

STATE OF NEW YORK
SUPREME COURT

COUNTY OF RENSSELAER

JAY BURDICK, CONNIE PLOUFFE,
EDWARD PLOUFFE, FRANK
SEYMOUR, EMILY MARPE, as parent and
natural guardian of E.B., an infant, and, G.Y.,
an infant, JACQUELINE MONETTE, WILLIAM
SHARPE, EDWARD PERROTTI-SOUSIS,
MARK DENUÉ and MEGAN DUNN,
individually, and on behalf of all similarly situated,

**AFFIDAVIT OF
HYEONG-MOO SHIN, Ph.D.**

Plaintiffs,

v.

Index No.: 00253835

TONOGA INC., (d/b/a TACONIC),

Defendant.

STATE OF TEXAS)

COUNTY OF TARRANT) ss:

HYEONG-MOO SHIN, Ph.D., being duly sworn, deposes and says:

1. I am an assistant professor in the Department of Earth and Environmental Sciences at the University of Texas at Arlington. I obtained my B.S. in Environmental Engineering from Yonsei University in South Korea, my M.S. in Environmental Engineering from Carnegie Mellon University and my Ph.D. in Environmental Health Sciences from the University of California, Irvine (UC-Irvine). As a graduate research assistant at UC-Irvine, and then a postdoctoral researcher at the University of California, Davis, I was involved in the analysis of data obtained from the C8 Health Project which involved the simulation of the fate and transport of C8, the trade name for the chemical ammonium perfluorooctanoate (APFO) which when released into the environment is converted to perfluorooctanoic acid (PFOA)

and was found to have contaminated the drinking water in communities along the Ohio River in the states of Ohio and West Virginia. I have published a number of papers in the peer-reviewed scientific literature as a result of this research, including four papers in which I was the lead author. In total, I have been a lead author or a co-author of 14 papers published in the scientific peer-reviewed literature related to PFOA exposure and epidemiologic studies. A copy of my CV is attached as **Exhibit A**. I make this Affidavit in opposition to the motion of Defendant to exclude my testimony.

2. After being asked to consult on this case by plaintiffs' attorneys, I reviewed numerous documents produced by defendant Tonoga, Inc. (a/k/a Taconic) ("Taconic") as well as documents and data obtained from the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH). A list of the documents I have relied upon in forming my opinions in this case is attached as **Exhibit B**. I have also reviewed the deposition transcripts of a number of current and former employees of Taconic taken in this litigation. A list of these witnesses is attached as **Exhibit C**. These documents and electronic files include data on well concentrations of PFOA in the vicinity of Petersburg, New York, some information on the depths of these wells, data showing soil PFOA concentrations measured in the vicinity of Petersburg, as well as surface water sampling conducted for PFOA concentration in this area. This information also included measured PFOA blood serum levels for the residents of Petersburg who were tested by the New York State Department of Health, which showed PFOA levels from non-detect to 1,550 ppb. I also reviewed publicly available information and data about three other facilities, two in Vermont, one in Hoosick Falls, New York, that defendant has alleged possibly contributed to the contamination in Petersburg.

3. The documents and testimony reviewed also include information about the manufacturing processes performed at the Taconic Petersburg facility as well as the amount of PFOA-containing dispersions utilized per year by Taconic. An important document utilized in my analysis was the Dispersion Processor Material Balance Project Report prepared by Barr Engineering Company in 2005 (**Exhibit D**). This study was undertaken as part of a commitment made by the Fluoropolymer Manufacturers Group of the Society of the Plastics Industry, Inc. (SPI) to understand whether and how APFO in aqueous PTFE dispersions could be a significant exposure pathway for PFOA to the general population. (*Id.* at p. 1). A number of dispersion processors that performed manufacturing operations similar to Taconic participated in this study to determine the proportion of APFO in these dispersions that was destroyed, released into the air, released into wastewater, contained in solid waste or remained in the final products. In performing this study, Barr analyzed various PTFE dispersions utilized by these processors at the time and determined the average amount of APFO contained in these dispersions to be 0.28%. (*Id.*, at p. 14 of 83, par. 6). Barr also studied and quantified the percentage of APFO from the dispersions that was released into the air based upon the type of ovens that were utilized by the processor, either radiant heating or recirculating ovens. Timothy Kosto, Taconic's Director of Technology and Manufacturing, testified that he utilized this report to provide him the information he needed to estimate Taconic's emissions because Taconic did not have testing data from its facility. (**Kosto**, pp. 191-192).

PFOA/APFO

4. APFO/PFOA is one of the major environmental contaminants of concern in the United States. APFO was used as a surfactant in the manufacture of Teflon® and other fluoropolymers. Because of its water- and stain-resistant properties, APFO was a component

of polytetrafluoroethylene (PTFE) dispersions applied to coat various products such as frying pans, fabrics, tapes and others. APFO was also a component of fluorinated ethylene propylene (FEP) dispersions. At the manufacturing facilities such as Taconic where PTFE and FEP dispersions were applied to fabrics and other surfaces, APFO was largely vaporized and then released during the heating and sintering processes. According to the documents provided, dispersions containing APFO were used at Taconic through approximately 2013.

