Exhibit 332

EXPERT REPORT OF STEVEN BIRD, MD
WITH REGARD TO TRACK ONE PLAINTIFF MIKE CRISWELL

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

OUTLINE OF TOPICS

I. SUMMARY

1. I was asked to review the case of Mike Criswell and evaluate the available facts and information regarding Mr. Criswell'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 regarding 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 appropriately 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. Criswell received a diagnosis for bladder cancer. It is my opinion that, based on a review of his exposure history and circumstances at Camp Lejeune, Mr. Criswell'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 four 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. Criswell's personal medical history and other factors, Mr. Criswell'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. Criswell'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 RESIDING IN FAMILY HOUSING

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 the procedures, 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 typically from contaminated water;
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 determined to be 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 to stop 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 family housing.

i. According to historical materials, Camp Lejeune consists of 15 different housing areas, with families living in housing an average of two years.[2] During the 1970s and 1980s, family housing areas were served by three water-distribution systems, all of which used groundwater as the source for drinking water—Hadnot Point, Tarawa Terrace, and Holcomb Boulevard.

ii. Individuals who resided in family housing used water in all of the ways that constituted the necessities of life, to include bathing, showering, hygiene involving sinks and water, flushing, cooking, laundering, cleaning, and other water uses inside the home. The schematics cited by the historian depict small bathroom/shower square footage, with no windows, which can increase inhalation exposure due to lack of ventilation.

iii. Documents cited by Mr. Longley show alleged health problems related to mildew and inadequate ventilation in the Tarawa Terrace neighborhood.

iv. A newspaper article from 1990, showing long-existing ventilation issues in the housing units, noted that many of the Tarawa Terrace residents were getting various ailments from the poor housing conditions in which they lived. "An industrial hygienist who spoke on condition of anonymity said some of the problems in the housing units appear to be what he termed 'sick building syndrome.' He said this condition exists when there is not enough fresh air coming into the house to dispel the carbon dioxide. 'Houses have to breathe,' he said. The hygienist also added that any water damage will foster the growth of mildew and molds and 'you never get rid of it.'"

[2] *See* ATSDR, Report of the Camp Lejeune Water-Modeling Expert Panel, Sec. 1.1, October 2005 (noting that "families live in base housing for an average of 2 years"), https://stacks.cdc.gov/view/cdc/134077 (last visited 11/26/24).

c. *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 ventilation hoods on the 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.

d. *Inhalation exposures throughout military duties*
    i. VOC inhalation exposure settings that existed in the course and scope of military duties included but were 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 MIKE CRISWELL

22. Based upon the documents and information provided, I note the following exposure history: Jefferson Michael Criswell ("Mike") was born on June 16th, 1955. He was 5'8" and weighed approximately 170 pounds when he was at Camp Lejeune.

23. According to his Exposure Profile and other information as per the reliance list to be forthcoming, Mr. Criswell was exposed to water at Camp Lejeune from approximately January 4, 1975, through April 1, 1977, for a period of approximately 804 days at Hadnot Point and approximately 612 residential days at Tarawa Terrace.

24. After recruit training at Parris Island, Mr. Criswell joined for duty at Camp Lejeune as a Field Artillery Battery Man (0811) on 1/4/1975. 1482_CRISWELL_VBA_0000003543.

25. Mr. Criswell lived with his wife at the time, Mary Ellen Cleveland, while he was stationed at Camp Lejeune. Criswell Dep. 72:11-13. For approximately the first six months at Camp Lejeune, while the pair were awaiting base housing, they stayed at Camp Geiger trailer park with his wife's uncle. Criswell Dep. 71:4-25. On July 31, 1975, Mr. Criswell and his wife moved to Tarawa Terrace, and resided there until his release from active duty. CLJA_Housing-0000148899. He showered in the barracks and in assigned family housing, as is stated in more detail below.

26. Mr. Criswell's primary assignment on base was 2nd 155mm Howitzer Battery, 2nd Field Artillery Group. 01482_CIRSWELL_VBA_0000003543. His main duty location was a facility nicknamed the "gun park" which was located on the Mainside of Camp Lejeune; he typically spent five days a week, Monday through Friday, at the gun park. Criswell Dep. 118:5-8.

