Exhibit 86

December 8, 2024

J.J. Snidow, Esq.
Keller Postman LLC
150 N Riverside Plaza, Suite 4100
Chicago, IL 60606

RE: *Camp Lejeune Water Contamination Litigation: Kidney cancer outcome*

Dear Mr. Snidow,

I am in receipt of your correspondence and materials regarding the above-named litigation. It is my understanding that this action relates to 5 bellwether plaintiffs who allege that they developed kidney cancer due to their exposure to contaminated drinking water for not less than 30 days between August 1, 1953, and December 31, 1987, at United States Marine Corps Base Camp Lejeune in North Carolina. The chemical contaminants in the water included the volatile organic compounds trichloroethylene, tetrachloroethylene, vinyl chloride, and benzene. The chemical contaminants existed at significant levels in the water. For example, the maximum reconstructed concentrations of these hazardous chemicals in Camp Lejeune water during 1983 were 156.6, 36, 33.5, and 2.4 times the maximum contaminant level allowed in drinking water by the United States Environmental Protection Agency, respectively.

My report in this matter concerns the results of my review and analysis of scientific evidence regarding the human health effects associated with exposure to the aforementioned volatile organic compounds, and specifically, the evidence for a general causal relationship between exposure to these chemicals at the levels found at Camp Lejeune and the subsequent risk of kidney cancer among the exposed.

My opinions in this matter pertain to the field of forensic medicine and forensic epidemiology. Forensic medicine refers to the intersection of medicine and law. Epidemiology is defined as the scientific study of disease and injury in populations, including prevalence, risk, and incidence in specific populations. Inferential conclusions regarding the prevalence, incidence, risk, and causation of disease must be based on the proper interpretation of epidemiologic study and the proper application of epidemiologic methods. The scientific field that dictates how probabilities may be inferred from epidemiologic data and methods and how the inferences can be applied to individuals or groups of individuals in a legal setting is forensic epidemiology, a discipline from within the field of forensic medicine. Forensic epidemiology provides the scientific basis for the evaluation of individual

causation, to the extent that probability or likelihood of causation may be evaluated. The methods applied in this report are consistent with those outlined in the Reference Guide on Epidemiology, from the Reference Manual on Scientific Evidence, published by the Federal Judicial Center and the National Academies of Science (3rd Edition, 2011), as well as in the text Forensic Epidemiology: Principles and Practice, published by Elsevier (2016). All of my opinions in this matter are given to a reasonable degree of medical and scientific certainty.

My qualifications to perform the analysis and render the opinions described herein are as follows:
I am Professor and Chair of Forensic and Legal Medicine with the Faculty of Forensic and Legal Medicine of the Royal College of Physicians (London, UK), and a consultant in the fields of forensic medicine and forensic epidemiology. I hold qualification as a member of the Faculty of Forensic and Legal Medicine (FFLM) of the Royal College of Physicians (UK). I hold the following relevant academic degrees and certifications: a doctor of medicine degree (Med.Dr.) from Umeå University, a doctor of philosophy (Ph.D.) in public health/ epidemiology from Oregon State University, a master of public health (MPH) in epidemiology and biostatistics, also from Oregon State University, and a master's degree in forensic medical sciences (MScFMS) with the Academy of Forensic Medical Sciences in the United Kingdom, *i.a.* In addition to my degreed education, I have completed a 2-year post-doctoral fellowship in forensic pathology at Umeå University in Sweden and hold a Diploma of Legal Medicine (DLM) with the FFLM. I am a fellow of the American Academy of Forensic Sciences, the Academy of Forensic Medical Sciences, and the American College of Epidemiology. I am also a Fulbright Fellow and held a 3-year roster appointment (2017-20) with the United States Department of State as a Fulbright Specialist in the field of forensic medicine.

I serve as tenured Associate Professor of Forensic Medicine and Epidemiology at Maastricht University, and a joint Clinical Professor of Psychiatry and Public Health and Preventative Medicine at Oregon Health and Science University School of Medicine, where I have taught courses for the past >20 years in forensic medicine, forensic epidemiology, and injury epidemiology. From 2005-2017 I held an appointment as an Adjunct Professor of Forensic Medicine and Epidemiology at the Institute of Forensic Medicine, Faculty of Health Sciences, Aarhus University, Aarhus, Denmark, and am a recent (2020-2021) visiting professor at University of Indonesia in the Faculty of Medicine.

I am the Editor in Chief of the Journal of Forensic and Legal Medicine (Elsevier), serve or have served as an associate editor or editorial board member of an additional 14 scientific peer-reviewed journals, and have published approximately 230 scientific papers, abstracts, book chapters and books, including the text for Elsevier, Forensic Epidemiology: Principles and Practice (2016). My scientific publications have been cited by other authors of peer-reviewed publications more than 5,000 times.

I have provided testimony in more than 450 civil and criminal trials in state and Federal courts throughout the United States, Canada, Australia, and Europe. Please see my CV for further details.

Documents reviewed:

In forming my opinions in this matter, I reviewed the literature and articles cited in this report as well as following documents supplied to me by your office:

- 2024.08.07 CL Water Lit [270] TRACK 1 PRETRIAL SCHEDULE ORDER (23-00897).pdf
- CLJ Letter to Freeman.odt
- Appendix to CLJ Letter.pdf

Report table of contents:

Relevant background facts pertaining to drinking water contamination at Camp Lejeune

In 1941, the United States Congress authorized over 14 million dollars for the construction of a military base that would become Marine Corps Base Camp Lejeune.[1] Today Camp Lejeune is the largest Marine Corps base in the United States and occupies 244-square miles on the Atlantic coast near the City of Jacksonville, North Carolina. The base includes training schools for infantry, engineers, service support, and medical support, as well as a Naval Hospital and Naval Dental Center.[2] Camp Lejeune has 9 family housing areas, and families live in base housing for an average of 2 years. Additionally, schools, day care centers, and administrative offices are located on the base. As of 2007, approximately 54,000 people were living and/or working at Camp Lejeune, including about 43,000 active-duty personnel and 11,000 military dependents and civilian employees. Camp Lejeune and the surrounding community are home to a population of nearly 150,000 people.[1]

Camp Lejeune water system and water contamination

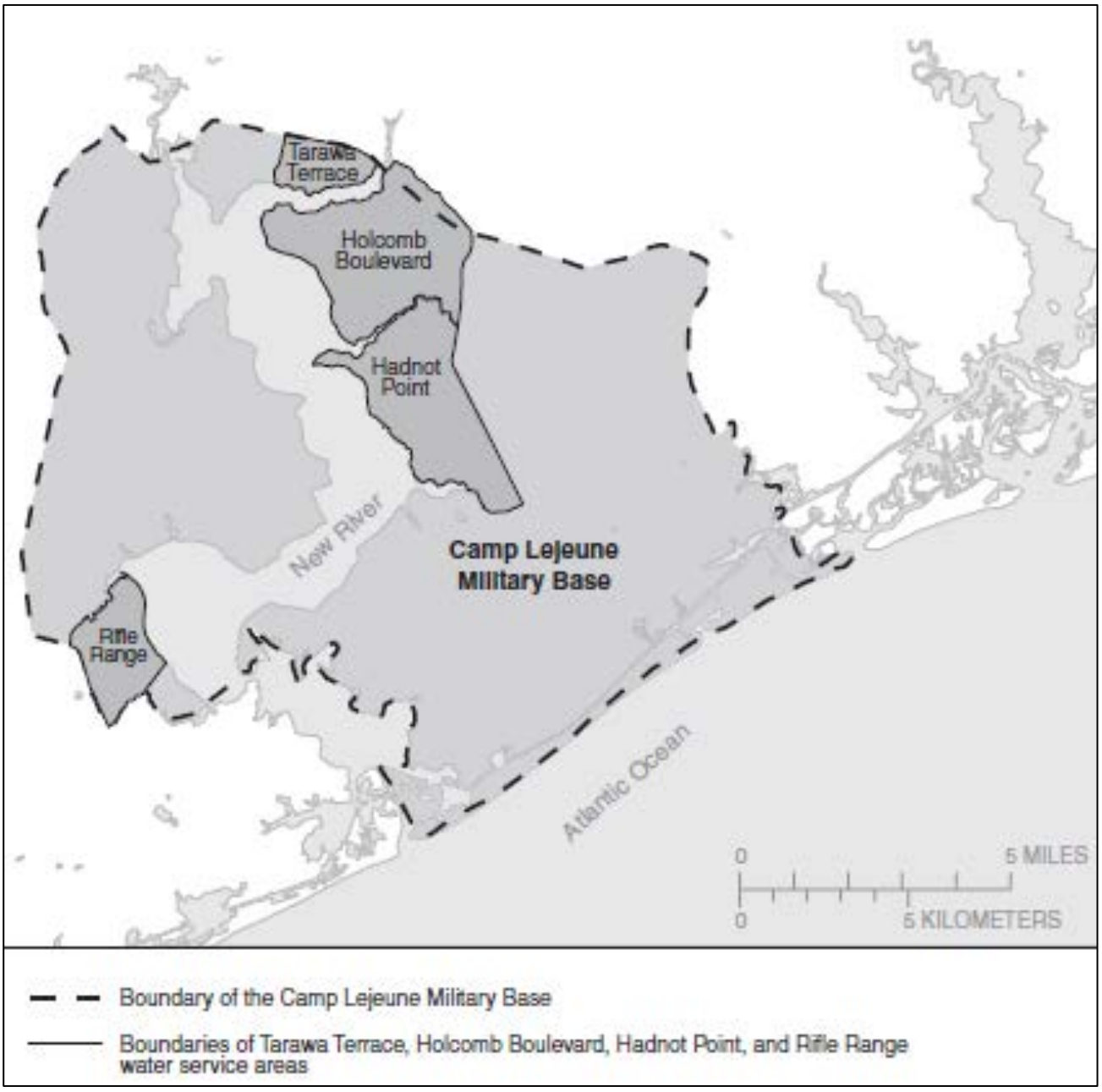
In the 1980s, the Camp Lejeune military base obtained its drinking water from as many as 8 water systems, which were fed by more than 100 individual wells that pumped water from a freshwater aquifer located approximately 180 feet below the ground.[2] Each of Camp Lejeune's water systems included wells, a water treatment plant, reservoirs, elevated storage tanks, and distribution lines to provide the treated water to the system's respective service areas. Drinking water at Camp Lejeune was created by combining and treating groundwater from multiple individual wells that were rotated on and off, so that not all wells provided water to the system at any given time. Water was treated to remove minerals and particles and to protect against microbial contamination. After treatment, water was considered "finished" drinking water.

From the 1970s through 1987, Hadnot Point, Tarawa Terrace, Holcomb Boulevard, and Rifle Range water systems provided drinking water to most of Camp Lejeune's housing areas (*Figure 1*).[2] The water treatment plants for the Hadnot Point and Tarawa Terrace water systems were constructed during the 1940s and 1950s. The Rifle Range water system was constructed in 1965. The water treatment plant for the Holcomb Boulevard water system began operating at Camp Lejeune in 1972; prior to that time, the Hadnot Point water system provided water to the Holcomb Boulevard service area. In the 1980s, each of these 4 systems had between 4 and 35 wells that could provide water to their respective service areas. In 1987, the Tarawa Terrace water treatment plant was shut down and the Holcomb Boulevard water distribution system was expanded to include the Tarawa Terrace water service area.