5. Once released into the environment, APFO vapors cool and condense to form fumes of fine particulate matter that are then carried by the wind until washed out of the air by precipitation (wet deposition) or settling down to the ground by gravity (dry deposition). APFO is readily dissolved into water where it dissociates to form perfluorooctanoate (PFO^-) and ammonium ion (NH_4^+). Under acidic conditions, PFO^- is protonated to form PFOA.
6. APFO released into the environment that becomes PFO^- and PFOA is highly resistant to further environmental degradation. These chemicals are extremely environmentally persistent. Traces of PFOA can remain on some consumer products manufactured before the chemical's use was eliminated, and are responsible for background exposures to PFOA for the general U.S. population. However, the source of PFOA contamination in drinking water in the United States and around the world comes from APFO released from manufacturing facilities. Due to potential health concerns, in 2006 the U.S. Environmental Protection Agency initiated the 2010/2015 PFOA Stewardship Program.¹ Eight companies that used large quantities of PFOA in manufacturing agreed to reduce facility emissions and product content of PFOA and related chemicals on a global basis by 95 percent no later than 2010 with a goal of elimination of all PFOA use by 2015. Since the initiation of this program, the

¹ <https://www.epa.gov/assessing-and-managing-chemicals-under-tsca/fact-sheet-20102015-pfoa-stewardship-program#launch>

PFOA blood serum levels in the general U.S. population have steadily declined each year (Jain, 2018), except for those subpopulations exposed to PFOA released into the environment by manufacturing facilities that remains in the soil and drinking water in those communities (Herrick et al. 2017; Shin et al. 2011a).

7. PFOA was found in the water supplies of approximately 70,000 people who lived along the Ohio River in Ohio and West Virginia. The source of this PFOA was determined to be DuPont's Washington Works facility, located in Parkersburg, West Virginia. The principal route of the contamination to the groundwater was from air deposition to the soil, where the chemical dissociated as described above and was dissolved into rain water and carried through the vadose zone (i.e., the zone between the ground surface and down to the water table) into the groundwater contaminating the well fields of these communities. For some of these communities, discharge of liquid waste containing APFO into the Ohio River was also determined to be a route of the contamination. PFOA was detected in soil and private well water located more than 5 miles from the Washington Works plant in the prevailing wind direction for the area. The major route of PFOA exposure found through the C8 Health Project research was ingestion of drinking water contaminated with the substance, although breathing of particulate matter and ingestion of fruits and vegetables onto which PFOA was deposited were also found to be likely routes of exposure.
8. Once PFOA enters the body, it is not readily removed and is present in the bloodstream for long periods of time where it can be measured through blood testing. Estimates of the half-life of PFOA in the body range from 2 to 8 years, and likely vary from individual to individual. My research on the C8 Health Project focused on modeling the environmental fate and transport of PFOA from when it was released to the environment through when the

affected population was exposed, and on developing exposure models to predict historical exposures of these individuals to PFOA.

GENERAL METHODOLOGIES UTILIZED

9. The scientific methodologies utilized to analyze and assess the fate and transport of toxins such as APFO/PFOA involve reviewing published literature regarding the behavior of chemical substances released into the environment, reviewing the testing of environmental media for such substances, and analyzing patterns of contamination utilizing various modeling or statistical techniques. Attached as **Exhibit E** are papers published in the scientific literature referenced in this Affidavit that were utilized in my analysis.
10. The methodologies I utilized in my analysis of the fate and transport of APFO/PFOA in Petersburg, New York, were essentially the same ones utilized in my research of the area of contamination around the Washington Works facility in West Virginia and published in multiple articles I co-authored in the peer reviewed scientific literature that are listed in **Exhibits A and E**.
11. Plotting contaminant levels vs. distance from the source is a standard methodology in analyzing the transport of air emissions and investigating the likely source of such emissions. Testing such plots using regression analysis is also a standard methodology in science and engineering. Regression analysis is a statistical tool to determine how closely a regression line fits a dataset, in this case, an inverse log-linear relationship between the distance from the Taconic facility and the PFOA levels found in the private wells. The R^2 , a goodness-of-fit statistic, is used to determine how close the data are to the fitted regression equation. The larger R^2 is, the more the relationship between two quantities (i.e., distance from the facility and the PFOA levels) can be explained from the regression equation.

12. Prediction of wind-driven transport of air emissions based upon both prevailing wind directions and topography is also a generally accepted method of analyzing and modeling the transport of contaminants from air emissions. (Shin et al. 2012).

OPINIONS

13. Based upon my review of the data contained in the documents and electronic files listed in **Exhibit B**, the information I obtained from the deposition testimony listed in **Exhibit C**, the scientific articles referenced in **Exhibit E**, as well as my research expertise and experience with the C8 Health Project and my general research expertise and experience as an environmental engineer and environmental health scientist, I reached the following opinions relevant to the claims made in this case with reasonable scientific certainty:

a. The source of the PFOA found in the 215 private wells reflected in the NYSDEC data as well as the Town of Petersburg municipal wells, all located within an approximate 7-mile radius of the Taconic facility and mainly distributed in a linear orientation mimicking the shape of the valley (SW to NE), originated from air releases of APFO from that facility. This is shown graphically in **Exhibit F**, an annotated aerial photograph produced by NYSDEC. The pattern of airborne contamination from the Taconic facility is substantially similar to what was found in the investigation of the Washington Works facility in West Virginia. PFOA water concentrations in private wells of both sites are shown to gradually decrease with distance from the facility.

