/documents/2746960/GenX8eFilings.pdf>

