

Exhibit 330

**EXPERT REPORT OF STEVEN BIRD, MD
WITH REGARD TO TRACK ONE PLAINTIFF MARK CAGIANO**

Dated: February 7, 2025
Corrected: June 11, 2025

OUTLINE OF TOPICS

- I. SUMMARY**
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I. SUMMARY

1. I was asked to review the case of Mark Cagiano and evaluate the available facts and information with regard to Mr. Cagiano's exposures to the relevant chemical contaminants in the water at Camp Lejeune during pertinent times. I have authored this Expert Report, in addition to my prior expert reports on general causation with regard to bladder cancer and the chemical contaminants at issue, and my supplemental report regarding EPA's recent ban of TCE and PCE. My prior reports are incorporated herein by reference.

2. This report contains, or cites to, or will be accompanied by appropriately: (i) a complete statement of all opinions I will express and the basis and reasons for them; (ii) the facts or data considered in forming the opinions; (iii) a listing of exhibits used to summarize or support the opinions; (iv) my qualifications and a list of all publications authored in the previous 10 years; (v) a list of all other cases in which, during the previous 4 years, I have testified as an expert at trial or by deposition; and (vi) a statement of the compensation to be paid for my work in this case.

3. Mr. Cagiano has a diagnosis of bladder cancer. It is my opinion that, based on a review of his exposure history and circumstances at Camp Lejeune, Mr. Cagiano's exposures to the chemical contaminants in the water at Camp Lejeune were above *de minimis* levels and were significant and substantial, including when compared to exposures discussed in one or more relevant scientific studies as cited previously in my general causation reports.¹

4. The methodology and basis for the opinions stated herein are not novel and, for the reasons set forth, are generally accepted in the medical and scientific community.

II. QUALIFICATIONS

5. A copy of my Curriculum Vitae, was provided with my prior expert reports in this matter, as was information including i) my qualifications and a list of all publications authored in the previous 10 years; ii) a list of all other cases in which, during the previous 4 years, I have testified as an expert at trial or by deposition; and iii) a statement of the compensation to be paid to myself for my work in this case.

6. I earned my Bachelor of Science degree in biology *cum laude* in 1991 from Yale University, where I was named a Yale University Richter Fellow. I worked in the laboratory of Professor Sidney Altman, Dean of Yale College and winner of the 1989 Nobel Prize in Chemistry. I was awarded my Doctor of Medicine degree by Northwestern University in 1995 and was also elected to the Alpha Omega Alpha national medical honor society (generally awarded to the top 10% of medical students nationally). Following medical school, I gained post-graduate training through residencies with the Naval Hospital San Diego (surgery) and the

¹ My understanding is that one or more other properly qualified medical experts are concurrently providing reports and expert opinions to the effect that, based on a review of Mr. Cagiano's personal medical history and other factors, Mr. Cagiano's chemical exposures at Camp Lejeune were as likely as not a substantial factor in causing his bladder cancer. I have not sought to review Mr. Cagiano's medical records.

University of Massachusetts Medical School (emergency medicine). In addition, I completed a two-year fellowship in medical toxicology at the University of Massachusetts Medical School in 2004.

7. I began my independent clinical career in the Department of Emergency Medicine at the University of Massachusetts Medical School in 2002. I was promoted to Assistant Professor of Emergency Medicine in 2004, to Associate Professor in 2010, and to full Professor in 2016. In addition, I served as Program Director of the Emergency Medicine Residency Program and as Vice Chair of Education for the Department of Emergency Medicine at the University of Massachusetts Medical School from 2011 to 2019. I am currently the Division Chief of Medical Toxicology at the UMass Chan Medical School and UMass Memorial Health. I work as an Attending Emergency Physician at UMass Memorial Medical Center and Clinton Hospital. I am actively involved with numerous professional committees within the UMass Chan Medical School and its Department of Emergency Medicine and Division of Medical Toxicology, and in national and international scientific organizations, such as the Society for Academic Emergency Medicine, the American College of Medical Toxicology, and the American College of Emergency Physicians. I served on the Board of Directors of the Society for Academic Emergency Medicine from 2014-2020 and was President of the Society from 2018-2019. Additionally, I was formerly President of the Medical Staff of UMass Memorial Healthcare.

8. During my professional career, I have received several awards, including the Navy and Marine Corp Achievement Medal; the Outstanding Contribution to Medical Toxicology Research by the American College of Medical Toxicology; the Society for Academic Emergency Medicine ("SAEM") Best Resident Basic Science Presentation Award; the SAEM New England Regional Research Directors Excellence in Research Award; the teaching award (twice) from the UMass Emergency Medicine Residency; and a Young Investigator Award from the Society for Academic Emergency Medicine.

9. I am a reviewer for several scientific journals, including the Journal of Medical Toxicology; Clinical Toxicology; Annals of Emergency Medicine; Academic Emergency Medicine; Toxicology; the New England Journal of Medicine; and JAMA. I currently serve on the Editorial Board of Academic Emergency Medicine and was a founding editorial board member of the Journal of Medical Toxicology. I am certified by the American Board of Emergency Medicine and the American Board of Medical Toxicology. I currently hold a license to practice medicine in Massachusetts. In my practice of emergency medicine and medical toxicology, I evaluate people exposed or potentially exposed to a variety of substances on a daily basis. In my review of this case, I utilized scientifically valid and reliable methods to perform my research, followed by a differential etiology methodology and consideration of the weight of the evidence and the Bradford-Hill viewpoints.

