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 DENUE and MEGAN DUNN, individually, and on behalf of all similarly situated,

Plaintiffs,

v.

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

Defendant.

AFFIDAVIT OF DONALD I. SIEGEL, Ph.D.

Index No.: 00253835

STATE OF NEW YORK)

COUNTY OF ONONDAGA) ss:

Donald I. Siegel, Ph.D., being duly sworn, deposes and says:

1. I am an expert in the field of hydrogeology and have been retained by plaintiffs in this case to analyze and provide opinions regarding the groundwater contamination in Petersburgh, New York. I make this Affidavit in opposition to Defendant's motion to exclude my testimony.

2. I am an Emeritus Full Professor and Chair of the Department of Earth Sciences at Syracuse University, in Syracuse New York. I hold a Ph.D. in hydrogeology. I am also a principal at Independent Environmental Scientists, Inc. I am a Fellow in the American Geophysical Union, the Geological Society of America, the American Association for the Advancement of Science and the current President Elect of the Geological Society of America. I am also a Lifetime Associate

member of the National Research Council (NRC) of the National Academy of Sciences. A copy of my C.V. is attached as **Exhibit A.**

3. I have been elected and served as Chairman of the Hydrogeological Division of the Geological Society of America (GSA) and as GSA Councilor for the Society (2002-2005). I have been awarded all GSA professional honors related to my fields of expertise, hydrogeology and hydrogeochemistry: the Birdsall-Dreiss Distinguished Lectureship (1992-1993); The Hydrogeology Distinguished Service Award, 2001; and the O.E. Meinzer Award in Hydrogeology in 2005 in recognition of my research contributions to this discipline of study.

4. I have also served on numerous National Research Council (National Academy of Sciences) Committees, including: Techniques for Assessing Ground Water Contamination, 1991-1993; Techniques for Wetland Delineation, 1993-1994; the United States Geological Survey (USGS) Hydrologic Research: Water Use, 2000-2001; USGS Hydrologic Research: Regional Aquifer System Analysis, 1998-2000; USGS Hydrologic Research: Stream Information Program, 2001-2004; and Committee on Groundwater Fluxes, 2002-2003. I served as the Chairman of the NRC's River Science Committee from 2002-2005, and as a member of the Committee on Environmental Impact of Coal-Gas Methane Production (2008-2010). I also served as Chair of the Committee on 3rd Phase National Water Quality Assessment, USGS, from 2010-2012 and as Chair of the Water Science and Technology Board of the NRC.

5. In September of 2011 I served on an international panel of scientists that was formed to provide advice to the Chinese government regarding water contamination issues in China. I traveled to China with leading scientists from around the world for a forum to discuss groundwater contamination issues and remediation strategies that could be applied to China's rapidly growing environmental concerns.

6. I have served as Associate Editor of Water Resources Research, 1993-1996; 2010 -

present; Associate Editor of Wetlands, 1995-1998; Associate Editor of Ground Water, 1997-2005; Associate Editor of Geology, 2005-2007; and Associate Editor of the Hydrogeology Journal, 2005-present. I have also served as the book editor for the publishing arm of the Geological Society of America.

7. I have published 150 peer-reviewed research papers and books on topics spanning the breadth of the hydrogeologic discipline, from contaminant geochemistry to wetland hydrology. I have also been awarded millions of dollars for my research programs from numerous sources over the years I have worked at Syracuse University, including various governmental agencies and private companies.

8. I have been retained as an expert consultant in over 50 environmental contamination sites related to a wide range of hydrogeologic issues, including solvent spills and contamination, landfill siting and characterization, water supply and wetland issues. I have worked on behalf of governments, industry, insurance companies and residents allegedly affected by groundwater contamination.

9. In arriving at my opinions in this case, I reviewed numerous documents produced by Defendant Taconic as well as documents and data obtained from the NYDEC and the NYDOH. A list of the documents I have relied on 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 hereto as **Exhibit C**. These documents and electronic files include data on well concentrations of PFOA in the vicinity of Petersburgh, New York, information on the depths of these wells, data showing soil PFOA concentrations measured in the vicinity of Petersburgh, as well as surface water sampling conducted for PFOA concentration in this area. The documents and testimony reviewed also include information about the manufacturing processes performed at the Taconic Petersburgh

facility as well as the PFOA concentrations typically found in the PTFE dispersions that Taconic used.

