Exhibit 338

EXPERT REPORT OF STEVEN BIRD, MD
WITH REGARD TO TRACK ONE PLAINTIFF EDWARD RAYMOND

Dated: February 7, 2025

OUTLINE OF TOPICS

I. SUMMARY

1. I was asked to review the case of Edward Raymond and evaluate the available facts and information with regard to Mr. Raymond'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, cites to, or will be appropriately accompanied by: (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 four 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. Raymond was diagnosed with bladder cancer. It is my opinion that, based on a review of his exposure history and circumstances at Camp Lejeune, Mr. Raymond'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 University of

[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. Raymond's personal medical history and other factors, Mr. Raymond's chemical exposures at Camp Lejeune were as likely as not substantial factors in causing his bladder cancer. I have not sought to review Mr. Raymond's medical records.

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 deposition and declaration testimony;
b. Plaintiff's Exposure Profile;
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 as well as the practices 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.
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 use. According to a 1982 Utilities and Management Plan, the AC could only run when temperatures exceeded 85 degrees Fahrenheit.

b. Inhalation exposures at mess halls.

i. The amount of water used daily within the mess halls was significant. The Marine Corps estimated that the mess halls utilized 116,000 gallons of water per day. Contemporaneous reports and requests from the U.S. Marine Corps acknowledge the inadequate ventilation of steam within the mess halls. Historical documents show the lack of a ventilation hood on mess hall dishwashers until approximately 1986 or 1987. Dr. Longley noted HVAC issues and poor ventilation in the mess hall, which would provide a setting to increase the quantity of inhalation exposure. Settings in which there was VOC inhalation exposure included but were not limited to:

1. Eating in mess halls where steam tables with pans of hot water were used to keep food warm;
2. Cooking with water in mess hall kitchens; and
3. Using large dishwashers in mess hall kitchens.

c. 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/or 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, and sleeping in their homes and quarters.

V. ANALYSIS AND OPINIONS IN THE CASE OF EDWARD RAYMOND

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, Edward Raymond was born on [redacted] 1945. He was 5'10" and weighed approximately 165 pounds when he entered the United States Marine Corps.

24. The available information indicates that Mr. Raymond primarily resided and worked at Hadnot Point throughout the dates of November 22, 1963, to December 1, 1965. 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, Mr. Raymond was exposed to contaminated water for approximately 662 days during this time period of 1963 to 1965.

25. Notably, Mr. Raymond completed infantry training at Camp Lejeune and recalls the training was on base and that they lived in barracks-style housing. Raymond Dep. 83:16-84:6. He was then assigned to the 8th Comm Battalion for his remaining two years at Camp Lejeune.

26. Mr. Raymond worked as a Radio Telegraph Operator (MOS 2533). During his time as a radio operator, he would maintain equipment and participate in training and field operations. Raymond Dep. 94:11-22. He lived in the Mainside Barracks at Hadnot Point, and he ate most of his meals at the nearby mess hall. 95:22-96:20.

27. I have reviewed ATSDR historical reconstruction modeling estimating certain monthly average contaminant levels in the water distribution systems affecting the Mr. Raymond, 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)	*Trans*-1,2-dichloroethylene (1,2,-tDCE)	Vinyl chloride (VC)	Benzene
263	Nov. 1963	0	24	0	0	1
264	Dec. 1963	0	21	0	0	1
265	Jan. 1964	0	22	0	0	1
266	Feb. 1964	0	21	0	0	0
267	Mar. 1964	0	18	0	0	0
268	Apr. 1964	0	25	0	0	1
269	May 1964	0	21	0	0	1
270	June 1964	0	20	0	0	0
271	July 1964	0	21	0	0	0
272	Aug. 1964	0	25	0	0	1
273	Sept. 1964	0	22	0	0	1
274	Oct. 1964	0	24	0	0	1
275	Nov. 1964	0	25	0	0	1
276	Dec. 1964	0	23	0	0	1
277	Jan. 1965	0	22	0	0	1
278	Feb. 1965	0	23	0	0	1
279	Mar. 1965	0	19	0	0	0
280	Apr. 1965	0	26	0	0	1
281	May 1965	0	21	0	0	1
282	June 1965	0	21	0	0	1
283	July 1965	0	21	0	0	1
284	Aug. 1965	0	25	0	0	1
285	Sept. 1965	0	22	0	0	1
286	Oct. 1965	0	23	0	0	1
287	Nov. 1965	0	23	0	0	1
288	Dec. 1965	0	21	0	0	1