[1] US Marine Corps. Camp Lejeune History. https://www.lejeune.marines.mil/visitors/history.aspx

[2] US Government Accountability Office, Defense Health Care Activities Related to past Drinking Water Contamination at Marine Corps Base Camp Lejeune: Report to Congressional Committees, GAO-07-276, SuDoc. GA 1.13:GAO-07-276 (Washington, DC: US GAO, 2007). https://www.gao.gov/assets/gao-07-276.pdf

Figure 1. Selected Water Service Areas at Camp Lejeune Serving Base Housing from the 1970s through 1987.



In 1980, the Department of the Navy established the Navy Assessment and Control of Installation Pollutants (NACIP) program to identify, assess, and control environmental contamination from past hazardous material storage, transfer, processing, and disposal operations. Under the NACIP program, initial assessment studies were conducted to determine the potential for environmental contamination at Navy and Marines Corps bases.

Efforts to assess drinking water at Camp Lejeune for contaminants began in the 1980s, when the Navy initiated water testing at the camp. In 1980, one water test identified the presence of volatile organic compounds (VOCs) and a separate test indicated contamination by unidentified chemicals. From October 1980 to September 1981, 8 samples were collected from the Hadnot Point water system and analyzed for total trihalomethanes (TTHMs), contaminants that are a byproduct of the water treatment process. Results from 4 of the 8 samples indicated the presence of unidentified chemicals that were interfering with the TTHM analyses. Reports for each of the 4 analyses contained an Army laboratory official's handwritten notes about the unidentified chemicals: 2 of the notes classified the water as "*highly contaminated*" and notes for the other 2 analyses recommended analyzing the water for organic compounds.

In 1982, water monitoring for TTHMs led to the identification of trichloroethylene (TCE) and tetrachloroethylene (PCE) as contaminants in the Hadnot Point and Tarawa Terrace water systems at Camp Lejeune. Sampling results indicated that the levels of TCE and PCE varied but were up to 280 and 20.8 times greater than the maximum contaminant level (MCL) allowed in drinking water (5 parts per billion), respectively.

Table 1. Sampling Results from Hadnot Point and Tarawa Terrace Water System for May 1982 and July 1982.

		Concentrations of chemicals in parts per billion (ppb)	
Housing area	*Samples*	*TCE (MCL, 5 ppb)*	*PCE (MCL, 5 ppb)*
May 1982 samples			
Hadnot Point	1	1400	15
Tarawa Terrace	2	Not reported	80
July 1982 samples			
Hadnot Point	3	19	<1
	4	21	<1
	5	No data	1
Tarawa Terrace	6	Not reported	76
	7	Not reported	82
	8	Not reported	104

Former Camp Lejeune environmental officials said they did not take additional steps to address the contamination after TCE and PCE were identified at that time.

In July 1984, the Naval Assessment and Control of Installation Pollutants Confirmation Study tested water from 40 Camp Lejeune wells and 10 were contaminated. Eight wells at Hadnot Point and 2 at

Tarawa tested positive for both TCE and PCE, and all wells at Hadnot Point had levels of benzene. The highest level of benzene contamination was 720 ppb at Hadnot Point well HP-602 on December 10, 1984, 144 times greater than the MCL allowed in drinking water (5 parts per billion).[3]

Camp Lejeune officials removed the 10 contaminated wells from service in 1984 and 1985. However, the wells were used intermittently through 1987 to supplement low water levels. By 1987, the contaminated wells at Hadnot Point and Tarawa Terrace were permanently closed.[4]

In 1988 the Department of the Navy issued a formal request for the Agency for Toxic Substances and Disease Registry (ATSDR) to perform a public health assessment (PHA) at Camp Lejeune and in 1989 the base was designated as a Superfund Site under the Comprehensive Environmental Response, Compensation, and Liability Act. Based on the limited information available at the time, ATSDR's 1997 public health assessment (PHA) cited past exposures to chemicals at Camp Lejeune as a public health hazard.[5] The 1997 report came to be regarded as deficient and was later unpublished by the agency.

In 2007 and 2013, Maslia and coworkers at ATSDR reported results from historical reconstruction of the contamination associated with the Tarawa Terrace and Hadnot Point systems, respectively, using ground water fate and transport and distribution system models.

Monthly average estimates of contaminant concentrations in each system were computed and reported in peer-reviewed agency reports.[3,6,7] *Table 2* shows the maximum reconstructed concentrations (MRC) of contaminant VOCs in finished drinking water from Hadnot Point and Tarawa Terrace Water Systems during 1983 and 1984, relative to the MCL allowed in drinking water. These

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[3] Maslia ML, et al. 2013. 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. https://www.atsdr.cdc.gov/sites/lejeune/docs/chapter_A_hadnotpoint.pdf

[4] Beckley-Jackson L. "Don't Drink the Water" The Camp Lejeune Water Contamination Incident. DttP. 2016;44(4):4-9. https://journals.ala.org/index.php/dttp/article/view/6223/8097

[5] US Agency for Toxic Substances and Disease Registry, Federal Facilities Assessment Branch, Division of Health Assessment and Consultation, Public Health Assessment for U.S. Marine Corps Camp Lejeune Military Reservation Camp Lejeune, Onslow County, North Carolina, NC6 170022580 (Atlanta, GA: Agency for Toxic Substances and Disease Registry, 1997).

[6] US Agency for Toxic Substances and Disease Registry, ATSDR's Current Health Study at Marine Corps Base Camp Lejeune, NC Use of Water-modeling Methods: ATSDR's Current Health Study at Marine Corps Base Camp Lejeune, NC Use of Water-modeling Methods, by Morris L. Maslia, SuDoc. HE 20.502:L 53/3 (Wilmington, DE: ATSDR, 2007).

[7] Maslia ML, et al. Analyses of Groundwater Flow, Contaminant Fate and Transport, and Distribution of Drinking Water at Tarawa Terrace and Vicinity, U.S. Marine Corps Base Camp Lejeune, North Carolina: Historical Reconstruction and Present-Day Conditions—Executive Summary. Atlanta, GA: Agency for Toxic Substances and Disease Registry; 2007. http://www.atsdr.cdc.gov/sites/lejeune/tarawaterrace.html

results demonstrated that people who lived and worked in areas served by the Hadnot Point water system on Camp Lejeune drank water containing TCE at levels exceeding 150 times the MCL allowed in drinking water. Similarly, people served by the Tarawa Terrace system drank water containing 36 times the MCL of PCE. Drinking water from the Hadnot Point system also contained elevated levels of PCE, vinyl chloride, and benzene.

Table 2. Maximum reconstructed concentrations (MRC) of contaminant VOCs (parts per billion) in finished drinking water from Hadnot Point and Tarawa Terrace Water Systems during 1983 and 1984 relative to maximum contaminant levels (MCL) allowed in drinking water.

Chemical	*Current MCL*	*Hadnot Point*		*Tarawa Terrace*	
		MRC	*MRC/MCL*	*MRC*	*MRC/MCL*
trichloroethylene (TCE)	5	783	156.6	1 to 10	0.12 to 2
tetrachloroethylene (PCE)	5	39	7.8	180	36
vinyl chloride (VC)	2	67	33.5		
benzene	5	12	2.4		

In 2017, ATSDR published its final PHA of Camp Lejeune. The "bottom line" of the updated PHA was:[8]

> *"Marines and Naval personnel, residents (including infants and children), and civilian workers were exposed to trichloroethylene (TCE), tetrachloroethylene (PCE), dichloroethylene (DCE), vinyl chloride, benzene, and other contaminants in the drinking water at Camp Lejeune from the 1950s through February 1985. Exposures to these chemicals increase the risks for cancers, birth defects, and other health-related problems."*

The North Carolina Department of Natural Resources and Community Development investigated a suspected off base pollutant of the water supply. Their 1985 report determined that the source of Tarawa Terrace's PCE contamination was from an off-base dry-cleaner. That business had been in operation since 1953, slowly polluting 3 wells in the Tarawa Terrace water supply system.[9]

Later reports determined that TCE seeped into wells located within 100 meters of equipment dumping grounds. In addition, massive fuel leaks into the groundwater from the Hadnot Point Fuel Farm (HPFF) have been implicated as the source of some of the VOC contaminants.[10] The fuel farm was

[8] US Agency for Toxic Substances and Disease Registry, Public Health Assessment for Camp Lejeune drinking water U.S. Marine Corps Camp Lejeune, North Carolina. 2017. https://www.atsdr.cdc.gov/sites/lejeune/2017-PHA.html

[9] Rick Shiver, Summary Report: A Groundwater Investigation to Define the Source(s) of Tetrachloroethylene That Have Contaminated Three Community Water Supply Wells At Tarawa Terrace I Camp Lejeune Marine Corps Marine Base Onslow County, Report no. CLW 004826, North Carolina Department of Natural Resources and Community Development, 1985. http://tftptf.com/images/ShiverReport_TT_Cont_1985.pdf

[10] US Congress, House Committee on Science and Technology, Camp Lejeune Contamination and Compensation, Looking Back, Moving Forward: Hearing before the Subcommittee on Investigations and Oversight, Committee on

constructed in 1941 and was comprised of 14 fuel tanks buried in the ground and one large 600,000-gallon tank located above ground. The fuel farm was within 1,200 feet from potable water well HP–602 which was also constructed in 1941.

The first documented fuel leak at the HPFF occurred in 1979 when an estimated 20,000 to 30,000 gallons of fuel leaked from an underground valve. The following year a condition survey revealed that because of age, failure to clean the tanks, and lack of maintenance, there had been a general condition of corrosion and deterioration of the tanks and connecting pipelines. An engineer recommended replacing the connecting piping, inspection of all the tanks for leaks, and repairing existing leaks. By March of 1983, Navy and Marine Corps officials determined that rehabilitation of the HPFF was not cost effective and in 1985, a recommendation was made to replace the HPFF with a new facility; the fuel farm was finally replaced in 1990.

There are no known records indicating that the Marine Corps made any attempt to remediate the 20,000- to-30,000-gallon 1979 fuel leak between 1980 and 1988. In a correspondence in May 1988, the facilities assistant chief of staff, notified the State of North Carolina that a 15-foot-thick fuel plume was contaminating the groundwater underlying the bulk fuel facility. The base Staff Judge Advocate noted that the fuel farm was losing fuel into groundwater at the rate of 1,500 gallons per month and warned that delays will result in an indefensible waste of money and a continuing threat to human health and the environment.