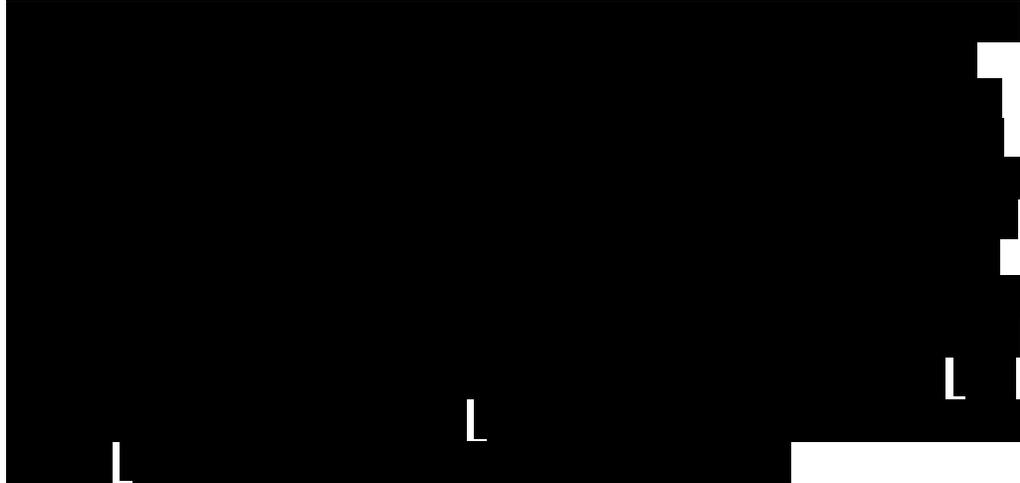
b. From approximately 1961 through at least 2013, Taconic utilized large volumes of PTFE and FEP dispersions that contained APFO. The Barr study (**Exhibit D**) indicated that the average dispersion used by processors such as Taconic in the early 2000s was 0.28%. (*Id.*, at p. 14 of 83, par. 6). The Barr study assumed that no additional APFO was added to the stock dispersions used by processors. (*Id.*)

[REDACTED] (**Exhibit G**; [REDACTED]).

c. The Barr study (**Exhibit D**) indicated that dispersion processors manufacturing PTFE coated fabrics [REDACTED] utilized two types of ovens, radiant heated and recirculating ovens. Both types

reached temperatures of 300-400 °C (572-752 °F). The Barr study demonstrated that for radiant heated ovens, the percentage of the total APFO in the dispersions that was released into the air during the fabric coating manufacturing process ranged from 39 to 54%. For the recirculating ovens, the percentage of the total APFO released into the air ranged from 9 to 19%. (*Id.*, at p. 52 of 83 and Table 5).

d.



e.



f. Taconic produced two documents which contained estimates of yearly APFO-containing dispersion use at the approximate time of the Barr study. **Exhibit I** states that Taconic was using 987,000 lbs. of PTFE dispersion in the 2005 time period. **Exhibit J** summarizes the volumes of PTFE dispersions containing APFO that were used in manufacturing at Taconic from 2006 to 2013, indicating dispersion usage fluctuating between 956,000 lbs. and 1,283,000 lbs. per year. Using 987,000 as a conservative estimate of annual PTFE dispersion usage together with the Barr's estimate of the average amount of APFO in those dispersions (0.28%), it is estimated that 2,763 lbs. of APFO per year entered Taconic's ovens during this time period, not accounting for the additional amounts of the pure APFO products (**Exhibit G**) Taconic added to the standard dispersions. Assuming that approximately 987,000 lbs. of PTFE dispersions containing an average of 0.28% APFO were used and an average of 31.5% of that APFO was released from the ovens to the air, it is estimated that approximately 870.5 lbs. [=956,000 lbs × 0.315 × 0.0028] of APFO was released annually from Taconic's coating ovens to the environment through 2006.

- g. Between 1961 and 1991, a period of 30 years, Taconic employed no pollution control devices, and therefore, all of the APFO in the exhaust stream was released to the environment. Assuming a similar volume of dispersions were utilized over this period results in over 13 tons (26,115 lbs. = 870.5 lbs./year × 30 years) of APFO being released into the environment via air emissions by Taconic prior to 1991. Even if Taconic utilized an average of only half the volume of dispersions it utilized in 2005-2012 in its early years of operation, 6.5 tons of highly environmentally persistent APFO was released from Taconic into the air prior to 1991 before any pollution control devices were installed.
- h. The first pollution control device used at Taconic, the “Smog-Hog”, was installed in 1991 (**Exhibit K**). Oven exhaust was channeled through this device which was essentially an electrostatic precipitator. (*Id.*, **Green** pp. 27-28). This is a filtration device that removes fine particles, like dust and smoke, from a flowing gas using the force of an induced electrostatic charge minimally impeding the flow of gases through the unit. The Smog Hog installed at Taconic would reduce emissions of the APFO exited the ovens and entered the Smog Hog in the form of fine particulate matter. Based on interviews with DuPont facility engineers during the C8 Health Project, it was learned that PFOA in the dryer atmosphere was assumed to be present as a vapor (Paustenbach et al. 2007). The sublimation point of APFO, a temperature when the transition from the solid phase to the gas phase without passing through an intermediate liquid phase occurs, is 130 °C (Barton et al. 2007). This indicates that the form of APFO in the oven exhaust (typically reported at 300-400 °C) is assumed to be present as a vapor. Based upon the temperatures of exhaust from the ovens, it is unlikely that any appreciable amount of the APFO in the exhaust stream was in the form of particulate matter that is large enough to be captured by the Smog Hog. Without any testing data showing otherwise, it is impossible to conclude that this device removed any appreciable amount of APFO. Thus, assuming that Taconic utilized a similar amount of dispersion in its manufacturing processes between 1991 and 1996 as was utilized in 2005, another 4,352 lbs. of APFO was released through air emissions from Taconic during those years.
- i. In 1996 the first Fume Eliminator was added (**Exhibit L**) replacing the Smog Hog, although the Smog Hog was retained as a backup. The Fume Eliminator passed exhaust from the ovens through a water vapor and then through two sets of fiberglass type filters before exiting the stacks. (**Green**, pp. 52-54). Because of the tendency for APFO vapors to form particulate matter when they cool and the effect of the exhaust passing through water vapor would be to cool the exhaust, the fume eliminators probably removed some of the APFO air emissions exiting the Taconic coating ovens after 1996. Documents produced by Taconic demonstrated that additional fume eliminators were added after 1996. The only test data produced by Taconic showing the efficiency of a fume eliminator in