III. MATERIALS REVIEWED

10. I have been provided with the following case-specific materials, which I have reviewed and have relied upon in formulating my opinions in this case, all of which will be itemized in more detail in the reliance list forthcoming for this report:

- a. Plaintiff's available deposition and declaration testimony;
- b. Plaintiff's Exposure Profile document;
- c. Information regarding the relevant chemicals, applicable toxicological, medical and epidemiological science;
- d. Information regarding ATSDR-estimated, historically reconstructed water concentrations for relevant chemicals in the Camp Lejeune water;
- e. Expert Report of Morris Maslia;
- f. Expert Report of Dr. Kelly Reynolds;
- g. Expert reports of Kyle Longley; and
- h. Materials as were previously listed in connection with my prior general causation reports, submitted in this matter.

11. In addition to the materials provided, I have also reviewed and relied upon the studies and literature cited in this report, all of which are based on scientifically valid principles or are the types of materials I and other physicians and scientific and medical experts normally rely upon to make our opinions in formulating my opinions in this case.

IV. HISTORICAL EVIDENCE OF LIFE AT CAMP LEJEUNE RELATED TO SERVICE MEMBERS

12. In forming my opinions in this case, I have reviewed the expert report and documents cited by Dr. Kyle Longley regarding Camp Lejeune policies and procedures along with the practices of and empirical facts of life at Camp Lejeune which would directly affect the absorption of the water contaminants during the pertinent times generally.

13. With regard to the topic of absorption by ingestion, I note that according to historical materials produced in the case and ATSDR publications, the finished potable water used by Marines and others in a variety of manners and contexts would obviously lead to ingestion. Dr. Longley noted general historical observations relevant to the likelihood of increased ingestion of contaminated water at Camp Lejeune:

- a. The Hadnot Point water distribution system served as the "nervous center" of the base, meaning that any persons visiting, working, or residing across the base, regardless of whether they lived at Hadnot Point, likely had numerous opportunities to ingest contaminated water, whether through recreational, training, or work activities;
- b. The military aimed "to keep the Marines on base" and encouraged the use of the base as an all-inclusive, self-sustaining city/county providing all basic needs to include hospital services, schools, restaurants, gyms, theaters, entertainment, shopping, clubs, sporting competitions, etc., thereby increasing the likelihood of Camp Lejeune inhabitants' frequent and continuous water ingestion from within the Camp Lejeune water treatment systems;
- c. Mess halls and restaurants pulled drinking and mixing water from contaminated water sources, including water used during meal preparation and cooking;

- d. While today people rely on bottled water, from the 1950s through the 1980s people drank tap water from the faucet, using the water to create teas, coffee, or powder drinks such as Kool-Aid.
- e. Canteens, water fountains, and water buffalos on base were typically sourced from contaminated water sources;
- f. The hot climate of the North Carolina coastline (highs in the 80s and 90s for five months) increased water consumption;
- g. Strenuous military training regimens and directives to enlisted persons to stay fit and hydrated in accordance with hydration guidelines increased water consumption; and
- h. Even when military training took place in the field, contaminated water was typically used as the water source for drinking, meal prep, and cooking through the use of water buffalos, primarily filled at Hadnot Point locations.

14. Based upon a review of historical and ATSDR publications, residents, workers, and civilians at Camp Lejeune had numerous opportunities to routinely and continuously ingest significant amounts of contaminated water on base.

15. In addition, I note that according to historical materials produced in the case and ATSDR publications, the finished potable water used by Marines and others in a variety of manners and contexts would obviously lead to inhalation of the water contaminants.

16. Dr. Longley noted the following historical observations relevant to the likelihood of increased inhalation of contaminated water for a military servicemember at Camp Lejeune:

- a. *Inhalation exposures through barracks housing.*
 - i. Water utilization in barracks housing was significant, with an average of 862,000 gallons of water per day in those bachelor housing units that drew water from the Hadnot Point water supply. According to the report, within these barracks in the Hadnot Point area, shower flow rates were 4.5 gallons per minute, toilet flow rates were 4.5 gallons per flush, and faucet flow rates were 3.5 gallons per minute. Water vapors occur with showering, flushing, the use of sinks for hygiene, cleaning with water, and other water uses within the barracks.
 - ii. Historical documents denote a myriad of deficiencies within barracks' housing and other facilities. These included a high rate of faulty or inoperable exhaust fans, lack of vapor barriers allowing for vapor intrusion, standing water on the floor, condensation on windows indicating elevated interior humidity, and mildew presence indicative of excessive moisture in the air. Each of these deficiencies has the capability of significantly increasing an individual's inhalation exposure to the water contaminants.
 - iii. A 1981 "Report on Study Concerning Mildew and Excessive Moisture in Various Buildings at the Marine Corps Base, Camp Lejeune" notes that some of the air conditioning units in some barracks were having a reverse effect and acting as humidifiers because of clogged fan coil units. It also

notes that “hot moist air [would] enter the sleeping rooms” in some barracks from the laundry rooms and the bathrooms. Some barracks even had condensation on the walls of the sleeping rooms.