As many as 1 million military and civilian staff and their families might have been exposed to the contaminated drinking water for more than 30 years from 1950 to 1985.[8]

Notification and legislation

In April 1985, residents served by the Tarawa Terrace water system on Camp Lejeune were notified that 2 wells had been taken offline after the discovery of "*minute (trace) amounts of several organic chemicals*."[2] Beginning in 1999, certain families were alerted to their exposures when they were contacted by ATSDR or its contractors as part of the agency's effort to investigate "*birth defects and childhood cancers in children exposed in utero to VOC-contaminated drinking water*."[4] These notifications were limited to families with children born on base between 1968 and 1985. The Marine Corps eventually embarked on a comprehensive, individualized notification campaign in 2007 after Congress ordered it to do so in the 2007 Defense Authorization Act.[10] The Camp Lejeune Notification Registry, the primary output of this effort, now has over 279,000 registrants from all 50 states.[11]

Science and Technology, House of Representatives, One Hundred Eleventh Congress, Second Session, September 16, 2010, 111th Cong., 2d sess. SuDoc. Y 4.SCI 2:111-108 (Washington: US GPO, 2010). https://www.congress.gov/111/chrg/CHRG-111hhrg58485/CHRG-111hhrg58485.pdf

[11] Camp Lejeune Historic Drinking Water. https://clnr.hqi.usmc.mil/clwater/Home.aspx

A bipartisan coalition of legislators introduced the Camp Lejeune Justice Act of 2021 (CLJA) to provide "*long-overdue judicial relief*" for individuals exposed to contamination at Camp Lejeune.[12] The Act, which was incorporated as section 804 in the Honoring our PACT Act of 2022 included the following key elements:[13]

- Individuals who were exposed to contaminated water at Camp Lejeune are empowered to bring an action in the Eastern District of North Carolina "*to obtain appropriate relief for harm*" caused by their exposure. To qualify under the CLJA, claimants must have lived, worked, or been otherwise exposed to contaminated water for not less than 30 days between August 1, 1953, and December 31, 1987.
- Claimants who do file in court are entitled to a standard of proof lower than the preponderance-of-the-evidence standard typically used in tort cases: they need only show that **"*a causal relationship is at least as likely as not*."**

Characteristics of the major chemical contaminants detected in Camp Lejeune water

Trichloroethylene (TCE) is a colorless, volatile liquid.[14] Liquid TCE evaporates quickly into the air. It is nonflammable and has a sweet odor. The 2 major uses of TCE are as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals, especially the refrigerant, HFC-134a. The time it takes for TCE to break down varies by its location:

- TCE breaks down quickly in air.
- TCE breaks down very slowly in soil and water and is removed mostly through evaporation into the air.
- TCE is expected to remain in groundwater for a long time since it is not able to evaporate.
- TCE does not build up significantly in plants or animals.

TCE is a known carcinogen and is also known to cause other very serious side effects in humans. There is strong evidence that TCE can cause cancer in people. Lifetime exposure to TCE resulted in increased liver cancer in mice and increased kidney cancer and testicular cancer in rats. The Department of Health and Human Services (DHHS) considers TCE to be a known human carcinogen.

[12] Press Release, Senator Thom Tillis, Tillis, Blumenthal, Burr, and Peters Introduce the Camp Lejeune Justice Act to Ensure Legal Rights for Water Contamination Victims (Nov. 4, 2021), https://www.tillis.senate.gov/2021/11/tillis-blumenthal-burr-and-peters-introduce-the-camp-lejeune-justice-act-to-ensure-legal-rights-for-water-contamination-victims

[13] U.S. Congress. H.R.2192 - Camp Lejeune Justice Act of 2021. https://www.congress.gov/bill/117th-congress/house-bill/2192/text

[14] Agency for Toxic Substances and Disease Registry. ToxFAQs™ for Trichloroethylene (TCE). https://www.atsdr.cdc.gov/toxfaqs/tfacts19.pdf

The International Agency for Research on Cancer (IARC) classified TCE as carcinogenic to humans. The EPA has characterized TCE as carcinogenic to humans by all routes of exposure.

The following entities have specifically found a causal relationship between TCE and kidney cancer:

- EPA Toxicological Review of TCE (EPA 2011, p. 4-632):[15] *"...TCE is characterized as carcinogenic to humans by all routes of exposure. This conclusion is based on convincing evidence of a causal association between TCE exposure in humans and kidney cancer. The kidney cancer association cannot be reasonably attributed to chance, bias, or confounding."*
- IARC (IARC 2014, p. 189):[16] *"There is sufficient evidence in humans for the carcinogenicity of trichloroethylene. Trichloroethylene causes cancer of the kidney."*
- National Toxicology Program (NTP) Monograph on TCE (NTP 2015, p. 177-178):[17] *"Epidemiological studies have demonstrated a causal relationship between trichloroethylene exposure and kidney cancer based on consistent evidence of increased risk across studies with different study designs, in different geographical areas, and in different occupational settings; evidence of increasing cancer risk with increasing level or duration of exposure; and statistically significant increased risks of kidney cancer across studies combined in two meta-analyses. Overall, increased risks of kidney cancer were found among individuals with the highest exposure in the most informative studies (i.e., studies with higher levels of exposure to trichloroethylene and better assessments of exposure and disease…." "… biases or confounding by known or suspected occupational co-exposures, smoking, or other lifestyle factors are unlikely to explain the positive findings across studies…" "Toxicokinetic and mechanistic data in both humans and animals provide credible evidence for the biological plausibility of the proposed mechanisms of trichloroethylene's carcinogenicity in humans."*
- Agency for Toxic Substances and Disease Registry concluded that there is "*sufficient evidence for causation for TCE and kidney cancer."*[18]

Exposure to moderate amounts of TCE may cause headaches, dizziness, and sleepiness. Exposure to large amounts may cause coma and even death. Eating or breathing high levels of TCE may damage some of the nerves in the face. Exposure to high levels can also result in changes in the

[15] EPA Toxicological Review of TCE, September 2011. https://iris.epa.gov/static/pdfs/Chapter2_0199tr.pdf
[16] IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol 106. Trichloroethylene, Tetrachloroethylene, and Some Other Chlorinated Agents. Lyon, France 2014. https://publications.iarc.fr/_publications/media/download/6688/c1deb8e919b7f30f2505d2f3b5ab3e79f300d097.pdf
[17] National Toxicology Program (NTP). Report on Carcinogens. Monograph on Trichloroethylene. January 2015. http://ntp.niehs.nih.gov/ntp/roc/monographs/finaltce_508.pdf
[18] Agency for Toxic Substances and Disease Registry. ATSDR Assessment of the Evidence for the Drinking Water Contaminants at Camp Lejeune and Specific Cancers and Other Diseases. January 13, 2017. https://www.atsdr.cdc.gov/camp-lejeune/media/pdfs/2024/10/ATSDR_summary_of_the_evidence_for_causality_TCE_PCE_508.pdf

rhythm of the heartbeat, liver damage, and evidence of kidney damage. Skin contact with concentrated solutions of TCE can cause skin rashes. There is some evidence that exposure to TCE in the workplace may cause scleroderma, an autoimmune disease, in some people. Some men occupationally exposed to TCE, and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

The EPA has set a maximum contaminant level (MCL) goal of 5 micrograms (μg) TCE per liter (5 ppb) as a national primary drinking standard.[19]

In October 2023, the EPA proposed a ban on all uses of TCE.[20] This action, taken under the Toxic Substances Control Act (TSCA), would protect people from TCE-associated health risks by banning the manufacture, processing, and distribution of TCE for all uses. EPA's proposed risk management rule would take effect in 1 year for consumer products and most commercial uses and would implement stringent worker protections on the limited remaining commercial and industrial uses that would be phased down over a longer period.

Tetrachloroethylene (perchloroethylene, PCE) is a nonflammable colorless liquid.[21] It is used as a dry-cleaning agent and metal degreasing solvent. The time it takes for PCE to break down varies by its location:

- PCE breaks down very slowly in the air and so it can be transported long distances in the air. Half of the amount in the air will degrade in approximately 100 days.
- PCE evaporates quickly from water into the air. It is generally slow to break down in water.
- PCE may evaporate quickly from shallow soil or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.
- PCE can break down to TCE, dichloroethylene, vinyl chloride, and ethene.

Studies in humans have shown associations between exposure to PCE and risks of developing kidney cancer, bladder cancer, multiple myeloma, and non-Hodgkin's lymphoma. In animals, PCE has been shown to cause cancers of the liver, kidney, and blood system. The DHHS considers PCE to be reasonably anticipated to be a human carcinogen. EPA considers PCE likely to be carcinogenic to humans by all routes of exposure. IARC considers PCE probably carcinogenic to humans.

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[19] United States Environmental Protection Agency. National Primary Drinking Water Regulations. https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations

[20] EPA. Biden-Harris Administration Proposes Ban on Trichloroethylene to Protect Public from Toxic Chemical Known to Cause Serious Health Risks. https://www.epa.gov/newsreleases/biden-harris-administration-proposes-ban-trichloroethylene-protect-public-toxic

[21] Agency for Toxic Substances and Disease Registry. Tetrachloroethylene – ToxFAQs. https://www.atsdr.cdc.gov/toxfaqs/tfacts18.pdf

Breathing high levels of PCE for a brief period may cause dizziness or drowsiness, headache, and incoordination. Exposure to higher levels may cause unconsciousness and even death. Exposure for longer periods to low levels of PCE may cause changes in mood, memory, attention, reaction time, and vision. Studies in animals exposed to PCE have shown liver and kidney effects, and changes in brain chemistry.

The EPA MCL for the amount of PCE that can be in drinking water is 5 μg per liter of water (5 ppb).[19]

Vinyl chloride (VC) is a colorless gas with a mild, sweet odor.[22] It burns easily, and it is not stable at high temperatures. VC is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, TCE, and PCE are broken down. VC is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

The time it takes for VC to break down varies by its location. Liquid VC evaporates easily. VC in water or soil evaporates rapidly if it is near the surface. VC in the air degrades to other substances within a few days, some of which can be harmful. Small amounts of VC can dissolve in water. VC is unlikely to accumulate in plants or animals that are consumed by people.

Workers highly exposed to VC have developed a specific type of cancer known as angiosarcoma of the liver.[23] DHHS has classified VC as known as a human carcinogen. EPA has classified VC as a known human carcinogen by the inhalation route of exposure and classified it as carcinogenic by the oral route and highly likely to be carcinogenic by the dermal route. IARC determined that VC is carcinogenic to humans.

There have been sound and statistically significant epidemiology studies assessing an increased risk ration for exposure to vinyl chloride and the development of kidney cancer. Further, there is a scientifically reasonable and plausible mechanism of the development of kidney cancer as a result of the exposure to vinyl chloride.

Breathing high levels of VC can cause dizziness or sleepiness. Breathing very high levels can cause loss of consciousness, and breathing extremely high levels can cause death. Some people who have breathed VC for several years have changes in the structure of their livers. People are more likely to

[22] Agency for Toxic Substances and Disease Registry. Vinyl chloride – ToxFAQs. https://www.atsdr.cdc.gov/toxfaqs/tfacts20.pdf

[23] Toxicological Profile for Vinyl Chloride. Atlanta (GA): Agency for Toxic Substances and Disease Registry (US); 2024. Available from: https://www.ncbi.nlm.nih.gov/books/NBK601943/

develop these changes if they breathe high levels of VC. Some people who work with VC have nerve damage and develop alterations in immunity. The lowest levels that produce liver changes, nerve damage, and alterations in immunity in people are not known. Some workers exposed to very high levels of VC have problems with the blood flow in their hands. Not all of the effects of drinking high levels of VC are known at this time. If VC is spilled on skin, it will cause numbness, redness, and blisters. Animal studies have shown that exposure to VC during pregnancy can affect the growth and development of the fetus.