removing APFO from the exhaust stream at Taconic² was performed in 2016 by the APCC (**Smith, Ex. 18**). This testing was performed on emissions from a new fume eliminator that was installed in 2014. At the time this 2016 testing was performed, Taconic was using APFO-free dispersions, so there should not have been any APFO in the exhaust stream. Nevertheless, some APFO was detected in the air stream both before and after passing through the fume eliminator, with the device removing 78% of that trace amount. Because (1) the fume eliminator involved in this test was not in use during the years Taconic used dispersions containing the standard amount of APFO; (2) the amount of APFO entering the fume eliminator during this test was a tiny fraction of the amount of APFO that was in the exhaust stream during earlier years; and (3) this was a single test performed in December when the ambient temperature was cold enhancing the conversion of APFO vapors to particulate matter, this 78% removal efficiency is not highly reliable. It is highly likely that the efficiency of the fume eliminators used between 1996 and 2006 when more APFO was contained in the exhaust, and especially in summer months, has been lower than 78%, making the percentage of APFO released into the air during those years higher than 22%. However, even adopting this 78% efficiency estimate and applying it to reduce emissions from 1996 to 2005, yields another 191.5 lbs. per year or a total of another 1,915 lbs. of APFO was released by Taconic into the environment between 1996 and 2005.

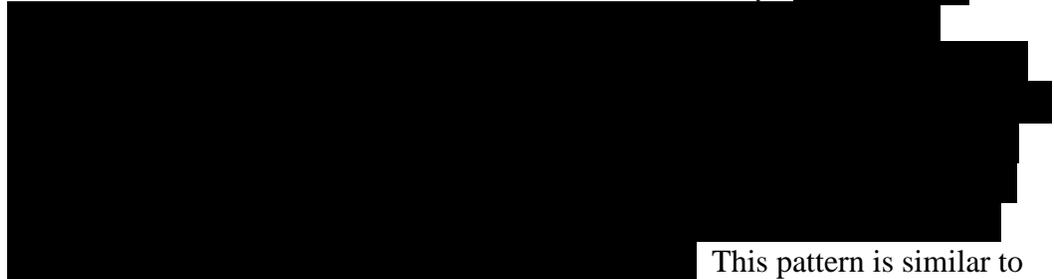
- j. According to **Exhibit J**, between 2006 and 2013 Taconic transitioned from standard level APFO dispersions to low level APFO dispersions and eventually to APFO-free dispersions. In 2006 and 2007, Taconic utilized 1,110,703 lbs. of standard level APFO dispersions as well as some low level APFO dispersions. Using the same assumptions from paragraph 13(i) above, Taconic released an additional 215 lbs. of APFO into the air in 2006-2007. When utilizing the lower content APFO dispersions in the following years through 2013, Taconic released an additional amount of APFO in its exhaust emissions that is not captured in this estimate, but was not negligible.
- k. According to the above calculations, Taconic had released over 16 tons of APFO into the Petersburg environment between 1961 and 2007. Even if this estimate is overstated by a factor of 2, which is highly unlikely, at least 8 tons of APFO were released into the environment by this facility. Virtually all of this APFO/PFOA released from this facility to ambient air is transported to the soil, surface water and groundwater in the area, because this compound is extremely stable in the environment and is rarely degradable under typical environmental conditions. Based upon my experience and research in the Ohio River Valley

² Taconic produced a report by Adirondack Environmental Services Inc. from 1997 (Smith, Ex. 17) purporting to show testing of APFO emissions. For the reasons set forth in ¶27 below, this report provides no reliable information on APFO emissions from the fume eliminator because the test method utilized by Adirondack was unreliable by its own admission.

regarding releases of APFO from the DuPont Washington Works Plant, 8 tons of APFO can easily contaminate the groundwater at the levels detected in the 215 private wells and the Town of Petersburg municipal wells.

- l. In addition, some of the PFOA found in the wells located on and close to Taconic's property was likely contributed through Taconic's wastewater emissions containing additional APFO/PFOA released into Taconic's septic system that leached into the groundwater. According to Taconic documents and employee testimony, prior to 1996 all wastewater at Taconic was discharged into a septic system and leach fields. (**Exhibit N, Green** pp. 47-51). According to the Barr report (**Exhibit D**), APFO released in liquid waste averaged approximately 1-3% of total APFO in the dispersions utilized. (*Id.*, p. 46 of 83).
- m. O'Brien & Gere (OBG) conducted air modeling for volatile organic compounds (VOCs) at Taconic in 2014. (**Exhibit M**). Although testing was not performed for APFO/PFOA, this modeling used the same inputs and made the same assumptions that would be used to model APFO air dispersion off the Taconic property. OBG determined that the wind rose (graphic depiction of wind speed and the prevailing wind directions) from the meteorological station at the Bennington airport, Vermont, is not representative of the prevailing wind at the Taconic site because of its valley orientation. (*Id.*, p. 3, §3.4). Instead, OBG relied on a wind rose from the Albany airport, New York. OBG concluded "the [Albany] wind rose shows high frequencies of southerly and west northwest winds. Since the valley orientation at the [Taconic] site would likely create a dominance of southerly winds, the Albany meteorological data is proposed to be used in this analysis." *Id.* at pp. 3-4. I agree with OBG's assessment that the dominant wind direction at the Taconic site would be from the south toward the northeast based upon the prevailing winds and steepness and orientation of the valley.
- n. To establish the likelihood that Taconic is the primary source of PFOA contamination in private wells in this area, I created two graphs plotting the approximate distance from Taconic (*x* axis) and PFOA concentrations in private wells (*y* axis) for contaminated private wells located northeast of the Taconic facility. (**Exhibits O1 and O2**). There is a strong inverse log-linear relationship between the distance from Taconic and PFOA concentrations in private wells. Even though well depth of these wells was not accounted for, which can cause some of the data scatter (e.g., shallow wells will be more contaminated than deep wells), there is a high model performance (measured by R^2) that supports to a reasonable degree of scientific certainty that the source of the PFOA in the contaminated wells is Taconic. This pattern of groundwater contamination from air emissions is consistent with the pattern found in Little Hocking, Ohio from APFO emissions from the DuPont Washington Works facility. (Shin et al. 2011a).