- iv. A “Final Report on High Humidity/Moisture Conditions Miscellaneous Buildings Camp Lejeune, North Carolina” from 1983 entails that its stated purpose is to show the pervading problem of humidity and moisture across the base. It specifically makes mention of several barracks. Some of the issues include property damage from mold and mildew and “[a]n inordinately high number” of nonfunctioning exhaust fans in the bathrooms. This latter issue led the report authors to conclude that an “insufficient regimen of preventive and general maintenance is occurring.”
- v. Additionally, even when the barracks had functioning air conditioning units, the military would, at times, not turn on the air conditioning units in an effort to curb energy waste. According to a 1982 Utilities and Management Plan, the AC could only run when temperatures exceeded 85 degrees Fahrenheit.

b. Inhalation exposures throughout military duties

- i. VOC inhalation exposure settings that existed in the course and scope of military duties included but are not limited to:
 - 1. Basewide, high-pressure steam cleaning of all vehicles with steam from a portable steam jenny mixed with water to remove accumulations of oils, grease, and dirt;
 - 2. Water training from contaminated sources, including swimming and training in a pool natatorium;
 - 3. Laundry with and without the use of steam jennys;
 - 4. Water use and consumption during field training; and
 - 5. Water consumption within tent cities (showering, cooking, meal prep).

17. According to Dr. Longley’s research, the military estimated that soldiers could use 0.2 gallons of water a day for teeth brushing, 0.25 gallons per day for shaving, 0.75 gallons of water for washing hands, and 1.7 gallons total for personal hygiene. Water requirements for sanitization of meal preparation and serving equipment were estimated at 0.75 gallons per soldier per meal.

18. Finally, with regard to the exposure pathway of dermal absorption, I note that, according to historical materials produced in the case and ATSDR publications, the finished potable water used by Marines and others in a variety of manners and contexts would lead to obvious dermal exposure, as a VOC mass is absorbed through the skin into the bloodstream from a contacting medium, such as water and water vapor.

19. Dermal exposure opportunities, as identified when discussing inhalation above, include showering, bathing, general hygiene, cooking, laundering, cleaning, training activities using or within contaminated water, recreational swimming, recreational use of water, and other activities where the contacting medium containing a VOC concentration contacts the skin surface.

20. Studies have shown that damaged skin, a frequent hallmark of Marine training and life at Camp Lejeune according to Dr. Longley's research, exhibits increased absorption rates for both hydrophilic and lipophilic compounds. [Chiang A. J Appl Toxicol 2012;32:537-63; Nielsen JB. Arch Derm Res 2007;299:423-31; Tsai JC. J Pharm Sci 2001;90:1242-54] Additionally, skin conditions such as eczema can lead to a marked increase in the absorption of solvents such as toluene and xylene .[Hino R. Contact Dermatitis. 2008;58:76-9].

21. The end result of the above descriptions of the routes of exposure to TCE, PCE, benzene, and vinyl chloride via ingestion, inhalation, and/or dermal is that persons present on the base during the contamination periods had the opportunity for significant exposure to, and absorption, of contaminants contained in water and vapor through their routine habits, including but not limited to showering/bathing, cooking, eating, military duties and training, working, civilian and recreational activities, while sleeping in their homes and quarters.

V. ANALYSIS AND OPINIONS IN THE CASE OF MARK CAGIANO

22. Based upon the documents and information provided, I note the following exposure history:

23. According to his Exposure Profile and other information as per the reliance list to be forthcoming, Mark Cagiano was born on [REDACTED], 1953. He was 5'9" and weighed approximately 180 pounds when he was at Camp Lejeune.

24. The available information indicates that Mr. Cagiano primarily worked at Hadnot Point throughout the dates of July 31, 1976, and December 31, 1987. Absent any additional evidence that he left the base or the pertinent areas such as Hadnot Point that were contaminated during that period of time that is identified in his Exposure Profile, Mr. Cagiano was exposed to contaminated water for approximately 1,056 days during this time period of 1976 to 1987.

25. For his first few months at Camp Lejeune, Mr. Cagiano lived off base in Jacksonville, and then, that winter, he moved into base housing with his wife where they remained until his 1980 transfer. Cagiano Dep. 75:13-76:15, 77:9. They lived in a three-bedroom, one-bath, single-family house in MOQ3142, Paradise Point 76:16-22.

26. Mr. Cagiano was then stationed in Nashville, Tennessee, Fort Sill, Oklahoma, and Washington, D.C., between May 26, 1980, and April 25, 1987, when he returned to Camp Lejeune. Cagiano Dep. 64:14-66:10; 00569_CAGIANO_VBA_0000000462. Upon his return, Mr. Cagiano lived in Jacksonville for a period of time that he cannot recall until he moved into base housing again, this time at MOQ2168 on Paradise Point. Cagiano Dep. 78:1-4.