27. I have reviewed ATSDR historical reconstruction modeling estimating certain monthly average contaminant levels in the water distribution systems affecting the Plaintiff, including Hadnot Point and Tarawa Terrace. In that regard, below are cropped excerpts 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);[3] and Simulated Concentration of Tetrachloroethylene (PCE) in Finished Water at the Water Treatment Plant, Tarawa Terrace, U.S. Marine Corps Base Camp Lejeune, North Carolina:[4]

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
397	Jan. 1975	4	179	109	7	3
398	Feb. 1975	6	252	155	11	3
399	Mar. 1975	6	261	159	11	2
400	Apr. 1975	4	174	99	7	3
401	May 1975	5	211	124	9	3
402	June 1975	7	260	151	11	2
403	July 1975	8	294	168	13	3
404	Aug. 1975	10	368	205	16	3
405	Sept. 1975	8	285	156	12	3
406	Oct. 1975	1	61	28	2	3
407	Nov. 1975	14	503	274	23	3
408	Dec. 1975	13	451	240	20	3
409	Jan. 1976	7	227	116	10	3
410	Feb. 1976	10	317	164	14	3
411	Mar. 1976	10	323	166	15	2
412	Apr. 1976	6	212	104	9	4
413	May 1976	8	257	130	12	3
414	June 1976	10	314	158	15	3
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

[3] https://www.atsdr.cdc.gov/camp-lejeune/media/pdfs/2024/10/chapter_A_hadnotpoint_1.pdf
[4] https://www.atsdr.cdc.gov/camp-lejeune/media/pdfs/AppI5.pdf

Appendix A2. Simulated tetrachloroethylene and its degradation by-products in finished water, Tarawa Terrace water treatment plant, January 1951–March 1987[1].—Continued

[PCE, tetrachloroethylene; µg/L, microgram per liter; 1,2-tDCE, *trans*-1,2-dichloroethylene; TCE, trichloroethylene; VC, vinyl chloride; WTP, water treatment plant]

Stress-period	Month and year	Single specie using MT3DMS model[2]	Multispecies, multiphase using TechFlowMP model[3]			
		[4]PCE, in µg/L	[5]PCE, in µg/L	[5]1,2-tDCE, in µg/L	[5]TCE, in µg/L	[5]VC, in µg/L
295	July 1975	62.05	44.45	5.28	1.77	2.78
296	Aug 1975	62.25	44.52	5.31	1.78	2.81
297	Sept 1975	62.46	44.57	5.34	1.78	2.83
298	Oct 1975	62.69	44.62	5.36	1.78	2.85
299	Nov 1975	62.92	44.69	5.39	1.78	2.87
300	Dec 1975	63.18	44.74	5.41	1.78	2.89
301	Jan 1976	73.96	51.53	6.24	2.06	3.34
302	Feb 1976	74.94	53.43	6.62	2.15	3.60
303	Mar 1976	75.97	54.44	6.80	2.20	3.72
304	Apr 1976	76.97	55.38	6.99	2.24	3.85
305	May 1976	78.00	56.21	7.16	2.28	3.98
306	June 1976	79.02	57.07	7.34	2.32	4.10
307	July 1976	80.07	57.86	7.51	2.35	4.22
308	Aug 1976	81.13	58.73	7.69	2.39	4.34
309	Sept 1976	82.17	59.58	7.86	2.43	4.46
310	Oct 1976	83.25	60.41	8.02	2.46	4.57
311	Nov 1976	84.31	61.28	8.19	2.50	4.68
312	Dec 1976	85.41	62.10	8.35	2.53	4.79
313	Jan 1977	86.61	62.97	8.52	2.57	4.89
314	Feb 1977	87.70	63.98	8.71	2.62	5.01
315	Mar 1977	88.91	64.81	8.86	2.65	5.11

28. 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:

Tarawa Terrace

Exposure Dates	Total Days	Residential Location	TCE (ug/l-M)	PCE (ug/l-M)(TechFlowMP Model)	PCE (ug/l-M)(MT3DMS Model)	VC (ug/l-M)	BZ (ug/l-M)
7/29/1975-7/31/1975	3	Tarawa Terrace	1.77	44.45	62.05	2.78	0
8/1/1975-8/31/1975	31	Tarawa Terrace	1.78	44.52	62.25	2.81	0
9/1/1975-9/30/1975	30	Tarawa Terrace	1.78	44.57	62.46	2.83	0
10/1/1975-10/31/1975	31	Tarawa Terrace	1.78	44.62	62.69	2.85	0
11/1/1975-11/30/1975	30	Tarawa Terrace	1.78	44.69	62.92	2.87	0
12/1/1975-12/31/1975	31	Tarawa Terrace	1.78	44.74	63.18	2.89	0
1/1/1976-1/31/1976	31	Tarawa Terrace	2.06	51.53	73.96	3.34	0
2/1/1976-2/29/1976	29	Tarawa Terrace	2.15	53.43	74.94	3.6	0
3/1/1976-3/31/1976	31	Tarawa Terrace	2.20	54.44	75.97	3.72	0
4/1/1976-4/30/1976	30	Tarawa Terrace	2.24	55.38	76.97	3.85	0
5/1/1976-5/31/1976	31	Tarawa Terrace	2.28	56.21	78.00	3.98	0
6/1/1976-6/30/1976	30	Tarawa Terrace	2.32	57.07	79.02	4.1	0
7/1/1976-7/31/1976	31	Tarawa Terrace	2.35	57.86	80.07	4.22	0
8/1/1976-8/31/1976	31	Tarawa Terrace	2.39	58.73	81.13	4.34	0