The EPA MCL for the amount of VC that can be in drinking water is 2 μg per liter of water (2 ppb).[19]

Benzene is a colorless liquid with a petroleum-like odor.[24] It evaporates into the air very quickly and dissolves in water. It is highly flammable. Benzene is made naturally in the environment from burning wood and volcanic activity. It is also found in human-made sources like cigarette smoke and motor vehicle exhaust. Benzene is used in industry as a solvent and to make other products such as plastics, nylon resins, detergents, paint removers, and rubber goods. Benzene is especially important for unleaded gasoline because of its anti-knock characteristics.

The time it takes for benzene to break down varies by its location. In the air, benzene breaks down within a few days. It may also be removed from the air by rain or snow and go back to the ground. Benzene quickly evaporates from surface water and soil into the air. Benzene can travel through the soil and can get into groundwater. It is not expected to accumulate in plants or animals.

Medical scientists have concluded that people exposed to benzene for a long period of time can develop bone marrow cancers, including acute myelogenous leukemia. In addition, a recent analysis of scientific literature found an association between exposure to occupational benzene and kidney cancer.[25] Studies in animals show that rats and mice exposed to benzene develop tumors at many sites in their body, and like humans, can develop leukemia. The U.S. DHHS and EPA consider benzene as a known human carcinogen and IARC has classified benzene as carcinogenic to humans.

Breathing in benzene for a long period of time can affect blood cells and bone marrow. Reduced numbers of red blood cells and white blood cells have been seen in workers exposed to benzene. This can lead to anemia and reduce the ability to fight off diseases and infections. These changes

[24] Agency for Toxic Substances and Disease Registry. Benzene – ToxFAQs. https://www.atsdr.cdc.gov/toxfaqs/tfacts3.pdf

[25] Seyyedsalehi MS, et al. Occupational benzene exposure and risk of kidney and bladder cancers: a systematic review and meta-analysis. Eur J Cancer Prev. 2024 Aug 20. doi: 10.1097/CEJ.0000000000000911. Epub ahead of print.

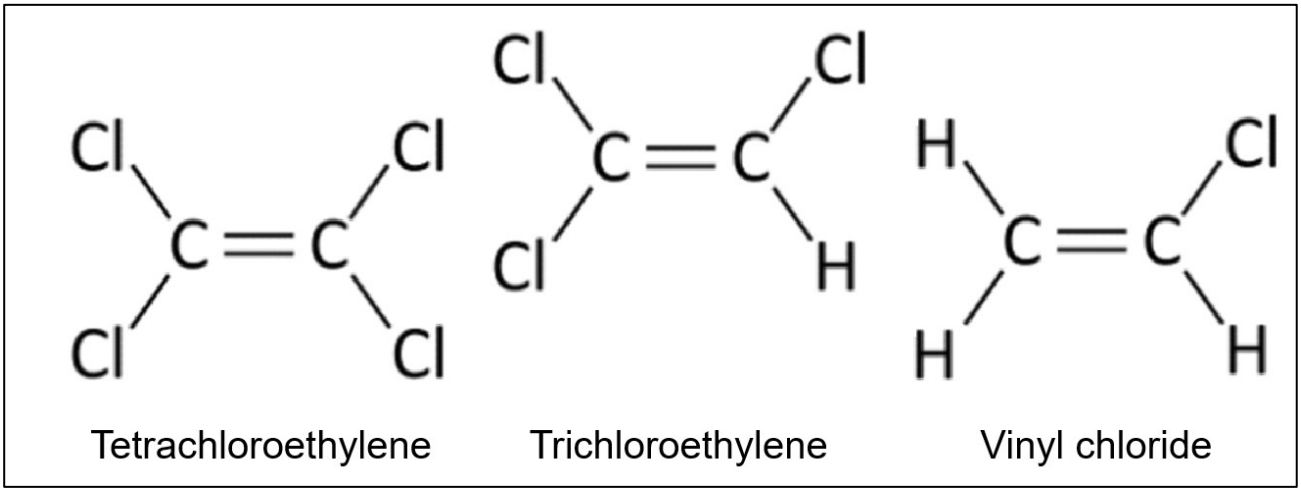
were also seen in animals after breathing in benzene and after eating benzene for a long period of time.

The EPA MCL for the amount of benzene that can be in drinking water is 5 μg per liter of water (5 ppb).[19]

Degradation of the chemical contaminants of Camp Lejeune water

Tetrachloroethylene, trichloroethylene, and vinyl chloride are structurally similar compounds (*Figure 2*), varying only by the number of chlorines (Cl). These chemicals are broken down in groundwater and in the human body to other chemicals called metabolites that are known to mediate both the cancer and noncancer effects associated with the parent compound.[26,27]

Figure 2. Chemical structures of tetrachloroethylene, trichloroethylene, and vinyl chloride.



In the context of groundwater, PCE and TCE can be broken down by microorganisms. The microbial degradation mechanisms are different depending on whether the organism grows in the presence or absence of oxygen (aerobic or anaerobic, respectively).[28] *Figure 3* shows PCE and TCE degradation

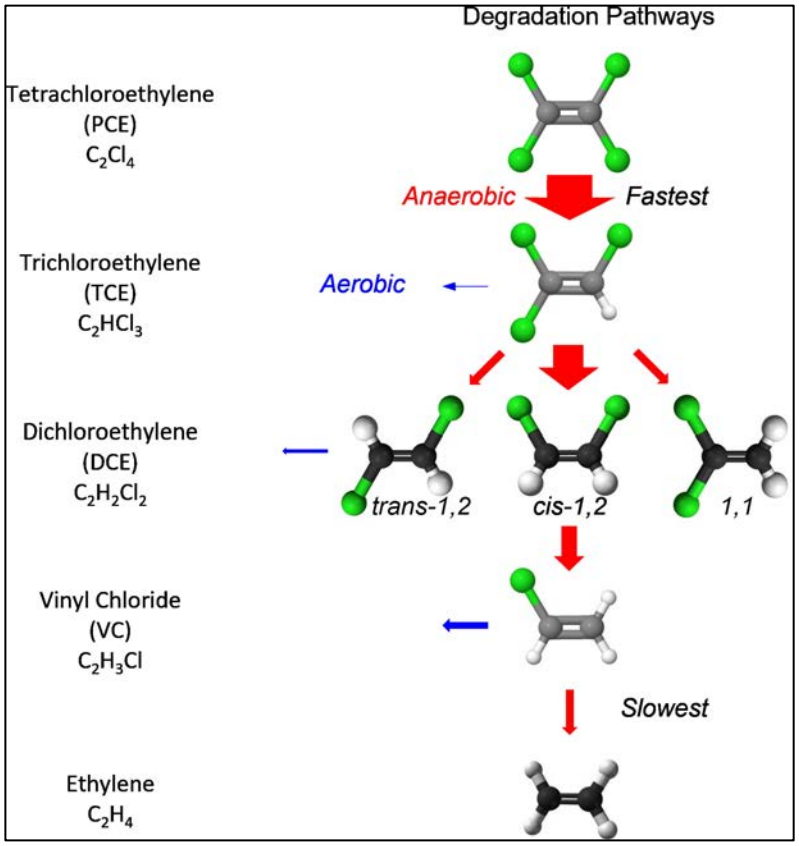
[26] Valdiviezo A, et al. Reanalysis of Trichloroethylene and Tetrachloroethylene Metabolism to Glutathione Conjugates Using Human, Rat, and Mouse Liver in Vitro Models to Improve Precision in Risk Characterization. Environ Health Perspect. 2022;130(11):117009.

[27] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Trichloroethylene, Tetrachloroethylene, and Some Other Chlorinated Agents. Lyon (FR): International Agency for Research on Cancer; 2014. (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, No. 106.)
Available from: https://www.ncbi.nlm.nih.gov/books/NBK294281/

[28] Dolinová I, et al. Microbial degradation of chloroethenes: a review. Environ Sci Pollut Res Int. 2017;24(15):13262-13283.

pathways by microorganisms.[29] Notably, **PCE breaks down to TCE** by the removal of one chlorine (dechlorination) anaerobically and that **vinyl chloride is a breakdown product of both PCE and TCE** after additional dechlorination.

Figure 3. PCE and TCE degradation pathways and relative rates. Red arrows indicate anaerobic degradation, while blue arrows indicate aerobic degradation. The size of the arrows represents the relative reaction rates.



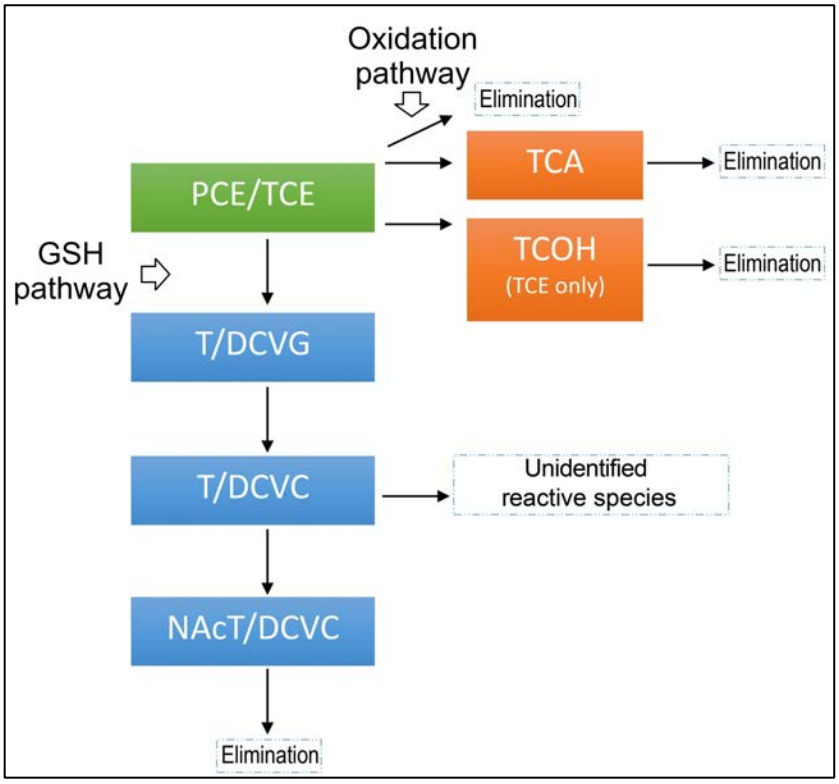
In the human body PCE and TCE are broken down (metabolized) through 2 pathways: oxidation and glutathione (GSH) conjugation (*Figure 4*). The major oxidative metabolites for TCE are trichloroacetic acid (TCA) and trichloroethanol (TCOH). Also, as part of the oxidation pathway, TCE is metabolized by cytochrome P450 system in the liver to a trichloroethylene oxide intermediate that is converted to the molecule chloral.[30] For PCE, only TCA has been consistently detected from oxidation.

[29] Emsbo-Mattingly SD, et al. Integrated differentiation of multiple trichloroethylene and tetrachloroethylene groundwater impacts using spatial concentration, biodegradation indices, chemical fingerprinting and carbon/chlorine isotope patterns. Environmental Forensics. 2022;24(5–6):329-350. https://doi.org/10.1080/15275922.2022.2047832

[30] Lash LH, et al. Metabolism of trichloroethylene. Environ Health Perspect. 2000 May;108 Suppl 2(Suppl 2):177-200.