27. While at Camp Lejeune, Mr. Cagiano worked as a battery motor transportation officer at the Area 5 motor pool, from July 31, 1976, to November 30, 1976. Cagiano Dep. 39:14-25, 40:12-15. His work included maintenance tasks, such as cleaning, greasing, and repairing. The trucks also had water buffaloes, but he was not responsible for filling them. Cagiano Dep. 42:1-15. Mr. Cagiano also worked as a garrison property officer, a fire support officer, a fire marshal, an executive officer, a battery historian, a commanding officer, and an

administrative officer. Cagiano Dep. 46:7, 47:13-48:15, 58:21-24, 59:8-16, 62:2, 62:13; 00569_CAGIANO_VBA_0000000461-62.

28. I have reviewed ATSDR historical reconstruction modeling estimating certain monthly average contaminant levels in the water distribution systems affecting the Plaintiff including Hadnot Point. In that regard, below is a cropped excerpt from the ATSDR report entitled, Analyses and Historical Reconstruction of Groundwater Flow, Contaminant Fate and Transport, and Distribution of Drinking Water Within the Service Areas of the Hadnot Point and Holcomb Boulevard Water Treatment Plants and Vicinities, U.S. Marine Corps Base Camp Lejeune, North Carolina, Chapter A: Summary and Findings (March 2013):²

² https://www.atsdr.cdc.gov/camp-lejeune/media/pdfs/2024/10/chapter_A_hadnotpoint_1.pdf

Appendix A7. Reconstructed (simulated) monthly mean concentrations in finished water for tetrachloroethylene (PCE), trichloroethylene (TCE), *trans*-1,2-dichloroethylene (1,2-tDCE), and vinyl chloride (VC) at the Hadnot Point water treatment plant, Hadnot Point–Holcomb Boulevard study area, U.S. Marine Corps Base Camp Lejeune, North Carolina, January 1942–June 2008.—Continued

[Concentrations in finished water computed using mixing-model approach; —, water treatment plant not operating; *, model simulations not conducted]

Stress period	Month and year	Concentrations in finished water, in micrograms per liter				
		Tetrachloroethylene (PCE)	Trichloroethylene (TCE)	<i>Trans</i> -1,2-dichloroethylene (1,2-tDCE)	Vinyl chloride (VC)	Benzene
415	July 1976	12	348	174	16	3
416	Aug. 1976	15	436	214	20	4
417	Sept. 1976	11	336	163	16	3
418	Oct. 1976	2	70	29	3	3
419	Nov. 1976	19	543	264	26	4
420	Dec. 1976	19	520	249	25	3
421	Jan. 1977	9	249	116	12	4
422	Feb. 1977	13	346	164	17	3
423	Mar. 1977	13	342	162	17	2
424	Apr. 1977	8	218	99	11	4
425	May 1977	10	264	123	13	3
426	June 1977	12	320	149	17	3
427	July 1977	14	355	164	19	3
428	Aug. 1977	17	440	199	23	4
429	Sept. 1977	13	338	152	18	4
430	Oct. 1977	2	69	27	3	4
431	Nov. 1977	22	544	245	30	4
432	Dec. 1977	21	513	229	28	4
433	Jan. 1978	10	250	109	14	4
434	Feb. 1978	14	348	154	19	3
435	Mar. 1978	15	352	157	20	3
436	Apr. 1978	9	231	99	13	5
437	May 1978	12	278	123	16	4
438	June 1978	14	333	148	19	3
439	July 1978	17	388	172	23	3
440	Aug. 1978	20	475	209	28	4
441	Sept. 1978	16	364	159	22	4
442	Oct. 1978	3	74	28	4	4
443	Nov. 1978	24	544	240	33	5
444	Dec. 1978	24	546	240	33	4

Stress period	Month and year	Concentrations in finished water, in micrograms per liter				
		Tetrachloroethylene (PCE)	Trichloroethylene (TCE)	<i>Trans</i> -1,2-dichloroethylene (1,2- <i>td</i> DCE)	Vinyl chloride (VC)	Benzene
445	Jan. 1979	12	268	117	16	6
446	Feb. 1979	17	370	163	23	5
447	Mar. 1979	17	378	165	24	5
448	Apr. 1979	11	230	101	15	4
449	May 1979	13	274	119	18	3
450	June 1979	15	320	138	21	3
451	July 1979	17	361	152	23	3
452	Aug. 1979	22	483	201	31	0
453	Sept. 1979	17	358	148	23	3
454	Oct. 1979	3	71	27	4	4
455	Nov. 1979	23	507	207	33	6
456	Dec. 1979	23	504	205	33	6
457	Jan. 1980	12	264	104	17	7
458	Feb. 1980	17	378	152	24	6
459	Mar. 1980	20	433	175	28	6
460	Apr. 1980	12	273	108	17	8
461	May 1980	15	322	131	21	6
545	May 1987	0	0	0	0	2
546	June 1987	0	0	0	0	2
547	July 1987	0	0	0	0	3
548	Aug. 1987	0	0	0	0	3
549	Sept. 1987	0	0	0	0	3
550	Oct. 1987	0	0	0	0	3
551	Nov. 1987	0	0	0	0	2
552	Dec. 1987	0	0	0	0	2
545	May 1987	0	0	0	0	2
546	June 1987	0	0	0	0	2
547	July 1987	0	0	0	0	3
548	Aug. 1987	0	0	0	0	3
549	Sept. 1987	0	0	0	0	3
550	Oct. 1987	0	0	0	0	3
551	Nov. 1987	0	0	0	0	2
552	Dec. 1987	0	0	0	0	2