28. I have further reviewed the exposure assessment of Mr. Raymond 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/Residential)	TCE (ug/l-M)	PCE (ug/l-M)	VC (ug/l-M)	BZ (ug/l-M)
11/22/1963-11/30/1963	9	Hadnot Point	24	0	0	1
12/1/1963-12/31/1963	31	Hadnot Point	21	0	0	1
1/1/1964-1/31/1964	31	Hadnot Point	22	0	0	1
2/1/1964-2/29/1964	29	Hadnot Point	21	0	0	0
3/1/1964-3/31/1964	31	Hadnot Point	18	0	0	0
4/1/1964-4/30/1964	30	Hadnot Point	25	0	0	1
5/1/1964-5/31/1964	31	Hadnot Point	21	0	0	1
6/1/1964-6/30/1964	30	Hadnot Point	20	0	0	0
7/1/1964-7/31/1964	31	Hadnot Point	21	0	0	0
8/1/1964-8/31/1964	31	Hadnot Point	25	0	0	1
9/1/1964-9/30/1964	30	Hadnot Point	22	0	0	1
10/1/1964-10/4/1964	4	Hadnot Point	24	0	0	1
11/25/1964-11/30/1964	6	Hadnot Point	25	0	0	1
12/1/1964-12/17/1964; 12/28/1964-12/31/1964	21	Hadnot Point	23	0	0	1
1/1/1965-1/31/1965	31	Hadnot Point	22	0	0	1
2/1/1965-2/28/1965	28	Hadnot Point	23	0	0	1
3/1/1965-3/12/1965; 3/31/1965	13	Hadnot Point	19	0	0	0
4/1/1965-4/30/1965	30	Hadnot Point	26	0	0	1
5/1/1965-5/31/1965	31	Hadnot Point	21	0	0	1
6/1/1965-6/30/1965	30	Hadnot Point	21	0	0	1
7/1/1965-7/31/1965	31	Hadnot Point	21	0	0	1
8/1/1965-8/31/1965	31	Hadnot Point	25	0	0	1
9/1/1965-9/30/1965	30	Hadnot Point	22	0	0	1
10/1/1965-10/31/1965	31	Hadnot Point	23	0	0	1
11/1/1965-11/30/1965	30	Hadnot Point	23	0	0	1
12/1/1965	1	Hadnot Point	21	0	0	1
	662		**579**	**0**	**0**	**21**

29. Using this exposure assessment, Mr. Raymond 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 general causation expert report and its citations to publications, including but not limited to ATSDR 2018 and Bove 2024b.

30. 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 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. **1-6 quarters stationed on base as a service member from 1975 to 1985**: 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.

31. Additionally, Dr. Reynolds estimated Mr. Raymond's cumulative ingestion as follows:

Summed variable totals					
	Chart 1: 1L	**Chart 2: ATSDR marine in training (4.334 L consumption per day)**	**Chart 3: ATSDR Civilian worker RME (3.092 L consumption per day)**	**Chart 4: ATSDR Civilian worker CTE (1.227 L consumption per day)**	**Chart 5: Days on base and cumulative contaminant exposure concentrations FM 1957-1983**

moderate day averages

	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 ATSDR exposure assumptions)	Cumulative consumption (total ug= days*concentration per deposition/FM exposure assumptions)	Cumulative consumption (total ug= days*concentration per deposition/FM exposure assumptions)
TCE	579	14,676	63,606	45,378	18,007	97,239
PCE	-	-	-	-	-	-
VC	-	-	-	-	-	-
BZ	21	528	2,288	1,633	648	3,498

32. Dr. Reynolds calculated an estimated mass ingestion dose of TCE and benzene delivered to Mr. Raymond at Camp Lejeune ranging from **18,007 to 97,239 µg of TCE** and **648 to 3,498 µg of benzene.**

33. 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. Raymond was exposed to the relevant chemicals at Camp Lejeune at levels individually or collectively known to be hazardous to human health that were generally capable of causing humans to develop cancer in general and bladder cancer in particular and that placed Plaintiff Edward Raymond at an increased risk of developing bladder cancer.