Major metabolites through GSH conjugation for TCE include DCVG, DCVC, and NAcDCVC. For PCE, GSH metabolites include TCVG, TCVC, and NAcTCVC.[31] Even though the metabolic flux through oxidation predominates for both TCE and PCE, their GSH conjugates are thought to be of critical importance as some of their metabolites formed in kidneys are known to be highly reactive and are genotoxic.

Figure 4. TCE and PCE metabolism via oxidation and GSH pathways. Adapted from Luo et al. 2018.[32]



Benzene

Benzene must be metabolized to become carcinogenic. Its metabolism is summarized in *Figure 5*.[33] The initial metabolic step involves cytochrome P450-dependent oxidation to benzene oxide. Most benzene oxide spontaneously rearranges to phenol, which is either excreted or further metabolized

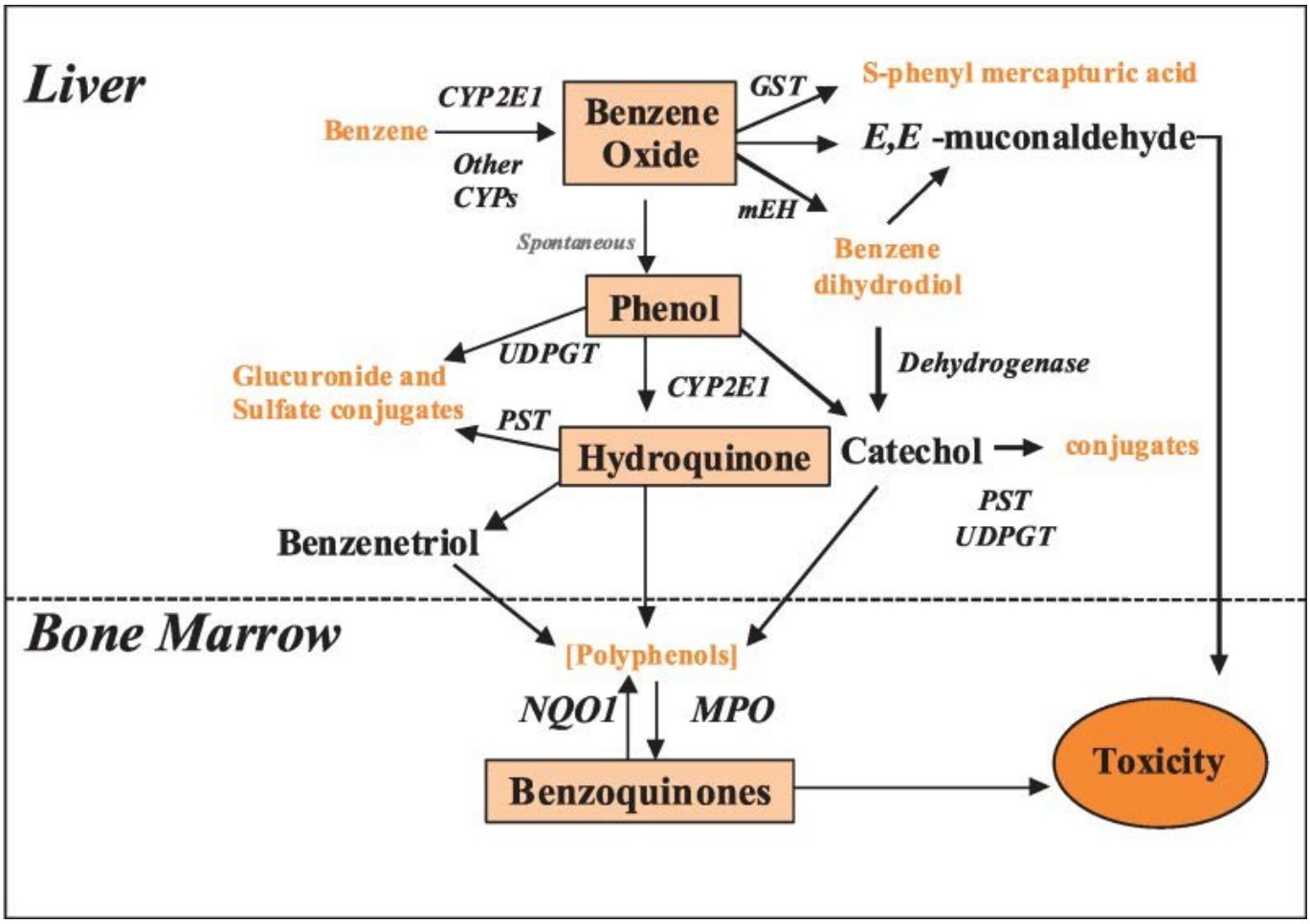
[31] TCE GSH metabolites: S-(1,2-dichlorovinyl)glutathione (DCVG), S-(1,2-dichlorovinyl)-L-cysteine (DCVC), N-acetyl-S-(1,2-dichlorovinyl)-L-cysteine (NAcDCVC).
PCE GSH metabolites: S-(1,2,2-trichlorovinyl)glutathione (TCVG), S-(1,2,2-trichlorovinyl)-L-cysteine (TCVC), and N-acetyl-S-(1,2,2-trichlorovinyl)-L-cysteine (NAcTCVC).

[32] Luo YS, et al. Comparative analysis of metabolism of trichloroethylene and tetrachloroethylene among mouse tissues and strains. Toxicology. 2018;409:33-43.

[33] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Benzene. Lyon (FR): International Agency for Research on Cancer; 2018. (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, No. 120.)

to hydroquinone. Human exposure to benzene at concentrations in air between 0.1 and 10 ppm, results in urinary metabolite profiles with 70–85% phenol, 5–10% of hydroquinone. Benzene oxide and several other benzene metabolites are electrophiles that readily react with peptides, proteins and DNA and can thereby interfere with cellular function. It remains unclear what role these different metabolites play in the carcinogenicity of benzene.

Figure 5. Simplified metabolic scheme for benzene showing major pathways and metabolizing enzymes leading to toxicity. CYP2E1, cytochrome P450 2E1; GST, glutathione-S-transferase; NQO1, NAD(P)H:quinone oxidoreductase 1; MPO, myeloperoxidase; UDPGT, Uridine diphosphate glucoronosyl transferase; PST, phenol sulphotransferase; mEH, microsomal epoxide hydrolase.



Studies that have assessed associations between exposure to drinking water contaminants at Camp Lejeune and adverse health outcomes

In 2007, Congress directed the National Research Council of the National Academies (NRC) and the Department of the Navy to jointly evaluate existing evidence of adverse health effects of prenatal, childhood, and adult exposures to toxic chemicals in the water at Camp Lejeune. The 2009 NRC report concluded that although the existing data could not reliably establish causal relationships between the chemicals present at Camp Lejeune and the medical conditions emerging among exposure victims, there was "*no scientific justification*" for the Navy and Marine Corps' continued delay in "*making decisions about how to follow up on the evident solvent exposures on the base and their possible consequences*."[34]

After publication of the 1997 ATSDR PHA, additional analyses and studies expanded the scientific knowledge about the contaminants in Camp Lejeune's drinking water. Further ATSDR studies of the base found links between:

- *in utero* exposure to TCE and benzene and neural tube defects[35]
- civilian work and military service at Camp Lejeune and risks for kidney cancers, rectum, lung, prostate, leukemias, and multiple myeloma[36,37]
- exposure to PCE, TCE, and benzene and preterm birth and birth weight issues[38]
- exposure to contamination at Camp Lejeune and male breast cancer.[39]

Bove and collaborators recently reported follow-up results of their previous mortality study comparing risk of specific causes of death between Marine Corps bases Camp Lejeune- and Camp Pendleton-based cohorts between 1979 and 2018.[40] The authors emphasized findings as notable when both

[34] National Research Council. Contaminated Water Supplies at Camp Lejeune. Assessing Potential Health Effects. https://nap.nationalacademies.org/catalog/12618/contaminated-water-supplies-at-camp-lejeune-assessing-potential-health-effects

[35] Ruckart PZ, et al. Evaluation of exposure to contaminated drinking water and specific birth defects and childhood cancers at Marine Corps Base Camp Lejeune, North Carolina: a case-control study. Environ Health. 2013;12:104.

[36] Bove FJ, et al. 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;13(1):10.

[37] Bove FJ, et al. Mortality study of civilian employees exposed to contaminated drinking water at USMC Base Camp Lejeune: a retrospective cohort study. Environ Health. 2014;13:68.

[38] Ruckart PZ, et al. Evaluation of contaminated drinking water and preterm birth, small for gestational age, and birth weight at Marine Corps Base Camp Lejeune, North Carolina: a cross-sectional study. Environ Health. 2014;13:99.

[39] Ruckart PZ, et al. Evaluation of contaminated drinking water and male breast cancer at Marine Corps Base Camp Lejeune, North Carolina: a case control study. Environ Health. 2015;14:74.

[40] Bove FJ, et al. Evaluation of mortality among Marines, Navy personnel, and civilian workers exposed to contaminated drinking water at USMC base Camp Lejeune: a cohort study. Environ Health. 2024;23(1):61.

the adjusted hazard ratio (aHR) was at least 1.20 and the ratio of the upper and lower bounds of the confidence interval (CIR) was ≤ 3.

Compared to Camp Pendleton Marines/Navy personnel, Camp Lejeune had elevated risk (aHR ≥ 1.20 and CIR ≤ 3) for cancers of the kidney (aHR, 1.21; 95% confidence interval [CI], 0.95, 1.54), esophagus (aHR, 1.24; 95% CI,1.00, 1.54) and female breast (aHR, 1.20; 95% CI, 0.73, 1.98). In addition, Camp Lejeune military personnel had elevated risk for death due to Parkinson disease, myelodysplastic syndrome and cancers of the testes, cervix and ovary.

The same team of researchers also recently reported the results of their study comparing cancer incidence between Marine Corps bases Camp Lejeune- and Camp Pendleton-based cohorts using individual-level data from US population-based cancer registries.[41] Compared with Camp Pendleton, Camp Lejeune Marines/Navy personnel had aHRs ≥ 1.20 with CIRs ≤ 3 for all myeloid cancers (HR, 1.24; 95% CI, 1.03, 1.49), acute myeloid leukemia (HR, 1.38; 95% CI, 1.03, 1.85), myelodysplastic and myeloproliferative syndromes (HR, 1.68; 95% CI, 1.07, 2.62), polycythemia vera (HR, 1.41; 95% CI, 0.94, 2.11), and cancers of the esophagus (HR, 1.27; 95% CI, 1.03, 1.56), larynx (HR, 1.21; 95% CI, 0.98, 1.50), soft tissue (HR,1.21; 95% CI, 0.92, 1.59), and thyroid (HR, 1.22; 95% CI, 1.03, 1.45).

In 2017, the same year as ATSDR's final Camp Lejeune PHA, ATSDR also reported the results of their assessment of the evidence for associations between the drinking water contaminants at Camp Lejeune and 16 diseases using the classification scheme outlined below.[42] The scheme made clear when the evidence for causality was "*at least as likely as not*" or at the level of "*equipoise and above*." The classification scheme used the following 4 categories:

1. Sufficient*: The evidence is sufficient to conclude that a causal relationship exists.*
2. Equipoise and Above*: The evidence is sufficient to conclude that a causal relationship is at least as likely as not, but not sufficient to conclude that a causal relationship exists.*
3. Below Equipoise*: The evidence is not sufficient to conclude that a causal relationship is at least as likely as not or is not sufficient to make a scientifically informed judgment.*
4. Against*: The evidence suggests the lack of a causal relationship.*

The criteria ATSDR used to define these categories were as follows:

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[41] Bove FJ, et al. 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. 2024;132(10):107008.