29. I have further reviewed the exposure assessment of Plaintiff as prepared by Dr. Kelly Reynolds as part of her expert report which includes the following information on levels of contaminant exposures:

Exposure Dates	Total Days	Exposure Location (Work)	TCE (ug/l-M)	PCE (ug/l-M)	VC (ug/l-M)	BZ (ug/l-M)
7/31/1976	1	Hadnot Point	348	12	16	3
8/1/1976-08/31/1976	31	Hadnot Point	436	15	20	4
9/1/1976-9/26/1976	26	Hadnot Point	356	11	16	3
10/09/1976-10/31/1976	23	Hadnot Point	70	2	3	3
11/1/1976-11/30/1976	30	Hadnot Point	543	19	26	4
12/1/1976-12/19/1976	19	Hadnot Point	520	19	25	3
12/27/1976-12/31/1976	5	Hadnot Point	520	19	25	3
1/1/1977-1/31/1977	31	Hadnot Point	249	9	12	4
2/1/1977-2/28/1977	28	Hadnot Point	346	13	17	3
3/1/1977-3/27/1977	27	Hadnot Point	342	13	17	2
4/5/1977-4/20/1977	16	Hadnot Point	218	8	11	4
11/14/1977-11/30/1977	17	Hadnot Point	544	22	30	4
12/1/1977-12/31/1977	31	Hadnot Point	513	21	28	4
1/1/1978-1/31/1978	31	Hadnot Point	250	10	14	4
2/1/1978-2/28/1978	28	Hadnot Point	348	14	19	3
3/1/1978-3/31/1978	31	Hadnot Point	352	15	20	3
4/1/1978-4/30/1978	30	Hadnot Point	231	9	13	5
5/1/1978-5/31/1978	31	Hadnot Point	278	12	16	4
6/1/1978-6/2/1978	2	Hadnot Point	333	14	19	3
7/1/1978-7/31/1978	31	Hadnot Point	388	17	23	3
8/1/1978-8/3/1978	3	Hadnot Point	475	20	28	4
8/14/1978-8/31/1978	18	Hadnot Point	475	20	28	4
9/1/1978-9/30/1978	30	Hadnot Point	364	16	22	4
10/01/1978-10/31/1978	31	Hadnot Point	74	3	4	4
11/1/1978-11/30/1978	30	Hadnot Point	544	24	33	5
12/1/1978-12/31/1978	31	Hadnot Point	546	24	33	4
1/1/1979-1/31/1979	31	Hadnot Point	268	12	16	6
2/1/1979-2/28/1979	28	Hadnot Point	370	17	23	5
3/1/1979-3/7/1979	7	Hadnot Point	378	17	24	5
11/28/1979-11/30/1979	3	Hadnot Point	507	23	33	6
12/1/1979-12/28/1979	28	Hadnot Point	504	23	33	6
1/3/1980-1/12/1980; 1/27/1980-1/31/1980	15	Hadnot Point	264	12	17	7

2/1/1980-2/29/1980	29	Hadnot Point	378	17	24	6
3/1/1980-3/31/1980	31	Hadnot Point	433	20	28	6
4/1/1980-4/30/1980	30	Hadnot Point	273	12	17	8
5/1/1980-5/26/1980	26	Hadnot Point	322	15	21	6
5/30/1987-5/31/1987	2	Hadnot Point	0	0	0	2
6/1/1987-6/30/1987	30	Hadnot Point	0	0	0	2
7/1/1987-7/31/1987	31	Hadnot Point	0	0	0	3
8/1/1987-8/31/1987	31	Hadnot Point	0	0	0	3
9/1/1987-9/30/1987	30	Hadnot Point	0	0	0	3
10/01/1987-10/31/1987	31	Hadnot Point	0	0	0	3
11/1/1987-11/30/1987	30	Hadnot Point	0	0	0	2
12/1/1987-12/31/1987	31	Hadnot Point	0	0	0	2
	1,056		12,365	510	701	168

30. Using this exposure assessment, Mr. Cagiano met or exceeded the levels that I discussed in my prior report on general causation as being hazardous to human health and generally capable of causing cancer, including bladder cancer, in exposed individuals. See in this regard, my prior expert report, and its citations to publications including but not limited to Aschengrau 1993, ATSDR 2018, and Bove 2024b.

31. Subject to the qualifications included in my general causation report for bladder cancer, below are the amounts of the Camp Lejeune water contaminants that have been shown to cause bladder cancer. It is my opinion to a reasonable degree of medical, scientific, and toxicological certainty that any individual with exposure to any one of these chemicals at the level (or higher than the levels) identified below, as likely as not, was at an increased risk of bladder cancer. The exposure quantities, to reiterate, should not be interpreted as floors below which cancer does not occur:

- a. **Cumulative exposure to 27-44 mg of PCE:** 1. Aschengrau A, Ozonoff D, Paulu C, et al. Cancer risk and tetrachloroethylene-contaminated drinking water in Massachusetts. *Arch Environ Health*. 1993;48(5):284-292.
- b. **Cumulative exposure to less than 110 ppb-months of TCE:** Agency for Toxic Substances and Disease Registry (ATSDR). *Morbidity Study of Former Marines, Employees, and Dependents Potentially Exposed to Contaminated Drinking Water at U.S. Marine Corps Base Camp Lejeune*. April 2018.
- c. **Cumulative exposure to less than 36 ppb-months of PCE:** ATSDR, 2018.
- d. **Cumulative exposure to 110 – 11,030 ppb-months of TCE:** ATSDR, 2018.
- e. **Cumulative exposure to 36 - 711 ppb-months of PCE:** ATSDR, 2018.