10. Based upon my review, I understand that from 1961 to approximately 2013 Taconic coated fiberglass cloth and other materials with PTFE dispersions containing the chemical surfactant APFO at its production facility in Petersburgh, New York. PTFE is not soluble in water, so Taconic added additional concentrated APFO to its dispersion mixes, which dissolves in water to disperse PTFE in coating baths prior to and during high-temperature treatment in a coating oven. **(Shin Ex. G)** [1] The coating process used at Taconic released PFOA (the non-salt version of APFO) and other fluorinated hydrocarbons to the atmosphere from exhaust vents associated with the coating ovens, to the soil from atmospheric deposition, to surface water from runoff across soil and directly to groundwater through wastewater discharge through an onsite septic system and leach field. In 2016, the NYDEC identified and mapped PFOA contamination in surface water, groundwater and soil at Taconic and throughout Petersburgh **(Shin Ex. F)**

OPINIONS

11. Based upon my review of all available environmental data regarding PFOA contamination of waters and soils in the Petersburgh area, I reached the following opinions relevant to the claims made in this case with a high degree of scientific certainty.

12. Taconic and the Town of Petersburgh are located in a north/south oriented valley in the Taconic Mountain Region of eastern New York. The Little Hoosic River flows to the north down the center of a geologically ancient fault-controlled valley eroded into ancient metamorphic bedrock (e.g. Potter, 1972, 1963; Bonham, 1950; Fisher, et al., 1970). The valley was eroded even

[1] References to "Shin Exhibit" and "Smith Exhibit" are to exhibits to the affidavits submitted to the Court by Hyeong-Moo Shin dated April 8, 2019 and the Attorney's Affidavit of Thomas Smith dated March 1, 2019.

deeper by Pleistocene glaciers that flowed up the valley from north to south. Glaciers left the valley about 12,000 years ago but not before depositing silt and clay high on the valley walls called moraines, and sand and gravel outwash deposits called kames at lower elevations and closer to the valley floor (e.g. DeSimone, D.J. and LaFleur, R.G., 1985). Valley shape has been slightly modified by river flow during the last 12,000 years. Precipitation and erosion transported valley-wall sand and gravel towards the valley center where the Little Hoosic re-worked the sand and gravel left by the glaciers in modern alluvium deposits in the river bed and banks (e.g. DeSimone, 2017).

13. There are two groundwater systems in the valley: 1) a shallow water table aquifer located in the kame and alluvium deposits, and 2) a deeper bedrock aquifer in the underlying bedrock. Shallow and deep bedrock aquifers are more likely than not hydraulically connected where near-surface fractured bedrock is in contact with highly permeable sand and gravel of shallow aquifers (e.g. Williams and Heisig, 2018).

14. Shallow groundwater flow typically mimics topography and flows to the east and northeast towards the Little Hoosic River near the Taconic facility and near the Town of Petersburgh. Deep bedrock flow is typically controlled by rock fracture and bedding plane geometry. Fractures and faults are oriented in a north-northeast/south-southwest direction throughout the Taconic Mountains (e.g. Potter, D.B., 1972); therefore, deep bedrock groundwater flows are more likely than not in a north/south direction.

15. Extracting water from the deep groundwater aquifer by three Taconic production water wells more likely than not induce downward movement of PFOA from the shallow aquifer to the bedrock aquifer. Deep bedrock water wells located close to the Taconic facility are therefore susceptible to PFOA contamination through this mechanism.

16. PFOA measured in surface water, groundwater and soil within 7 miles of the Taconic

facility is derived from atmospheric and wastewater discharges from Taconic.

17. Taconic discharged large volumes of untreated coating-process wastewater to the ground through onsite septic systems, dry wells and leach fields until at least 1996. Discharges to the ground by Taconic likely had a significant impact on the PFOA contamination of the groundwater. (**Shin Ex. N)** It is reported that an evaporator unit with an underground holding tank was installed in 1996 to reduce the amount of coating-process wastewater discharged to the ground. The tank itself and the contaminated wastewater in it, remained in communication with groundwater, as evidenced by observations of groundwater seeping into and therefore necessarily out of the tank. (***Id***; **Exhibit D)** Taconic continued to discharge process wastewater onsite until 1999. (**Smith Ex. 8, p.2 and Smith Ex. 9, pp. 5, 12-13**)

18. In 2005, a mass balance study was performed by the Barr Engineering Company for the Fluoropolymer Manufacturers Group of the Society of the Plastics Industry. The study estimated that the mass of APFO released in liquid coating-process waste from dispersion coating processes similar to Taconic's averaged approximately 1-3% of total APFO in the dispersions utilized. (**Shin Ex. D, p.46**). The average APFO content of the dispersions obtained from suppliers according to the Barr report was 0.28%. (**Shin Ex. D, p.14**). According to documents produced by Taconic, the annual dispersion usage in the 2005 time period was 987,000 lbs. (**Shin Ex. I, p.2**). From 2006-2013 the average PTFE dispersion usage ranged from 937,155 lbs. to 1,283,570 lbs. (**Shin Ex. J**). Assuming 987,000 lbs. as a conservative usage estimate, it stands to reason that 27.6 to 82.9 lbs. per year of PFOA were released in the coating-process wastewater. Therefore, a total of 939 to 2819 lbs. of PFOA were released to the ground during the 34 years prior to 1996. Since as noted above, Taconic continued to discharge coating-process wastewater onsite for three more years, even this significant volume is likely an underestimation. Furthermore, the figure of 0.28% APFO content does not take into account the additional concentrated APFO Taconic added