- o. The soils on the properties with contaminated wells and the soils on the properties within the Town of Petersburg Water District are also highly likely to be contaminated with PFOA released from the Taconic facility.



This pattern is similar to that depicted for the contaminated wells (**Exhibits O1 and O2**) demonstrating an inverse or negative relationship between distance from the Taconic facility and PFOA soil concentrations. Since migration of PFOA through the soils to the groundwater is the pathway by which the PFOA entered the groundwater, this is not a surprising finding, but is consistent with the soil and groundwater contamination having a single source – air emissions from Taconic. PFOA contamination of soil above contaminated groundwater is a virtual certainty because nearly all of the PFOA in the groundwater came from air emissions of AFPO that were deposited on the soil, dissolved in precipitation and migrated into the groundwater aquifer.

- p. The primary route of exposure of the residents of Petersburg who have elevated PFOA blood serum levels above background is likely to be ingestion of contaminated drinking water. This conclusion is based upon published research from the C8 Health Project. (Shin et al. 2011b)

APPLICATION OF METHODOLOGIES

14. In **Exhibit O1**, I plotted the PFOA concentration (*y axis*) against the distance from the Taconic facility (*x axis*) for the 37 contaminated private wells located in NE direction within two miles of the Taconic facility. The regression analysis yielded an R^2 value of 0.82, meaning that the log-linear regression model fits a dataset very well and explains 82% of variance in measured PFOA concentrations. In **Exhibit O2**, I created the same plot with the 48 contaminated wells in the same NE direction Taconic facility including the further contaminated wells (> two miles) from the plant and the R^2 value was 0.68 or the regression model explains 68% of variance in measured PFOA concentrations. The deviation from a 100% log-linear fit is likely due to other important variables that contribute to total variance,

but cannot be accounted for because of lack of data. The first and probably most important variable not considered in this regression analysis is well depth which was not available for all wells. Since PFOA must travel from the ground surface through the soil to the aquifer supplying the wells, the deeper the well, the further the distance it must travel and thus the more likely there will be dilution with less PFOA reaching the aquifer. Other factors that affect the amount of PFOA from air emissions that reaches the groundwater include soil permeability (sandy soils will allow more PFOA to migrate downward than clay soils) and vegetation cover where the APFO/PFOA reaches the ground (heavy vegetation can reduce the amount of APFO/PFOA reaching the soil). In light of these unaccounted variables, the R^2 values from the regression analysis are striking and strongly support Taconic as the sole source of contamination for these wells.

15. As stated above, the method I utilized to assess likely prevailing wind direction was identical to the method utilized by OBG in its air modeling for VOCs (a different chemical class from APFO/PFOA) performed for Taconic in 2014. (**Exhibit M**). In modeling the dispersion of air emissions of VOCs from Taconic, OBG came to the identical conclusions that I did in my analysis. We both determined that the wind rose from the meteorological station in Bennington, Vermont, would not reveal representative prevailing wind directions at the Taconic site because of its valley orientation. (**Exhibit M**, p. 3, §3.4). As a result, we both relied upon the wind rose from Albany, New York. OBG concluded and I agree that “the [Albany] wind rose shows high frequencies of southerly and west-northwest winds. Since the valley orientation at the site would likely create a dominance of southerly winds, the Albany meteorological data is proposed to be used in this analysis.” *Id.* at pp. 3-4.

16. The factual foundation of all of these opinions is also clearly set forth and includes data obtained from documents and testimony provided by defendant Taconic, its employees and consultants as well as data from the NYSDEC and NYSDOH. (**Exhibits B and C**). Mr. Hare and Mr. Washburn do not challenge the accuracy of any of the data relied upon, except as discussed below. These involve discrete issues, which as explained below, are either unsubstantiated, inaccurate or inconsequential.

RESPONSE TO AFFIDAVITS OF PAUL HARE AND STEPHEN WASHBURN

A. Other Possible Sources

17. Mr. Hare discusses three other locations in the same general geographic region as the Taconic facility that at one time used PTFE dispersions or resins that contained APFO: 1) the former Chemfab facility in North Bennington Vermont; 2) the former Warren Wire Facility in Pownal, Vermont; and: 3) the Saint-Gobain facility in Hoosick Falls, New York. (Hare Affidavit, ¶13). Mr. Hare provides no data or detailed information regarding how APFO was utilized at any of these facilities, how the APFO was emitted from these facilities (e.g., air, water) or the extent that PFOA was found in the environment near any of these other facilities. Mr. Hare also does not opine that any of these three facilities are the source of the contamination of the 215 private wells and the Town of Petersburg municipal wells, or that Taconic is not the source of the PFOA contamination found in these wells.