[42] Agency for Toxic Substances and Disease Registry. ATSDR Assessment of the Evidence for the Drinking Water Contaminants at Camp Lejeune and Specific Cancers and Other Diseases. January 13, 2017. https://www.atsdr.cdc.gov/camp-lejeune/media/pdfs/2024/10/ATSDR_summary_of_the_evidence_for_causality_TCE_PCE_508.pdf

Sufficient evidence for causation*: the evidence is sufficient to conclude that a causal relationship exists. This category would be met, for example, if:*

1. *There is sufficient evidence from human studies in which chance and biases (including confounding) can be ruled out with reasonable confidence, or*
2. *There is less than sufficient evidence from human studies but sufficient evidence in animal studies and strong evidence that the agent acts through a relevant mechanism in humans.*

Sufficient evidence from human studies can be provided by a meta-analysis and/or by several studies considered to have high utility.

Considerations in assessing the evidence include several of Hill's viewpoints: (1) temporal relationship, (2) consistent positive associations (e.g., ***risk ratio or odds ratio greater than 1.1****), (3) magnitude of the effect estimate (e.g., risk ratio, odds ratio), (4) exposure-response relationship, and (5) biological plausibility (Hill 1965).*

Equipoise and above evidence for causation*: The evidence is sufficient to conclude that a causal relationship is at least as likely as not, but not sufficient to conclude that a causal relationship exists. This category would be met, for example, if:*

1. *The degree of evidence from human studies is less than sufficient but there is supplementary evidence from animal studies and/or mechanistic studies that supports causality, or*
2. *A meta-analysis does not provide convincing evidence (e.g., the summary risk estimate is close to the null value of 1.0, i.e., ≤1.1), or if the meta-analysis observes a non-monotonic exposure-response relationship) but there is at least one epidemiological study considered to be of high utility occurring after the meta-analysis has been conducted, in which an association between the exposure and increased risk of the disease of interest has been found and in which chance and biases can be ruled out with reasonable confidence.*
3. *A meta-analysis has not been conducted, but there is at least one epidemiological study considered to be of high utility in which an association between the exposure and increased risk of the disease of interest has been found and in which chance and biases can be ruled out with reasonable confidence.*

Below Equipoise evidence for causation*: The evidence is not sufficient to conclude that a causal relationship is at least as likely as not or is not sufficient to make a scientifically informed judgment. This is a rather broad category that encompasses:*

- *evidence sufficient to conclude an association exists but where there is some doubt that biases can be ruled out and the animal and mechanistic evidence is weak, or*

- *evidence for an association that is so limited that there is substantial doubt that biases can be ruled out, or*
- *insufficient evidence to determine whether an association exists.*

Evidence against a causal relationship*: The evidence suggests the lack of a causal relationship.*

The use of this classification system is scientifically valid, uses sound methodology, and is consistent with my education, training, and experience over the many years I have been involved with the science of epidemiology.

As described above, the Camp Lejeune Justice Act of 2021 specified that claimants who file in court are entitled to a standard of proof lower than the preponderance-of-the-evidence standard typically used in tort cases and that they need only show that **"*a causal relationship is at least as likely as not*"** corresponding to the ATSDR classification "**Equipoise and above**".

Causation Analysis

Methods for epidemiologic investigation of causation: the Hill Criteria

The scientific basis for general and specific determinations of cause and effect were introduced through the inductive canons of John Stuart Mill [1862] and the rules proposed by the philosopher David Hume [1739]. In the current era, a practical approach to causation was laid out in a systematic fashion by Sir Austin Bradford-Hill in 1965. Hill outlined nine criteria (he called them viewpoints) by which population-based determinations of causation could be made when there is substantial epidemiologic evidence linking a disease or injury with an exposure, *e.g.* smoking and lung cancer. Hill's nine criteria have been universally adopted as a scientific basis for the evaluation of both general and specific causation. As used for evaluating both general and specific causation, the 9 criteria are as follows (*NB* The quoted sections and page numbers are from the 3rd edition of the Reference Manual on Scientific Evidence, a publication from the National Academies and Federal Judicial Center):[43]

1. *Strength of association* - Strength of association is generally considered to be the most important determinant of causation. Most simply stated, a strong association is more likely to indicate a causal relationship than is a weak association. Strength of association is measured by relative risk but can also be measured in general causation by the percentage decrease of an illness or injury in society if the injury cause were to be eliminated. This is also known

[43] https://www.nationalacademies.org/our-work/science-for-judges-development-of-the-third-edition-of-the-reference-manual-on-scientific-evidence

as the *etiologic fraction* that the particular cause contributes to the total societal burden of the disease.

"The higher the relative risk, the greater the likelihood that the relationship between exposure and disease or injury is causal. Assuming that an association is determined to be causal, the strength of the association plays an important role legally in determining the specific causation question—whether the agent caused an ***individual plaintiff's*** *injury"* (p. 602).

Strength of association is quantified by a comparison of the frequency of the injury or disease outcome among a group of individuals exposed to the hazard of interest to the frequency of the same injury or disease outcome in a population that is not exposed to the hazard. This is also known as the "base rate" of the condition. Strength of association can be quantified by relative risk (RR) or attributable risk percent (PC [probability of causation]). A relative risk of >2.0 implies that the exposure of interest caused the condition, and an attributable risk percent of >50% carries the same implication. The determination that an exposure was a "substantial factor in causing" a condition only requires that the exposure not be a trivial factor in causing the condition, and thus does not require a PC of >50%. **The Camp Lejeune Justice Act specified that claimants need only show that "*a causal relationship is at least as likely as not*".** That level corresponds to the ATSDR classification "equipoise and above" for which a relative risk of >1.1 is sufficient.

The formulae for calculating relative risk and attributable risk percent are as follows:

$$\frac{Risk\ of\ injury/disease\ among\ those\ exposed\ to\ hazard}{Base\ rate\ of\ injury/disease\ risk\ among\ unexposed} = RR$$

$$\frac{Risk\ of\ injury\ from\ hazard}{Risk\ of\ injury\ from\ hazard + Base\ rate\ of\ injury\ absent\ hazard} \times 100\% = PC$$

2. *Consistency* - The repetitive observation of a causal relationship in different circumstances strengthens the causal inference. Evidence of consistency can come from multiple studies of varied populations.
3. *Specificity* - In general causation this refers to the degree to which an exposure factor is associated with a particular outcome or population. A high degree of specificity is relatively uncommon, as many exposures can cause various diseases or injuries (*e.g.* cigarette smoking doesn't only cause lung cancer).
4. Temporality - the potential causal factor must precede the outcome it is assumed to affect. Other parameters of Temporality are important beyond sequence, including the latency

between exposure and the first indication of disease or injury. Temporality is an important factor to consider when assessing specific causation.

"When the latency period is known—or is known to be limited to a specific range of time…the time frame from exposure to manifestation of disease or injury can be critical to determining [individual] causation." (p. 601)

"*With regard to specific causation…there may be circumstances in which a temporal relationship supports the existence of a causal relationship. If the latency period between exposure and outcome is known, then exposure consistent with that information may lend credence to a causal relationship. This is particularly true when the latency period is short and competing causes are known and can be ruled out. Thus, if an individual suffers an acute respiratory response shortly after exposure to a suspected agent and other causes of that respiratory problem are known and can be ruled out, the temporal relationship involved supports the conclusion that a causal relationship exists. Similarly, exposure outside a known latency period constitutes evidence, perhaps conclusive evidence, against the existence of causation."* (p. 601)

5. *Biological gradient* - The outcome increases monotonically with increasing dose of exposure (also known as "dose-response"). This criterion may or may not have any relevance to specific causation; it is very important in the assessment of adverse drug reactions.

6. *[Biologic] Plausibility* - The observed association can be plausibly explained by known scientific principles. Hill put little stock in plausibility, asserting that it was a criterion "that I am convinced we cannot demand," as detailed scientific evidence describing an injury mechanism may lag behind observational evidence of a consistently observed causal association.

7. *Coherence* - A causal conclusion should not fundamentally contradict present substantive knowledge – it should "make sense" given current knowledge.

8. *Experiment* - In some cases there may be evidence from randomized experiments on animals or humans. Absence of experimental evidence of an injury or disease mechanism should not be confused with evidence against an investigated causal relationship, however. Most harmful exposures cannot be ethically investigated by experiments on humans.

9. *Analogy* - An analogous exposure and outcome may be translatable to the circumstances of previously unexplored causal investigation.

There is no formula or algorithm that dictates whether a causal inference is reasonable based on the Hill Criteria, as one or more factors may be absent even when a true causal relationship exists, and vice versa.

Overview of kidney cancer

Kidney cancer forms in tissues of the kidneys and includes renal cell carcinoma (RCC) and renal pelvis carcinoma. RCC forms in the lining of very small tubes in the kidney that filter the blood and remove waste products, while renal pelvis carcinoma forms in the center of the kidney where urine collects. RCC accounts for approximately 4% of adult malignancies, including approximately 80 to 85% of primary renal tumors.[44] Transitional cell carcinomas of the renal pelvis involve a type of cell that lines the inside of the renal pelvis and are the next most common forms of kidney cancer (approximately 8%). Other kidney tumors, such as oncocytomas, collecting duct tumors, and renal sarcomas, occur infrequently. Nephroblastoma, also known as Wilms tumor, is a type of kidney cancer that usually develops in children under the age of 5. Renal medullary carcinoma is a rare form of RCC seen in people with sickle cell disease and sickle cell trait.

Transitional cell carcinomas of the renal pelvis or upper tract, also known as urothelial carcinomas, have properties that are different from RCC. Transitional cell cancers in these locations are biologically similar to bladder tumors. Epidemiologic studies have included these cancers with other kidney cancers such as RCC. Epidemiologic investigations that have evaluated kidney cancer with and without inclusion of upper tract transitional cell carcinoma have shown similar risk ratios. Similarly, epidemiologic comparisons between kidney cancer only inclusive of RCC as compared with epidemiology focused more specifically on transitional cell carcinoma in the renal pelvis have found similar risk ratios. It is therefore appropriate to use kidney cancer epidemiology for a causation analysis involving transitional cell carcinoma of the upper tract. Further, TCE, PCE, vinyl chloride, and benzene have all been associated with transitional cell carcinoma.

Most people with RCC do not have obvious symptoms. This means that sometimes RCC is not found until the cancer is advanced. When symptoms do occur, the most common symptoms include blood in the urine, pain in the sides of the mid-back, a palpable mass in the abdomen or side of the back, swelling around the left testicle in men, weight loss, night sweats, and unexplained fever.

[44] Atkins MB, et al. Epidemiology, pathology, and pathogenesis of renal cell carcinoma. UpToDate.com

Epidemiology

In 2021, there were an estimated 646,960 people living with kidney and renal pelvis cancer in the United States.[45] The incidence of kidney cancer varies substantially worldwide, with the highest rates observed in Europe, North America, and Australia and the lowest rates in Asia.[46] Globally, kidney cancer incidence rates increased from the 1970s to the mid-1990s, then plateaued or decreased. Annual incidence rates of RCC in the United States, however, have continued to rise. The estimated number of new cases of kidney and renal pelvis tumors in the U.S. for 2024 is 81,610.[47] The continued upward trend is largely driven by increasing rates of localized disease, whereas rates of regional or metastatic disease have remained relatively stable. The increasing incidence of RCC has been attributed to increased detection as a result of the widespread use of imaging modalities such as computed tomography, ultrasonography, and magnetic resonance imaging.