9/1/1976-9/15/1976	15	Tarawa Terrace	2.43	59.58	82.17	4.46	0
9/16/1976-9/30/1976	15	Tarawa Terrace	2.43	59.58	82.17	4.46	0
10/1/1976-10/31/1976	31	Tarawa Terrace	2.46	60.41	83.25	4.57	0
11/1/1976-11/30/1976	30	Tarawa Terrace	2.50	61.28	84.31	4.68	0
12/1/1976-12/31/1976	31	Tarawa Terrace	2.53	62.10	85.41	4.79	0
1/1/1977-1/31/1977	31	Tarawa Terrace	2.57	62.97	86.61	4.89	0
2/1/1977-2/28/1977	28	Tarawa Terrace	2.62	63.98	87.70	5.01	0
3/1/1977-3/31/1977	31	Tarawa Terrace	2.65	64.81	88.91	5.11	0
4/1/1977	1	Tarawa Terrace	2.70	65.83	90.10	5.22	0
	612		**46**	**1,147**	**1,594**	**82**	**-**

*Red dates consider leave time exposure due to his residential location.

Hadnot Point

Exposure Dates	Total Days	Exposure Location (Work)	TCE (ug/l-M)	PCE (ug/l-M)	VC (ug/l-M)	BZ (ug/l-M)
1/4/1975-1/31/1975	28	Hadnot Point	179	4	7	3
2/1/1975-2/28/1975	28	Hadnot Point	252	6	11	3
3/1/1975-3/31/1975	31	Hadnot Point	261	6	11	2
4/1/1975-4/30/1975	30	Hadnot Point	174	4	7	3
5/1/1975-5/31/1975	31	Hadnot Point	211	5	9	3
6/1/1975-6/30/1975	30	Hadnot Point	260	7	11	2
7/1/1975-7/28/1975	28	Hadnot Point	294	8	13	3
7/29/1975-7/31/1975	3	Hadnot Point	294	8	13	3
8/1/1975-8/31/1975	31	Hadnot Point	368	10	16	3
9/1/1975-9/30/1975	30	Hadnot Point	285	8	12	3
10/1/1975-10/31/1975	31	Hadnot Point	61	1	2	3
11/1/1975-11/30/1975	30	Hadnot Point	503	14	23	3
12/1/1975-12/31/1975	31	Hadnot Point	451	13	20	3
1/1/1976-1/31/1976	31	Hadnot Point	227	7	10	3
2/1/1976-2/29/1976	29	Hadnot Point	317	10	14	3
3/1/1976-3/31/1976	31	Hadnot Point	323	10	15	2
4/1/1976-4/30/1976	30	Hadnot Point	212	6	9	4
5/1/1976-5/31/1976	31	Hadnot Point	257	8	12	3

6/1/1976-6/30/1976	30	Hadnot Point	314	10	15	3
7/1/1976-7/31/1976	31	Hadnot Point	348	12	16	3
8/1/1976-8/31/1976	31	Hadnot Point	436	15	20	4
9/1/1976-9/15/1976	0	Hadnot Point	336	11	16	3
9/16/1976-9/30/1976	15	Hadnot Point	336	11	16	3
10/1/1976-10/31/1976	31	Hadnot Point	70	2	3	3
11/1/1976-11/30/1976	30	Hadnot Point	543	19	26	4
12/1/1976-12/31/1976	31	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
3/1/1977-3/31/1977	31	Hadnot Point	342	13	17	2
4/1/1977	1	Hadnot Point	218	8	11	4
	804		**8,357**	**258**	**380**	**85**

29. Using this exposure assessment, Mr. Criswell met or exceeded the levels that I discussed in my prior report on general causation report 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 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, 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

31. Additionally, Dr. Reynolds calculated Mr. Criswell's cumulative ingestion as follows:

		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)**
Hadnot Point				
TCE	8,357	86,022	345,628	534,241
PCE	258	2,640	23,337	34,466
VC	380	3,897	34,441	50,865
BZ	85	858	7,581	11,196
Terawa Terrace				

TCE	46	911	3,905	6,036
PCE (TechFlowMP Model)	1,147	22,510	96,472	149,118
PCE (MT3DMS Model)	1,594	31,267	134,002	207,128
VC	82	1,610	6,899	10,663
BZ	-	-	-	-
Totals HP & TT				
TCE	8,403	86,933	349,534	540,278
PCE (TechFlowMP Model)	1,405	25,151	119,809	183,584
PCE (MT3DMS Model)	1,852	33,908	157,339	241,594
VC	462	5,507	41,339	61,528
BZ	85	858	7,581	11,196

32. Mr. Criswell was exposed to an amount of VOC exposure that is considered substantial since it is known to be hazardous to human health. Moreover, this only addresses chemicals 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].