18. Mr. Washburn suggests that my opinion that the source of the contamination found in the 215 private wells and Town of Petersburg municipal wells is the Taconic facility is invalid because there are other sources “that have the potential to impact surface water and groundwater quality within the Little Hoosick Valley...” that I failed to consider. (Washburn, ¶18). These other sources, according to Mr. Washburn, are the three locations

identified by Mr. Hare, as well as the former Petersburg Landfill. (Washburn ¶¶18-21).

Mr. Washburn also fails to state that PFOA contamination in the wells that I have attributed to Taconic came from any other source, but only that these other sources had that “potential”.

(Id.)

19. The closest of the three other “potential” sources identified by Mr. Hare and Mr. Washburn is the former Warren Wire company plant located in Pownal, Vermont. I reviewed publicly available data on the Pownal site from the Vermont Agency of Natural Resources, Department of Environmental Conservation³ (**Exhibit Q**). These data show only a small number of contaminated wells (blue dots are non-detect, meaning no PFOA was found), all located along the valley floor in the valley in which Pownal is situated, with only one well measuring above 100 ppt. No wells tested west of the valley floor near Pownal (in the direction of Petersburg) were found to be contaminated. Thus, the pattern of contamination in Pownal is not consistent with any spread of this contamination west toward Petersburg. Also, the prevailing winds depicted in the wind rose from Albany and Bennington are inconsistent with transport of air emissions in a westerly direction from Pownal (**Exhibit M**, pp.3-4 and Figures 3 &4), and there is a mountain located between Petersburg and Pownal that rises 1,850 feet from the valley floor in Pownal. (**Exhibit R**, a red triangle represents the location of the Taconic facility). Thus, even if APFO was emitted into the air from the former Warren Wire Co. facility, it would have to travel against the prevailing wind direction and rise over the 1,850 foot elevation to get to the wells found to be contaminated near Petersburg. Such a mode of transport is scientifically implausible, and there is no data to

³https://anrweb.vt.gov/PubDocs/DEC/PFOA/Maps/Pownal_Sampling_Map_20160702_24x36_All_Sample_Locations.pdf

support that it could have occurred as no wells on the western slope of the mountain between Pownal and Petersburg tested positive for PFOA.

20. The second site referenced by Mr. Hare and that Mr. Washburn alleges had “the potential to impact surface water and groundwater quality within the Little Hoosick Valley...”

(Washburn, ¶18) is the former Chemfab facility in North Bennington, Vermont. Again, neither Mr. Hare nor Mr. Washburn provide data to support this statement nor do they explain how any PFOA from North Bennington could have migrated to Petersburg.

Publicly available data on the North Bennington site, again from Vermont Agency of Natural Resources, Department of Environmental Conservation⁴ is depicted in **Exhibit S**. As this figure shows, there were no wells found south or southwest (the direction of Petersburg) from the Corrective Action Areas located within the Town of Bennington that tested above the detection limit for PFOA. Thus, these data do not support that any APFO/PFOA traveled southwest across the New York State line toward Petersburg.

21. The wind rose from the Bennington Airport (**Exhibit M**, figure 4) shows that the prevailing winds in the area are from the west and the south, with no strong winds over 10 miles per hour (MPH) from the northeast being recorded over a five-year period from January 1, 2008 through December 31, 2012. This fact alone explains why significant contamination was found for only a short distance in a southwesterly direction from the former Chemfab plant. (See **Exhibit S**). An additional factor making it implausible that contamination from the former Chemfab facility migrated to Petersburg is the significant topographical features that would inhibit APFO/PFOA air emissions from North Bennington from being carried in a

⁴ <https://anrweb.vt.gov/PubDocs/DEC/PFOA/Maps/Area-of-Interest-No-Bennington.pdf>

southwesterly direction toward Petersburg. (**Exhibit T**). The areas of interest in North Bennington are located more than 12 miles northeast of Petersburg, and there is a mountain that rises approximately 1,500 feet above the elevation level in North Bennington that any particulate matter would have to cross to get to the area of contamination in Petersburg. Finally, and most importantly, there are no data showing any contamination found from the northern most contaminated well in North Petersburg to the southern most contaminated well in North Bennington, a distance of well over five miles. It is scientifically implausible for APFO/PFOA to be carried by the wind southwest from North Bennington toward North Petersburg and not appear in greater quantities closer to North Bennington. Thus, there is no scientific basis to claim that APFO/PFOA from North Bennington traveled through the air and caused the contamination of any of the 215 private wells or the municipal wells in Petersburg.

22. The third site that Mr. Washburn claims had “the potential to impact surface water and groundwater quality within the Little Hoosick Valley...” (Washburn, ¶18) is the Saint-Gobain facility in Hoosick Falls. This facility is located approximately 12 miles north of Petersburg. Again, there is no data presented by Mr. Washburn showing PFOA levels detected in groundwater between North Petersburg and Hoosick Falls. There is no publicly available data on Hoosick Falls nor investigations documenting PFOA groundwater contamination from Hoosick Falls in a southerly direction stretching to North Petersburg. As with the North Bennington site, it is scientifically implausible for the Saint-Gobain facility to be the source of PFOA found in North Petersburg without PFOA being detected in other wells closer to Hoosick Falls. Again, the topography and prevailing winds explain why APFO/PFOA would not migrate south from Hoosick Falls to reach North Petersburg or

Petersburgh. **Exhibit T** shows the topography between Hoosick Falls and North Petersburgh (red triangle represents location of Taconic Facility). As demonstrated in this exhibit, the topography of Hoosick Falls from the south to the east flattens out significantly, while Petersburgh has the deep narrow valley topography. OBG's assessment that "the valley orientation at the [Petersburgh] site would likely create a dominance of southerly winds" is also relevant here, since Hoosick Falls is north of Petersburgh. To reach the contaminated wells in Petersburgh, air emissions from Hoosick Falls would have to flow against the gradient of the dominant southerly winds which would predominate until the area north of North Petersburgh, where the elevation to the east drops off and would permit the resumption of a more west to east dominant wind pattern. Without any evidence of PFOA contamination in wells between North Petersburgh and Hoosick Falls, it is not scientifically possible to attribute any of the PFOA contamination found between North Petersburgh and Petersburgh as coming from air emissions from the Saint-Gobain facility in Hoosick Falls.