34. 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. Raymond'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.

35. As additional biographical information, according to Mr. Raymond's deposition and declaration testimony, he drank at least one canteen of water a day, sometimes two, and he would also drink from the water fountains and from a cooler in the mess hall. Raymond Dep. 111:12-112:8; 109:10-24. He would fill his canteen from the water buffaloes on Mainside. *Id.* 110:5-23. He drank more water in the summer while training. Raymond Declaration para. 5.

36. In addition to ingestion exposure, Mr. Raymond also would have had inhalation and dermal exposures to the water contaminants.

37. Mr. Raymond lived in the Mainside barracks at Hadnot, and he ate most of his meals at the nearby mess hall. Raymond Dep. 95:22-96:20. He spent about an hour in the mess hall eating each meal. Raymond Declaration para. 15.

38. Mr. Raymond testified that he showered at least once a day for approximately 15 minutes. Raymond Dep. 108:15-22. He showered a second time three days a week. Raymond Declaration para. 7. He remembers that everyone showered at the same time in the gang showers in his barracks and the water would run continuously for approximately an hour during the mornings and evenings while the Marines would shower. Raymond Declaration para. 6, 10. In the mornings, Mr. Raymond spent about 30 minutes in the bathroom on his personal hygiene routine after his shower and while other Marines were still showering. Raymond Declaration para. 9. They kept the door closed and the room would accumulate steam. Raymond Declaration para. 11.

39. Mr. Raymond also occasionally was able to take showers when he did overnight training in the field because he stayed in tent cities and took 15-minute hot showers every second day. Raymond Declaration para. 12.

40. Mr. Raymond took his laundry on base to a cleaner and engaged in what the Marines term "field day" or a weekly deep cleaning of the bathroom and barracks that Mr. Raymond recalls taking about three hours each week. Raymond Declaration para. 13, 14. He also used water to clean his equipment. Raymond Declaration para. 17.

41. Mr. Raymond went to the hospital and the dentist and cleaned his car on base. Raymond Declaration para. 16, 17.

42. Mr. Raymond 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 two liters of TCE-contaminated drinking water.[3] 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.[4]

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

[4] 2014 ATSDR - Bove FJ, Ruckart PZ, Maslia M, Larson TC. Evaluation of mortality among marines and navy personnel exposed to contaminated drinking water at USMC base Camp Lejeune: a retrospective cohort study. Environ Health. 2014 Feb 19;13(1):10. doi: 10.1186/1476-069X-13-10. PMID: 24552493; PMCID: PMC3943370.

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

44. The end result of the above descriptions of the routes of exposure to TCE and benzene via ingestion, inhalation, and/or dermal is that Mr. Raymond 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.

45. Mr. Raymond was exposed to TCE 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.

46. For TCE, the ATSDR (2019b)[5] 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."

47. For benzene, the ATSDR (2007)[6] 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."

48. Considering TCE and benzene remain absorbed in the body for a minimum of 24 hours, this duration of exposure for Mr. Raymond was substantial. Mr. Raymond was chronically (perhaps hourly) exposed to the VOCs. Furthermore, the urothelial cells line the bladder, which is the storage vessel until the toxins are excreted through the urine. As a result, there was likely never a recovery period of non-exposure of TCE and Benzene to the urothelial cells of his bladder throughout his approximately **662 days** at Camp Lejeune.

49. Under the circumstances, it was more likely than not that Mr. Raymond was chronically exposed to the VOCs the entire time he was at Camp Lejeune. In Mr. Raymond's case, the duration of exposure would be **662 days** of chronic exposure to the VOCs in his body. This was a substantial duration to be exposed to known carcinogens.

[5] June 2019 ATSDR Public Health Statement for Trichloroethylene at pg. 2-3.
[6] August 2007, ATSDR Toxicological Profile for Benzene at pg. 4.

50. In conclusion, my opinion is that Mr. Raymond 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. Raymond 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.

51. Based on the foregoing, and for the reasons stated above, it is my opinion to a reasonable degree of medical, scientific, and toxicologial certainty that the exposures to the chemical contaminants that Mr. Raymond 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 capable of causing the development of cancer and of bladder cancer. These exposures were significant and were not minimal or insignificant.

52. 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

Steven Bird, M.D.