- f. **Cumulative exposure greater than 11,030 ppb-months of TCE: ATSDR, 2018.**
- g. **Cumulative exposure greater than 711 ppb-months of PCE: ATSDR, 2018.**
- h. **1098 ppb-months of TCE: Bove FJ. Cancer Incidence among Marines and Navy Personnel and Civilian Workers Exposed to Industrial Solvents in Drinking Water at US Marine Corps Base Camp Lejeune: A Cohort Study. Environ Health Perspect 2024b;132;10.**
- i. **45 ppb-months of PCE: Bove 2024b Cancer Incidence Study**
- j. **15 ppb-months of benzene: Bove 2024b Cancer Incidence Study**
- k. **66 ppb-months of vinyl chloride: Bove 2024b Cancer Incidence Study**
- l. **285 ppb-months of TVOC (Tarawa Terrace) or 1,224 ppb-months of TVOC (Hadnot Point): Bove 2024b Cancer Incidence Study**

32. Additionally, Dr. Reynolds calculated estimated Mr. Cagiano's mass ingestion doses as reflected below:

		Chart 1: 1L	Chart 2: ATSDR	Chart 3: Deposition/FM
	Cumulative ug/l-M	Cumulative consumption (total ug= days*concentration per L)	Cumulative consumption (total ug= days*concentration per ATSDR exposure assumptions)	Cumulative consumption (total ug= days*concentration per deposition/FM exposure assumptions)
TCE	12,365	115,100	1,319,000	2,012,342
PCE	510	5,187	54,399	45,738
VC	701	7,219	74,593	113,803
BZ	168	2,237	18,340	27,980

33. Regarding Mr. Cagiano's exposure to PCE, his estimated range of exposure **of 45,738 to 54,399 µg** meets and exceeds the 90th percentile exposure group in Dr. Aschengrau's Cape Cod PCE-contaminated water epidemiology study which showed 27,100 to 44,100 µg cumulative PCE exposure and identified a 303% increase³ for the development of bladder cancer. Her study was

³ Bladder Cancer. 39% increased risk of bladder cancer that was dose-related with 303% increase among 90th percentile of exposure; Adjusted relative risks among ever exposed subjects: 1.39 (95% ci=.067-2.91); Adjusted relative risks among 90th percentile of exposure: 4.03 (95% CL = .65-25.10) (303% increase).

adjusted for confounding factors such as smoking and family history. Of note, the cumulative delivered dose in the Cape Cod study was computed in terms of mass of PCE that entered a given house as a solute in drinking water over a specific amount of time. The water modeling did not attempt to compute the actual delivered dose of PCE received by the individuals under the study. For this reason, the estimated dose to any household member was estimated to be less than the cumulative amount of contaminants delivered to the household. Therefore, any individual household member in the 90th percentile of dose was likely receiving less than 27,100 to 44,100 µg, respectively.

34. Further, in the Aschengrau study, actual water sampling obtained from each town showed the following measurements and means of PCE, which are comparable to that in the Camp Lejeune cohort:

	Mean	Lowest measured	Highest measured	75 th Percentile
Barnstable	ND	ND	ND	ND
Bourne	57 µg/L	ND	540 µg/L	26 µg/L
Falmouth	47 µg/L	ND	75 µg/L	62 µg/L
Sandwich	36 µg/L	ND	92 µg/L	59 µg/L
Mashpee	<i>Not sampled</i>	<i>Not sampled</i>	<i>Not sampled</i>	<i>Not sampled</i>

35. Mr. Cagiano was exposed to an amount that is considered substantial since it is known to be hazardous to human health. This study only addressed the chemical in isolation and does not consider the additive (and perhaps synergistic) effect of combining ingestion of TCE, PCE, VC, and benzene. As I stated in my general causation report, while it is frequently assumed that the toxic effects of solvents are additive, the chemicals may also interact synergistically or antagonistically.” [Bruckner JV. Toxic effects of solvents and vapors. In Casarett and Doull’s Toxicology: The Basic Science of Poisons, 9th Ed., Chapter 24 (Toxic Effects of Solvents and Vapors), p. 2 of 157

36. Based on the above, as well as the totality of my prior reports and reviewed materials, it is my opinion, to a reasonable degree of medical, scientific, and toxicological certainty, that Mr. Cagiano was exposed to the relevant chemicals at Camp Lejeune at levels individually or collectively known to be hazardous to human health, that were capable of causing humans to develop cancer in general and bladder cancer in particular, and that placed Plaintiff Mark Cagiano at an increased risk of developing bladder cancer.