23. Mr. Washburn also suggests the former Petersburgh Landfill as a "potential" source of the PFOA contamination found in the private and municipal wells in Petersburgh. According the NYSDEC Site Characterization Report (**Smith, Ex. 15**), the Petersburgh Landfill was located on Cold Spring Road approximately 2 miles southeast of the center of the Town of Petersburgh. The landfill started operations in the early 1980s and ceased accepting waste in 1991. A cover was constructed over the landfill in 1997 and it was permanently closed. There is a small unnamed stream that drains the landfill and flows north where it meets the Little Hoosick River south of Rt. 2 near Jones Hollow Road. (**Exhibit U** is a map taken from **Smith Ex. 15**). Mr. Washburn states that leachate contaminated with PFOA that enters that

unnamed stream could potentially affect wells in the area. (Washburn, ¶21). He provides no data to support this statement.

24. The NYSDEC (**Exhibit V**) tested four surface water (SW) samples for PFOA levels in the Little Hoosick River: (1) a sample collected near the Taconic facility (SW-3), (2) a sample collected a few hundred feet downstream from where the unnamed tributary that drains the former landfill empties into the Little Hoosick River (SW-4), (3) a sample collected approximately one mile further downstream (SW-5) and (4) a sample collected approximately two miles further downstream (SW-6) before the Little Hoosick River converges into the Hoosick River. All four samples from the testing have virtually identical PFOA levels of 18, 23, 19 and 17 ppt. respectively. Although there are some higher PFOA levels measured in this small creek before it flows into the Little Hoosick River at point SW-4, once it merges the levels measured in the Little Hoosick are essentially the same as the levels before the creek flows into the river. (See **Exhibit U**). Based upon these data points, there is no evidence that PFOA from the unnamed tributary that drains the landfill is having any significant effect on the PFOA level in the Little Hoosick River. There is no further data showing that PFOA-contaminated water from the Little Hoosick River is recharging any of the contaminated private wells or the municipal wells. Most of the contaminated wells are located upstream from the confluence of the unnamed tributary. This means even if there was some recharge occurring from the Little Hoosick River, it would be occurring with water from the river *before* the tributary joined the river, so that the landfill could not be a plausible source. (See **Exhibit F**). Finally, because the PFOA levels in the Little Hoosick River are virtually stable from the point of the Taconic property to the convergence of the Little Hoosick River into the Hoosick River, it appears that if water from the Little Hoosick River

containing PFOA is recharging any of the contaminated wells, then this PFOA likely also came from Taconic, most likely from historical air emissions that deposited in the soil and are now being carried by precipitation to the river (“runoff”). For these reasons, the landfill is not a plausible source of PFOA in the contaminated private wells in Petersburg.

B. Estimates of APFO Emitted from the Taconic Facility

25. As stated above, precise calculation of the amount of APFO emitted into the air from the Taconic Facility is not possible due to the lack of accurate air emission testing during the years when APFO was contained in the PTFE and FEP dispersions used at Taconic. Taconic initially stated in answer to interrogatories promulgated by the New York State Senate that dispersions it used contained approximately 1% APFO. (**Smith Ex. 8**, p. 3). I had previously utilized this APFO percentage in calculations that were presented in Plaintiffs’ expert disclosure, while also performing separate calculations using the average APFO concentration in PTFE dispersions set forth in the Barr Mass Balance report (0.28%) (**Exhibit D**). Taconic has apparently changed its original answer of the average APFO in the dispersions it historically utilized. The source of the data from which this new estimate was derived is unclear as it is stated to be “based on conversations with various suppliers”. (**Smith Ex. 17**). However, in my calculations of Taconic’s likely APFO air emissions (Set forth in Paragraph 13 above), I only utilized the 0.28% provided in the Barr Mass Balance report, which was done in collaboration with multiple dispersion processors similar to Taconic.
26. Mr. Washburn is also critical of my opinion that the Smog Hog did not likely reduce the amount of APFO from the air stream exhausted from the Taconic coating ovens during the years 1991-1996 when this device was utilized. Specifically, he references a Clough