In the U.S., the incidence of kidney and renal pelvis cancers is lowest among Asian/Pacific Islanders (8.2 per 100,00 [100K]), highest among American Indian/Alaska Natives (33.0/100K), and similar among whites, blacks, and Hispanics (17.6, 19.3, and 17.9/100K, respectively).[47] Incidence is higher in men than women (23.9 vs. 12.1/100K, respectively). One in 43 (2.3%) men and 1 in 73 women develop invasive kidney and renal pelvis cancer during their lifetime.[47] For each sex, the probability developing invasive kidney and renal pelvis cancer varies by age, with the 65 to 84 age group having the highest probability (*Table 3).*.

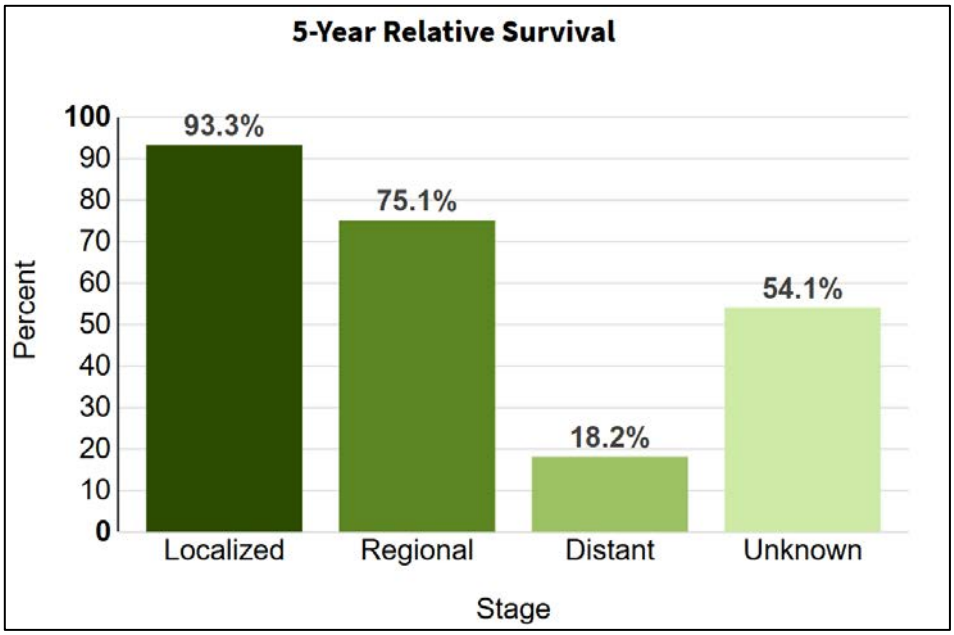
Table 3. Probability (%) of developing invasive kidney and renal pelvis cancer within selected age intervals by sex, United States, 2017–2019.[47]

		Probability, %				
Cancer site	Sex	Birth to 49 years	50–64 years	65–84 years	85 years and older	Birth to death
Kidney & renal pelvis	Male	0.3 (1 in 384)	0.7 (1 in 142)	1.5 (1 in 67)	0.6 (1 in 178)	2.3 (1 in 43)
	Female	0.2 (1 in 603)	0.3 (1 in 287)	0.8 (1 in 126)	0.3 (1 in 303)	1.4 (1 in 73)

The overall 5-year survival rate of patients with kidney cancer is 78.1%, but the earlier kidney and renal pelvis cancer are caught, the better chance a person has of surviving (*Figure 6*).[45]

[45] SEER Stat Fact Sheets: Kidney and Renal Pelvis http://seer.cancer.gov/statfacts/html/kidrp.html
[46] McNamara MA, et al. Ch 79: Cancer of the kidney. In: Niederhuber JE, Armitage JO, Doroshow JH, Kastan MB, Tepper JE, eds. Abeloff's Clinical Oncology. 6th ed. Philadelphia, Pa: Elsevier: 2020.
[47] Siegel RL, et al. Cancer statistics, 2024. CA Cancer J Clin. 2024;74(1):12-49.

Figure 6. Percent of Cases & 5-Year Relative Survival by Stage at Diagnosis: Kidney and Renal Pelvis Cancer



Pathology and pathogenesis

Renal cell carcinoma

RCC is a clinically and pathologically heterogeneous disease.[44] The 2004 World Health Organization classification for renal neoplasms recognized several distinct histologic subtypes of RCC often associated with distinct chromosomal (cytogenetic) features (*Table 4*).[48] These subtypes include clear cell RCC, papillary RCC, chromophobe RCC, hereditary cancer syndromes, multilocular cystic RCC, collecting duct carcinoma, medullary carcinoma, mucinous tubular and spindle cell carcinoma, neuroblastoma-associated RCC, Xp11.2 translocation–TFE3 carcinoma, and unclassified lesions.

[48] Lopez-Beltran A, et al. 2004 WHO classification of the renal tumors of the adults. Eur Urol. 2006;49(5):798–805.

Table 4. Histological Classification of Renal Cell Carcinoma

Histological Tumor Type	**Prevalence (%)**	**Cytogenetic Findings**
Clear cell RCC	70	3p25-26 (von Hippel-Lindau disease)
Papillary RCC	10–15	Trisomy of chromosomes 7 and 17, loss of Y chromosome, 7q34 (c-MET)
Chromophobe RCC	4–6	Loss of multiple chromosomes: 1, 2, 6, 10, 13, 17, 21
Multilocular cystic RCC	<1	Extracellular matrix gene
Collecting duct carcinoma	<1	Loss of multiple chromosomes: 1, 6, 8, 13, 14
Medullary carcinoma	<1	Sickle cell trait
Mucinous tubular and spindle cell carcinoma	<1	
Neuroblastoma-associated RCC	<1	
Xp11.2 translocation–TFE3 carcinoma	1–2	Translocations involving Xp11.2 (TFE3)
Unclassified lesions	4–5	

Clear cell RCC is the most common adult RCC, representing 70% of all RCCs. Clear cell carcinomas arise from the proximal tubule, the segment of the nephron in kidneys that reabsorbs most of the filtered water, sodium, glucose, and other substances. Clear cell RCC typically have a deletion of chromosome 3p. In addition to occurring in sporadic disease, clear cell carcinomas are specifically associated with von Hippel-Lindau disease. When seen with a microscope, the cells that make up clear cell RCC look very pale or clear.

Papillary renal cell carcinomas account for about 1 in 10 RCCs. These cancers often form little finger-like projections called papillae. The cells of these cancers take in certain dyes and look pink when seen with a microscope. Chromophobe RCC accounts for about 5% of RCCs. The cells of these cancers are pale, like the clear cells, but are darker.

Transitional Cell Cancer of the Renal Pelvis (urothelial carcinoma)

Transitional cells are a type of cell that lines the inside of the renal pelvis, ureters, and other organs. These cells are able to stretch when the renal pelvis or bladder is full of urine and shrink when it is emptied. Transitional cell cancer can form in the renal pelvis, the ureters, or both. Transitional cell cancer of the renal pelvis and ureter is caused by certain changes to the way transitional cells in the renal pelvis and ureters function, especially how they grow and divide into new cells. When cancerous cells develop in the renal pelvis or ureter, it's known as renal transitional cell carcinoma, also referred to as urothelial carcinoma or urothelial cancer.

Risk factors

Renal cell carcinoma

Hereditary cases account for about 5% of all cases of RCC.[49] There are several well-described hereditary RCC syndromes including von Hippel-Lindau, hereditary leiomyomatosis and renal cell carcinoma, Birt-Hogg-Dubé, hereditary papillary renal cell carcinoma, tuberous sclerosis, BAP1 tumor predisposition syndrome, hereditary paraganglioma-pheochromocytoma syndromes, MITF predisposition to familial RCC, Cowden syndrome, and hyperparathyroidism jaw tumor syndrome.

Sporadic, non-hereditary cases account for the majority of RCC. Several risk factors have been associated with sporadic RCC including exposure to toxic compounds, smoking, obesity, hypertension, prolonged ingestion of analgesic combinations, cytotoxic chemotherapy, chronic hepatitis C infection, kidney stones, acquired cystic disease of the kidney, and chronic kidney disease.[44]

Cigarette smoking is associated with an increased risk of developing RCC. In a meta-analysis (a study of other studies) that included data from 24 studies, the relative risks for RCC for all smokers, current smokers, and former smokers were 1.31, 1.36, and 1.16, respectively.[50]

Excessive body weight is a risk factor for RCC in both males and females as shown in a prospective analysis of over 300,000 participants in the National Institutes of Health and American Association for Retired Persons Diet and Health Study.[51] The relative risk of RCC increased progressively with baseline body mass index.

Hypertension has been found to predispose RCC development. A meta-analysis of 18 studies found that the history of hypertension was associated with 67% increased risk of kidney cancer and each 10-mmHg increase in SBP and DBP was associated with 10 and 22% increased risk of kidney cancer.[52] The results also suggested that the association was independent of antihypertensive medications or obesity.

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[49] Carlo MI, et al. Familial Kidney Cancer: Implications of New Syndromes and Molecular Insights. Eur Urol. 2019;76(6):754-764.

[50] Cumberbatch MG, et al. The Role of Tobacco Smoke in Bladder and Kidney Carcinogenesis: A Comparison of Exposures and Meta-analysis of Incidence and Mortality Risks. Eur Urol. 2016;70(3):458-66.

[51] Adams KF, et al. Body size and renal cell cancer incidence in a large US cohort study. Am J Epidemiol. 2008;168(3):268-77.

[52] Hidayat K, et al. Blood pressure and kidney cancer risk: meta-analysis of prospective studies. J Hypertens. 2017;35(7):1333-1344.

The prolonged ingestion of analgesic combinations, particularly compounds containing phenacetin (of which acetaminophen is a major metabolite) and aspirin, can lead to chronic renal failure. Such patients are at increased risk for renal pelvic and urothelial tumors.[53]

The use of cytotoxic chemotherapy in childhood for malignancies, autoimmune disorders, or bone marrow transplant conditioning has been associated with the subsequent development of translocation RCC.[54]

An epidemiologic study of over 67,000 patients found that chronic infection with hepatitis C virus was associated with a significantly increased risk of RCC after correcting for age, ethnicity, sex, and the presence of chronic kidney disease (HR, 1.77; 95% CI, 1.05, 2.98).[55]

A history of kidney stones may be associated with both RCC and transitional cell carcinoma of the upper urinary tract. In a meta-analysis that pooled data from almost 63,000 patients with kidney stones, the risk ratio of developing RCC was 1.96 (95% CI, 1.24, 2.49), and the increased risk appeared to be largely limited to males.[56] The risk ratio for transitional cell carcinoma was 2.14 (95% CI, 1.35, 3.40). However, the study was subject to a number of limitations, including recall/reporting bias and the increased frequency of scans in patients with stones.