37. When determining whether a person’s exposure to a toxic chemical, mixture, or stew of such chemicals is substantial versus *de minimis* in nature, it is important to consider the amount of the exposure, the duration of the exposure, the frequency of the exposure, and the intensity of the exposure. Here, a review of the available facts and information concerning Mr. Cagiano’s ingestion, inhalation, and dermal exposure to the contaminated water at Camp Lejeune reflects that it constituted a substantial exposure capable of causing bladder cancer consistent with the analysis and conclusions in my general causation report.

38. According to Mr. Cagiano's deposition and declaration testimony, he obtained his drinking water from the fountains in the barracks or, when he worked as a battery motor transportation officer, the motor pool. Cagiano Dep. 81:23-82:1. He drank from a canteen that he believes would hold a quart of water and refilled this canteen more than once throughout the day. Cagiano Dep. 82:5-11. During field training days, Mr. Cagiano drank from water buffaloes. Cagiano Dep. 83:24-84:4. He recalls drinking more water when he had physical training and drinking large quantities of water at Camp Lejeune because of the heat, especially when he trained in the field. Cagiano Declaration para. 5.

39. I have considered and analyzed qualitative and quantitative factors, including a mass ingestion dose, contributing to Mr. Cagiano's ingestion exposure at Camp Lejeune. I opine that Mr. Cagiano was exposed to substantial levels of TCE, PCE, vinyl chloride and benzene via his ingestion of toxic chemicals at Camp Lejeune.

40. In addition to ingestion exposure, Mr. Cagiano also would have had inhalation and dermal exposures to the water contaminants. When absorbed VOCs from inhalation and dermal exposures are considered (see below), Mr. Cagiano would have absorbed a significantly greater amount of the VOCs than from ingestion alone.

41. While at Camp Lejeune, Mr. Cagiano worked as a battery motor transportation officer at the Area 5 motor pool, from July 31, 1976, to November 30, 1976. Cagiano Dep. 39:14-25, 40:12-15. His work included maintenance tasks, such as cleaning vehicles. Cagiano Dep. 40:1-11.

42. Mr. Cagiano would shower daily at his home and would take additional showers on base in the barracks when he had physical training. Cagiano Dep. 79:11-23; Cagiano Declaration para. 7. Scheduled physical training occurred three times a week, but Mr. Cagiano would shower in the barracks more than that because, sometimes, he would engage in physical training independently and then would shower in the barracks on those occasions as well. Cagiano Dep. 81:5-14. On field training days, Mr. Cagiano would sometimes shower if they came back to the base at night. Both times he was at Camp Lejeune, Mr. Cagiano reports that there were two types of showers: one was semi-private and the other was an open shower concept with multiple showers. Cagiano Dep. 80:2-14, 85:15-24. Mr. Cagiano would take hot showers with steam and estimates the time he would spend in those showers at 15 minutes, both at home and in the barracks. Cagiano Dep. 80:2-25, 85:15-86:1, 88:20-89:2. Cagiano Dep. 84:17-21; Cagiano Declaration para. 8.

43. Mr. Cagiano shaved and brushed his teeth at his home in Paradise Point for about 15 minutes every morning. Cagiano Declaration para. 9. He also brushed his teeth for a couple of minutes every night before his shower. Cagiano Declaration para. 9.

44. Mr. Cagiano sometimes ate at the chow hall in the same area as his barracks. Cagiano Dep. 82:14-23.

45. Mr. Cagiano did his laundry at home and at the base laundry facility. Cagiano Dep. 86:18-25, 91:16-92:4. At his home in Paradise Point, Mr. Cagiano would occasionally help with washing the dishes. Cagiano Declaration para. 12. He also washed his car at his home. Cagiano Declaration para. 15.

46. Mr. Cagiano trained at the pool for two different swimming qualifications, each being two days long. Cagiano Declaration para. 13. He spent about 30 to 45 minutes in the water and two to three hours in the pool on each of these days. Cagiano Declaration para. 13.

47. Relevant to his dermal exposure, Mr. Cagiano recalls getting blisters from hikes at Camp Lejeune. Cagiano Declaration para. 14.

48. Mr. Cagiano was exposed to inhalation of VOCs throughout the day in a variety of settings. While it is difficult to quantify all these inhalation exposures, the dose from inhalation routes is - as likely as not - comparable or greater than the dose from the ingestion route. For example, an internal dose via inhalation of TCE during a 10-minute shower is comparable to an internal dose via the ingestion of 2 liters of TCE-contaminated drinking water.⁴ Andelman has estimated that the daily indoor inhalation exposure associated with contaminants originating in tap water may be as much as six times higher than ingestion exposure” [*Journal of the Air and Waste Management Association*, Volume 46, pages 830-837, 1996]. An article by Giardino and Wireman stated that “many scientists have shown that inhaling volatile organic chemicals (VOCs), such as benzene-contaminated water during showering, results in larger lifetime exposures than ingesting or dermally absorbing the VOCs from similarly contaminated water” [*Journal of Hazardous Materials*, Volume 62, pages 35-40, 1998]. McKone conducted a detailed analysis of household exposure to VOCs due to contaminated tap water and concluded that “indoor inhalation exposures attributable to a contaminated tap water can be between 1.5 and 6.0 ... times the exposure attributable to the consumption of 2 L/day tap water by a 70-kg adult” [*Environmental Science and Technology*, Volume 21, pages 1194-1201, 1987]. In fact, the ATSDR also concluded the dose from the inhalation and dermal routes may be as high as the dose from the ingestion route.⁵

49. A Marine in training, such as Mr. Cagiano, under warm weather conditions could drink between 1-2 quarts of water per hour. ATSDR 2014.