33. Regarding Mr. Criswell's cumulative ingestion exposure to PCE, his range of exposure of **119.809 to 183.584 mg** is in exceedance of the 90th percentile exposure group in Dr. Aschengrau's Cape Cod PCE-contaminated water epidemiology study which showed 27.1 to 44.1 mg of cumulative PCE exposure and identified a 303% increase[5] for the development of bladder cancer. Her study was 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:

[5] 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% cl=.067-2.91); Adjusted relative risks among 90th percentile of exposure: 4.03 (95% CL = .65-25.10) (303% increase).

	Mean	Lowest measured	Highest measured	75th 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	*Not sampled*	*Not sampled*	*Not sampled*	*Not sampled*

35. Mr. Criswell 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. Criswell 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 Mike Criswell 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. Criswell'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. Criswell's deposition and declaration testimony, he recalls drinking "a lot of water" in the morning to stay hydrated while exercising. Criswell Dep. 321:20-25. Mr. Criswell had physical training every morning at 6:30 until he began working with the military police. Criswell Declaration para. 15. He would fill his canteen using the water buffaloes. Criswell Dep. 117:19-118:4. He also drank water from the tap at his home in Tarawa Terrace. Id. 322:18-25.

39. I have considered and analyzed qualitative and quantitative factors, including a mass ingestion dose, contributing to Mr. Criswell's ingestion exposure at Camp Lejeune. I opine that Mr. Criswell 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. Criswell also would have had inhalation and dermal exposures to the water contaminants.

41. At his residence in Tarawa Terrace, Mr. Criswell used tap water for cooking and bathing. Id. 322:18-25. He showered at home and in the barracks in different barracks styles, one of them being a gang-style shower. Criswell Declaration para. 5. Mr. Criswell showered every day for about 15 to 20 minutes at his home in Tarawa Terrace. Criswell Dep. 326:7-10; Criswell Declaration para. 6-7. He also showered in the barracks five days a week, except for when he was working driving a truck on base. Criswell Declaration para. 6. He would spend 30 minutes in the bathroom during these barracks showers, 15 minutes in the actual shower, and about five minutes each in the lavatory area, shaving, and brushing his teeth. Criswell Declaration para. 7. When he showered in the gang showers, the water would run for about 30 to 45 minutes, continuously, as the Marines showered. Criswell Declaration para. 8.

42. Mr. Criswell also helped with things such as bathing his daughter a few times a week and doing laundry once a week at his Tarawa Terrace home. Criswell Declaration para. 8, 10. He pressed his uniforms at home, mopped the floors for about 20 minutes once a week, cleaned the bathroom for 20 to 30 minutes once a week, and handwashed dishes approximately every other night. Criswell Declaration para. 10-11.

43. He also cleaned the barracks bathrooms, at times with a toothbrush, and participated in "field days," or deep cleaning days. Criswell Declaration para. 11.

44. Mr. Criswell cleaned his truck at the Motor Pool every time he drove it and his howitzer at the gun park for about 30 minutes a day. Criswell Declaration para. 12, 16. Additionally, he deep cleaned the howitzer about twice a month for up to half of the day. Criswell Declaration para. 16.

45. Mr. Criswell ate both breakfast and lunch at the mess hall on base for 20 to 30 minutes each. Criswell Declaration para. 13.

46. Relevant to his dermal exposure, Mr. Criswell had frequent blisters because of the fact that he and the other Marines ran about three to five miles a day. Criswell Declaration para. 14.

47. Mr. Criswell 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.[6] 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

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

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.[7]

48. A Marine in training, such as Mr. Criswell, could drink between one and two quarts of water per hour under warm weather conditions. ATSDR 2014.

49. 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. Criswell 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.

50. Mr. Criswell 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.

51. 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."

52. 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."

53. 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."

[7] 2014 ATSDR

54. 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."

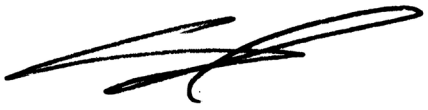
55. Considering all four VOCs would stay absorbed in the body for a minimum of 24 hours, this duration of exposure for the Plaintiff was substantial considering there was never a period of time while on base in which the VOCs and their metabolites were not coming into contact with his body. The VOCs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

56. Under the circumstances, it was more likely than not that Mr. Criswell was chronically exposed to the VOCs the entire time he was at Camp Lejeune. In Mr. Criswell's case, the duration of exposure would be **804 days** of chronic exposure to the VOCs in his body. This was a substantial duration to be exposed to known carcinogens.

57. In conclusion, my opinion is that Mr. Criswell 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. Criswell 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.

58. 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. Criswell 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.

59. 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

Steven Bird, M.D.