to its dispersion mixes during coating operations. (**Shin Ex. G)**

19. The hydrogeologic setting of the Petersburgh valley is highly vulnerable to the migration of contamination of all kinds that is deposited onto the soil in the form of particulate matter, including PFOA. Surficial materials near the valley bottom contain highly permeable sand and gravel. Thin soil covers the bedrock valley walls at higher elevations. Upper (near-surface) bedrock is fractured from tectonic forces and glacial erosion (Williams and Heisig, 2018). The water table is shallow. The bed of the Little Hoosic River itself consists of fractured bedrock covered by permeable materials of variable thickness. Given these conditions, PFOA would have more likely than not reached the water table aquifer almost immediately following release from the septic and leach field systems and within a year of release to the atmosphere.

20. PFOA contamination from Taconic would have spread quickly towards the Little Hoosic River due to the highly permeable alluvium on the river bottom and banks. PFOA contamination would have migrated towards deep bedrock wells through normal pumping action.

21. It is highly likely that by 2005, PFOA contamination moved through the groundwater in a northeast direction and contaminated properties beyond two residences to the north of the plant that tested positive in 2005 to wells that were found in 2016 to be contaminated northeast of those residences. These homes had some of the highest contamination levels when tested in 2016 and include the former home of plaintiffs E.B. and G.Y. and the current home of plaintiff William Sharpe.

22. It is more likely than not that PFOA contaminated wells will remain contaminated in the foreseeable future even though PFOA is no longer being released by Taconic operations. Continued contamination, at lower or possibly higher concentrations, will occur because of heterogeneities and dual porosity conditions which store and then release PFOA at variable times within the aquifers in question. Due to aquifer heterogeneity inherent with bedrock aquifers, it is

also more likely than not that the full extent of PFOA contaminated groundwater has not yet been determined. PFOA has contaminated shallow and deep groundwater aquifers throughout the valley. It is not possible to predict which wells were affected by groundwater discharge versus atmospheric deposition until more is understood about groundwater flow conditions and the hydraulic connections between shallow and deep aquifers. However, the PFOA contaminated wells closest to the Taconic facility are more likely to have been influenced by groundwater discharges.

23. My opinion with reasonable scientific certainty remains that shallow and deep groundwater near and downgradient of the Taconic facility was contaminated by wastewater discharge and atmospheric deposition. The extent to which the two identified sources of PFOA contamination from Taconic mixed in shallow or deep aquifers is difficult to determine and depends on the following: 1) the location of the well with respect to the direction of groundwater flow; 2) PFOA atmospheric deposition rate; and 3) the degree to which water was pumped for domestic or other purposes at or nearby the location. Regardless of the pathway, it is my opinion with a reasonable degree of scientific certainty, that all of the PFOA contamination in the contaminated municipal and private water wells within seven miles of the Taconic site were contaminated by one of the sources of PFOA contamination from Taconic's manufacturing facility.

24. Taconic's assertion that my opinions are not scientifically reliable is premised on the affidavit of Stephen Washburn, M.S., a chemical engineer. Mr. Washburn's affidavit mischaracterizes my opinions and are largely based on incorrect assumptions.

25. First, and perhaps most glaringly, Mr. Washburn apparently believes that I have opined that every well within the geographic class area (a 7-mile radius from the Taconic plant) was contaminated with PFOA through a single mechanism: the flow of contaminated groundwater

from beneath the surface at Taconic's facility, primarily from wastewater discharges. I have not said this.

26. Rather, based on data that Mr. Washburn does not contest, I have identified: (1) a likely shallow groundwater flow from Taconic to the east and northeast, toward the Little Hoosic River and Petersburgh, and (2) likely deep groundwater flows in a north/south direction.

27. Mr. Washburn apparently believes my opinions are invalid because not every contaminated well in the class area lies along these groundwater flowpaths. He further posits that the configuration of the Little Hoosic River watershed exerts a hydraulic constraint on groundwater, forcing it inwards toward the center of the valley and along the path of the river. Based on these assumptions, Mr. Washburn concludes that "only" 25% of the wells in the class area could be impacted by Taconic's wastewater discharges to groundwater or the Hoosic River. (Washburn Affidavit, ¶ 27)

28. Even if it were fully supported by hydrogeological data, such a conclusion is more of a concession than a critique of my conclusion or the methodology that led me to it.