Harbour & Associates (CHA) report (**Smith Ex. 21**) where testing was performed for Taconic in 2004. This can be found in of Table 2.13 of this report (bates # TACONIC_Paper-0000394). Mr. Washburn contends that since the average “stack temperature” measured in these tests was between 130 and 132 °F, my conclusion that the Smog Hog would not likely have removed any significant amount of APFO is incorrect. Mr. Washburn provides no test data to support his claim that the Smog Hog removed any APFO from the air stream. The table he references from the CHA Report (*Id.*) does not provide sufficient data to contradict my conclusion. From the testimony of witnesses (see paragraph 13(d) above) and from the Barr Mass Balance report (**Exhibit. D**), the temperatures reached in the top or sintering zone of the typical coating ovens used at Taconic reached over 700 °F. The CHA report does not indicate where in the stack the air temperature was measured. In other words, it does not indicate how far the air traveled in the exposed stack after it passed through the Smog Hog at the point its temperature was measured. If these temperature measurements occurred at the top of the stack, which is likely for the temperature to have dropped quickly, then this is not an accurate estimate of the temperatures of the exhaust when it passed through the Smog Hog. Because the test was performed on January 18, 2001 when the ambient air temperature was likely to be extremely low, the distance between the point where the gases exited the Smog Hog and the point where the temperature readings were taken as well as whether that distance was traveled in a stack exposed to ambient outdoor January temperatures, would be essential to know before any conclusions could be reached. If the temperature of the emissions was measured at the point the emissions exited near the top of the stack, by that point the APFO gases would have cooled quickly from the temperature when they entered the Smog Hog. The incomplete data from the CHA report do not provide sufficient

information to refute or even question my conclusion that the Smog Hog likely had low to no efficiency in removing APFO from the air stream.

27. Mr. Washburn also criticized my assessment of the efficiency of the Fume Eliminator in removing APFO from Taconic's air emissions. Mr. Washburn relies on two reports to support his contention that the fume eliminator was more efficient than indicated in the summary of my opinions provided in Plaintiffs' Expert Disclosure. The first is a report Taconic produced from testing done in 1997 by Adirondack Environmental Services Inc., which reported that APFO was not detected in the air emissions. (**Smith Ex. 17**). Mr. Washburn stated in his affidavit: "It is acknowledged that at the time the tests of the Fume Eliminator were conducted in 1997, standard, federally-approved analytical methods for PFOA were not available and thus there is increased uncertainty in the quantitative results of the testing." (Washburn ¶22). This acknowledgment could not be avoided, because Adirondack informed Taconic in 2003 that the methodology that was used in 1997 for the emissions testing and again in 2003 to test indoor air for APFO "was developed in-house ... and may not have been sensitive enough to detect small quantities of PFOA that may have been present in the samples." (**Exhibit W**). In an email from Mr. Steuer of Adirondack to Mr. Kawczak of Taconic, he explicitly stated that the "in-house" test method used by Adirondack was not reliable for detecting APFO/PFOA. (**Exhibit X**).
28. Mr. Washburn also relies upon the testing done by APCC in 2016 (**Smith, Ex. 18**, referenced in paragraph 13(i) above) to support the argument that the historic Fume Eliminator efficiency in removing APFO since 1996 was 78%. As explained above, this 78% efficiency estimate is of questionable validity because: 1) a newer fume eliminator (installed in 2014) was in operation at the time of testing and there is no data comparing its efficiency to the

prior models used during the time Taconic's exhaust stream contained high levels of APFO; 2) this testing was done in 2016 when Taconic was using APFO-free dispersions and while very small levels of APFO were still found in the oven exhaust from unknown sources, it is impossible to accurately extrapolate from the APFO removal efficiency of the Fume Eliminator at these low levels to what it would be capable of removing when Taconic was using standard level APFO dispersions; and 3) this one test was again done in the winter months when ambient temperatures were lower and there would be a greater degree of conversion of APFO vapors to particulate matter, thereby increasing the removal efficiency of APFO during the time of testing, while the removal efficiency would likely be lower in warmer months. In spite of these factors reducing the reliability of the 78% efficiency level, I utilized the 78% figure from the APCC report in estimating Taconic's APFO emissions after 1996 when the first fume eliminator was installed. Using this removal rate likely caused an underestimate of the amount of APFO Taconic released during the period when fume eliminators were in operation.

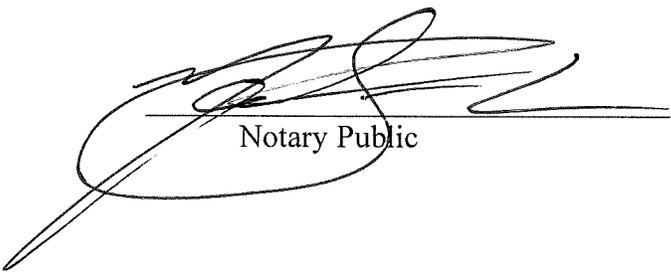
29. Again, as I stated above, precise calculations of the amount of APFO released from Taconic into the environment via air emissions between 1961, when the facility began operating, and 2013, when it stopped using APFO-containing dispersions, are impossible because Taconic did not perform a single valid air emissions test for APFO during this period. Estimating emissions based upon available data requires assumptions to be made and will have a margin of error in both directions. However, my estimates provided above are based upon the best available data. I utilized conservative assumptions for the efficiency of the fume eliminator, did not account for the numerous times the fume eliminator was not functioning (the likely reason they kept the Smog Hog as a backup), did not account for the pure PFOA Taconic

added to its dispersions at times (**Exhibit G**), used the questionable 78% removal efficiency of the fume eliminators, and did not account for continued emissions of APFO from the lower APFO dispersions used after 2007, all of which indicate my calculations are likely to be an underestimate. However, in spite of these conservative assumptions, my calculations show that upwards of sixteen tons of APFO was released from Taconic's air emissions into the Petersburg environment. Even if this estimate is off by a factor of 2, this amount of APFO is capable of causing the contamination found in the private and public wells in Petersburg as well as in the soil and surface waters.

30. In conclusion, all of the opinions I have expressed rely on scientific methodologies commonly utilized in analyzing the fate and transport of environmental contaminants and are based upon facts and data presented in the various references provided.


HYEONG-MOO SHIN, Ph.D.

Sworn to this 8
day of April, 2019


Notary Public