50. The end result of the above descriptions of the routes of exposure to TCE, PCE, vinyl chloride, and benzene via ingestion, inhalation, and/or dermal is that Mr. Cagiano was exposed to a substantial amount of known carcinogens at Camp Lejeune through exposure to and absorption of contaminants contained in water through his routine habits, including but not limited to showering/hygiene, eating, military duties and training, working, and recreational activities.

51. Mr. Cagiano was exposed to TCE, PCE, vinyl chloride, and benzene with such daily and/or weekly consistency and intensity, there was likely little to no recovery period from the VOCs in his body throughout his entire duration at Camp Lejeune.

⁴ Weisel CP. and Jo WK. Environ Health Perspect 1996;104:48-51

⁵ 2014 ATSDR

52. For PCE, the ATSDR (2019a) has stated the following: “When tetrachloroethylene is found in water, it can enter your body when you drink or touch the water or when you breathe in steam from the water. Most of the tetrachloroethylene that you breathe in or drink will move from your stomach or lungs into your bloodstream. If you have tetrachloroethylene in your blood, you will breathe most of it out very quickly. A small amount of tetrachloroethylene in your blood may get changed into other chemicals that leave your body in urine. It takes about 3 days for half of the tetrachloroethylene in your body to be eliminated.”

53. For TCE, the ATSDR (2019b) has stated the following: “When trichloroethylene is found in water, it can enter your body when you drink or touch the water or when you breathe in steam from the water. Most of the trichloroethylene that you breathe in or drink will move from your stomach or lungs into your bloodstream. Once in your blood, your liver changes much of the trichloroethylene into other chemicals. When the body absorbs more trichloroethylene than it can break down quickly, some of the trichloroethylene or its breakdown products can be stored in body fat for a brief period. However, once absorption ceases, trichloroethylene and its breakdown products quickly leave the fat. You will quickly breathe out much of the trichloroethylene that reaches your bloodstream; most of the trichloroethylene breakdown products leave your body in the urine within a day.”

54. For VC, the ATSDR (2006) has stated the following: “Most of the vinyl chloride is gone from your body a day after you breathe or swallow it.”

55. For benzene, the ATSDR (2007) has stated the following: “When you are exposed to benzene in food or drink, most of the benzene you take in by mouth passes through the lining of your gastrointestinal tract and enters your bloodstream. Once in the bloodstream, benzene travels throughout your body and can be temporarily stored in the bone marrow and fat. Benzene is converted to products, called metabolites, in the liver and bone marrow. Some of the harmful effects of benzene exposure are caused by these metabolites. Most of the metabolites of benzene leave the body in the urine within 48 hours after exposure.”

56. Considering all four VOCs would stay absorbed into the body at a minimum of 24 hours, this duration of exposure for the Plaintiff was substantial considering there was never a period of time while on base in which the VOCs and their metabolites would not have been coming into contact with his body. The VOCs will be absorbed in the body with the constant daily (perhaps hourly) chronic exposure to the VOCs.

57. Under the circumstances, it was more likely than not that Mr. Cagiano was chronically exposed to the VOCs the entire time he was at Camp Lejeune. In Mr. Cagiano’s case, the duration of exposure would be 1,056 days of chronic exposure to the VOCs in his body. This was a substantial duration to be exposed to known carcinogens.

58. In conclusion, my opinion is that Mr. Cagiano was exposed to levels of carcinogens that are known to be hazardous to human health, including bladder cancer, and as a result developed an increased risk of developing bladder cancer. Mr. Cagiano was exposed to a substantial amount of contaminants during his time at Camp Lejeune that are carcinogens, and his exposure

to the chemical contaminants was at levels that can generally cause cancer, including bladder cancer.

59. Based on the foregoing, and for the reasons stated above, it is my opinion to a reasonable degree of medical, scientific, and toxicological certainty that the exposures to the chemical contaminants that Mr. Cagiano had at the base went well above normal background levels of exposure, and that such cumulative exposure from the chemicals was at a substantial level that is generally capable of causing the development of cancer and of bladder cancer. These exposures were significant and were not minimal or insignificant.

60. The opinions I have reached are based on my review of the evidence of exposure in this case, the medical and scientific literature cited herein concerning chemical characteristics, science, exposure and disease, available epidemiologic, toxicological and other studies and science, and my knowledge, skill, experience and training as a physician, toxicologist and expert who has worked with chemical exposures and diseases for many years. All statements made herein are made with a reasonable degree of medical, scientific, and toxicological certainty.

DATED: February 7, 2025
Corrected: June 11, 2025

A handwritten signature in black ink, consisting of several fluid, overlapping strokes that form a stylized representation of the name 'Steven Bird'.

Steven Bird, M.D.