29. I have not opined that wastewater discharges have been the sole source of PFOA contamination of drinking water wells within the class area. Such discharges were, however, even assuming the accuracy of Mr. Washburn's restrictive assumptions, a significant source.

30. Taconic discharged PFOA in ways other than through coating-process wastewater discharges. As documented by plaintiffs' expert, Hyeong-Moo Shin, Ph.D., an even larger source of the contamination in the class area was atmospheric dispersion through Taconic's largely uncontrolled, high-volume emissions into the atmosphere. See Shin affidavit, *passim.*

31. Obviously, distribution of atmospheric discharges was not subject to the same directional constraints as groundwater flow, and, as shown by Dr. Shin, these atmospheric discharges were likely responsible for the contamination of wells that the wastewater discharges

did not affect. *Id*. pp. 7-12.

32. Nothing in Mr. Washburn's opinion remotely challenges, let alone invalidates, the methodology I used to determine that wells located downgradient and in relative proximity to the Taconic facility were adversely affected by Taconic's long-standing discharges of coating-process wastewater directly to the ground. Indeed, this would not be possible because, as summarized in this affidavit, I examined all available data, including: 1) the detailed mapping of PFOA contamination in surface water; 2) groundwater and soil sampled by the DEC; 3) maps of local topography; 4) known local geological features; 5) historical information regarding known discharges and 6) all hydrogeological data gathered to date, regardless of source. My conclusions are derived from the data and clearly observable and documented conditions. This is a standard scientific approach, so it is not surprising that Mr. Washburn, while stating his disagreement with my conclusions, says nothing about my methodology.

33. Moreover, Mr. Washburn's statements regarding hydrogeological conditions in the proximity of Taconic, to the extent they differ from mine, are based on unsupported assumptions. For example, there are no data to support his conclusion that all deep groundwater flow is constrained toward one part of the class area - the center of the valley - by the Little Hoosic River. To the contrary, the direction of deep groundwater flow applies to the entire Petersburgh area.

34. Mr. Washburn next suggests that "it is possible that some wells are hydraulically connected only to … PFOA sources other than Taconic and are highly unlikely to be impacted by releases from Taconic". (Washburn Affidavit, ¶ 28) This conclusion (again unrelated to methodological questions) is premised on an assumed "heterogeneity of overburden and bedrock fractures". There is no way to conclude that any such heterogeneity precludes a hydraulic connection of any well to Taconic. Moreover, Mr. Washburn's suggestion that "PFOA sources other than Taconic" may be hydraulically connected to contaminated wells in Petersburgh is

unsupported by any data whatsoever. Early in his affidavit he suggests that sources in Vermont (North Bennington and Pownal) or Hoosick Falls or the landfill in Petersburgh would have the "potential to impact surface water and groundwater quality within the Little Hoosick [sic] Valley". *Id.* ¶18. Although much is theoretically possible, there is no data to support a source for a hydraulic connection to contaminated wells other than Taconic's facility.

35. More importantly, Mr. Washburn's assumption of the "possibility" of "other sources" of PFOA in wells within the class area again ignores atmospheric dispersions, which is likely to be the main source of contamination for most of the wells. As Dr. Shin points out in his affidavit (¶¶17-24) the "potential sources" other than Taconic that are identified by Mr. Washburn and Taconic's other expert, Paul Wm. Hare, cannot account for the PFOA contamination of wells within the class area.

36. Finally, Mr. Washburn asserts that my observation that PFOA contaminated wells will remain contaminated in the foreseeable future "appears to be unfounded". (Washburn Affidavit, ¶29) This is incorrect. My observation is consistent with the scientific literature. For example, Stahl, et al. (2013) found that 96.88 % of PFOA remained in soil after a five-year leachate study. Weber, et al. (2017) found PFAS persisted in a sand and gravel aquifer for more than twenty years. Filipovic et al. (2015) found high PFOA concentrations remaining in soil for more than 30 years after local PFOA usage was discontinued. In its Drinking Water Health Advisory for PFOA (2016), cited by Mr. Washburn, the USEPA states "PFOA persists in soil near manufacturing facilities". USEPA, p.22. See also, Xiang, et al. (2018).

37. [redacted]

These results, found in samples taken years after Taconic purportedly stopped discharging PFOA, further support my opinion that PFOA will remain in Petersburgh area wells in the foreseeable future.

38. In conclusion, I have stated opinions in this matter with a reasonable degree of scientific certainty. My opinions are based on actual data and well-established hydrogeological principles I have applied in deriving the opinions.

A list of references cited herein is attached as **Exhibit E**.

DONALD I. SIEGEL, Ph.D.

Sworn to me this 25
day of April 2019

Notary Public

KRISTIN L SECORD
Notary Public – State of New York
NO. 01SE6358816
Qualified in Madison County
My Commission Expires May 15, 2021