The risk of developing RCC has been estimated to be up to 30 times greater in dialysis patients with acquired polycystic disease of the kidney than in the general population.[44] Among chronic dialysis patients, the incidence of acquired cystic disease is approximately 35 to 50%, and approximately 6% of these patients eventually developed RCC. Even among patients with chronic kidney disease who are not dialysis dependent, a decreasing estimated glomerular filtration rate has been associated with an increased risk of kidney cancer.

Occupational and environmental exposures to toxic compounds, such as TCE, PCE, VC, benzene, cadmium, asbestos, and petroleum byproducts, has been associated with an increased risk of RCC.[44,57] In an international multicenter study of over 1700 patients with RCCs and 2300 controls, an increased risk of cancer was observed in those exposed to asbestos (RR ,1.4; 95% CI, 1.1, 1.8),

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[53] Cho E, et al. Prospective evaluation of analgesic use and risk of renal cell cancer. Arch Intern Med. 2011 12;171(16):1487-93.
[54] Argani P, et al. Translocation carcinomas of the kidney after chemotherapy in childhood. J Clin Oncol. 2006;24(10):1529-34.
[55] Gordon SC, et al. Risk for renal cell carcinoma in chronic hepatitis C infection. Cancer Epidemiol Biomarkers Prev. 2010;19(4):1066-73.
[56] Cheungpasitporn W, et al. The risk of kidney cancer in patients with kidney stones: a systematic review and meta-analysis. QJM. 2015;108(3):205-12.
[57] Mandel JS, et al. International renal-cell cancer study. IV. Occupation. Int J Cancer. 1995;61(5):601-5.

cadmium (RR, 2.0; 95% CI, 1.0, 3.9), and gasoline (RR, 1.6; 95% CI, 1.2, 2.0).[57] Studies that have described associations between kidney cancer and prior exposures to TCE, PCE, and benzene are discussed below.

Urothelial Cancer

Chemical carcinogenesis is believed to be responsible for much of the burden of urothelial cancer, including the increased risk associated with cigarette smoke as well as various industrial exposures.[58,59] Smoking is the most common risk factor and accounts for approximately half of all urothelial cancers. Occupational and environmental exposures to aromatic amines, polycyclic aromatic hydrocarbons, and chlorinated solvents are other important risk factors. Increasing evidence suggests a significant influence of genetic predisposition on incidence.

Evidence of a relationship between exposure to the volatile organic compounds detected in Camp Lejeune water and kidney cancer

In the following section, studies that have evaluated kidney cancer risk among the people exposed to contaminated drinking water at Camp Lejeune are summarized. Following that discussion, relevant epidemiologic and mechanistic studies that assessed associations between kidney cancer risk and each of the 4 major chemical contaminants found in Camp Lejeune water are presented and evaluated for causality using Hill criteria.

Camp Lejeune Studies

Bove and colleagues at ATSDR are conducting an ongoing cohort study to determine whether the military personnel and civilians that were exposed to contaminated drinking water at Camp Lejeune have increased risks for cancers and other chronic diseases. In their initial report, they compared disease-specific mortality rates between 154,932 Marine and Naval personnel that began service between 1975 and 1985 and were stationed at Camp Lejeune and a similar population of 154,969 from Camp Pendleton Marine Corps Base in California.[36] In a contemporaneous report the same investigators compared disease-specific mortality rates between 4,647 full-time civilian workers employed at Camp Lejeune between 1973 and 1985 with a comparison cohort of 4,690 Camp Pendleton workers employed during 1973-1985.[37] The mortality follow-up period for both studies was 1979-2008. In their recent report of their updated analyses the follow-up period was extended to 2018.[40] Results of these comparisons relevant to kidney cancer mortality are summarized in *Table 5.* A kidney cancer mortality "latency period" was accounted for by lagging exposure to a base by 10

[58] Burger M, et al. Epidemiology and risk factors of urothelial bladder cancer. Eur Urol. 2013;63(2):234-41.

[59] Pesch B, et al. Occupational risk factors for urothelial carcinoma: agent-specific results from a case-control study in Germany. MURC Study Group. Multicenter Urothelial and Renal Cancer. Int J Epidemiol. 2000;29(2):238-47.

years. Study results demonstrated that for the follow-up period 1979-2018 Camp Lejeune military personnel had elevated risk for kidney cancer mortality compared to military personnel at Camp Pendleton (aHR, 1.21; 95% CI, 0.95, 1.54). Similarly, civilian workers employed at Camp Lejeune had elevated risk for kidney cancer mortality compared to civilian workers at Camp Pendleton (aHR, 1.44; 95% CI, 0.73, 2.84). The precision of the aHR estimates, assessed by the width of the 95% CI, was higher when the sample size was greater (military vs. civilian) and when the follow-up period was longer.

Study investigators emphasized findings as notable when both the adjusted hazard ratio (aHR) was at least 1.20 and the ratio of the upper and lower bounds of the confidence interval for the ratio (CIR) was ≤ 3. Although an appropriate CIR level for precision had not been specified nor validated in the literature, the authors considered CIRs ≤ 3 to indicate reasonable precision of the aHRs.

Table 5. Summary of kidney cancer mortality findings from the Camp Lejeune-related studies of ATSDR investigators using Camp Pendelton as the reference group. CIR, ratio of upper to lower limit of 95% confidence interval.

Study parameters	Study population	follow-up period	aHR	95% CI		CIR	Camp Lejeune cases	Camp Pendelton cases
				lower limit	upper limit			
Kidney cancer mortality	Military personnel	1979-2008	1.35	0.84	2.16	2.57	42	33
		1979-2018	1.21	0.95	1.54	1.62	139	126
	civilian workers	1979-2008	1.92	0.58	6.34	10.93	7	6
		1979-2018	1.44	0.73	2.84	3.89	24	15

The study with 1979-2018 follow-up also evaluated hazard ratios for kidney cancer mortality by amount of time stationed or employed at Camp Lejeune between October 1972 and December 1985 with Camp Pendleton as reference.[36] Monotonic trends (HR increased progressively with higher exposure duration) with aHRs ≥ 1.20 and CIRs > 3 in each stratum were observed for kidney cancer among civilian workers but not military personnel (*Table 6*).

Table 6. Hazard ratios for death due to kidney cancer and 95% confidence intervals for the analysis of the amount of time stationed or employed at Camp Lejeune between October 1972 and December 1985 with Camp Pendleton as reference. Low duration: 1 – 5 quarters; Medium duration: 6 – 22 quarters; High duration: 23 – 53 quarters.

	Low duration				Medium duration				High duration			
	HR	LCL	UCL	CIR	HR	LCL	UCL	CIR	HR	LCL	UCL	CIR
Military personnel	1.33	0.95	1.86	1.96	1.23	0.88	1.72	1.95	1.04	0.73	1.49	2.04
Civilian workers	1.36	0.48	3.82	7.96	1.36	0.54	3.41	6.31	1.68	0.75	3.76	5.01

In analyses internal to the Camp Lejeune cohort with the shorter follow-up (1979-2008), a monotonic exposure-response relationship (HR increased progressively with higher exposure levels) for kidney cancer and the categorized cumulative exposure variable for total volatile organic compounds (TVOC) was observed; HR for high exposure category, 1.54; 95% CI, 0.63, 3.75. (*Table 7*).[36] A nonmonotonic exposure-response trend was observed for PCE and kidney cancer; HR for high exposure category, 1.59; 95% CI, 0.66, 3.86). Non-monotonic and weaker effects were seen for other contaminants.

Table 7. Categorical Cumulative Exposures and Kidney Cancer Cause of Death (N=42). Reference group had no exposure to given contaminant. Adjusted Hazard Ratio (aHR) with 95% lower and upper confidence limits (LCL, UCL); 10-year exposure lag.

	Low Exposure				Medium Exposure				High Exposure			
	aHR	**LCL**	**UCL**	**N**	**aHR**	**LCL**	**UCL**	**N**	**aHR**	**LCL**	**UCL**	**N**
Total VOCs	1.42	0.58	3.47	10	1.44	0.58	3.59	10	1.54	0.63	3.75	11
PCE	1.4	0.54	3.58	8	1.82	0.75	4.42	11	1.59	0.66	3.86	11
TCE	1.54	0.65	3.61	11	1.21	0.47	3.09	8	1.52	0.64	3.61	11
VC	1.66	0.68	4.04	10	1.61	0.65	3.98	10	1.51	0.61	3.74	10
Benzene	1.31	0.52	3.29	8	1.38	0.58	3.28	10	1.36	0.57	3.25	10

Total VOC:	reference, ≤1μg/L;	low, >1-4,600;	medium, >4,600-12,250;	high, >12,250-64,016
PCE:	reference, ≤1μg/L;	low, >1-155;	medium, >155-380;	high, >380-8,585
TCE:	reference, ≤1μg/L;	low, >1-3,100;	medium, >3,100-7,700;	high, >7,700-39,745
VC:	reference, ≤1μg/L;	low, >1-205;	medium, >205-500;	high, >500-2,800
Benzene:	reference, <2μg/L;	low, >2-45;	medium, >45-110;	high, >110-601

Bove and associates also used 54 US cancer registries to determine individual level information on primary invasive cancers among members of the Camp Lejeune and Camp Pendelton cohorts between 1996 and 2017.[41] As shown in *Table 8*, the incidence of kidney cancer and renal cell or clear cell carcinoma were not significantly different between the 2 cohorts.

Table 8. Comparison of kidney cancer and renal cell or clear cell carcinoma outcomes at Camp Lejeune vs. Camp Pendleton among either: 1. the military personnel subgroup who began active duty and were stationed at either base between 1975 and 1985 (*N*=318,305). 2. civilian workers employed at either base between October 1972 and December 1985 (*N*=12,291).

Study parameters	Study population	follow-up period	aHR	95% CI		CIR	Camp Lejeune cases	Camp Pendelton cases
				lower limit	upper limit			
Kidney and renal pelvis cancer	Military personnel	1996-2017	1.02	0.95	1.18	1.24	710	721
	civilian workers	1996-2017	1.12	0.76	1.67	2.20	58	49
Renal cell and clear cell carcinoma	Military personnel	1996-2017	1.03	0.91	1.16	1.27	524	558
	civilian workers	1996-2017	1.05	0.67	1.66	2.48	43	37

Bove and colleagues acknowledged that they could not be certain that everyone who resided at Camp Lejeune between 1975 and 1985 was exposed to biologically meaningful levels of contaminants, and that they were unable to account for other environmental exposures that individuals from either camp may have sustained before, during, or after military service. They stated, however, that inclusion of unexposed individuals in the Camp Lejeune cohort would tend to **bias results toward the null** meaning that **the calculated hazard ratios underestimated the true effect**.

The selection of the Camp Pendleton Marine Corps Base as the comparison cohort was appealing because of its size and composition of military and civilians. However, the groundwater at Camp Pendleton was also contaminated with volatile organic compounds and has been designated a superfund site by the EPA. Throughout Camp Pendleton's history, operators improperly disposed of raw sewage, burned solid waste, and mishandled various hazardous substances.[60] Together, these actions created contaminated areas scattered throughout the property. In an initial investigation, the Marine Corps found 9 areas of contamination. Waste generation operations include maintenance and repair of vehicles, landfill operations, waste disposal areas such as scrap yards, and firefighting drill areas. Between 1984 and 1988, the U.S. Navy assessed the base and identified soil and ground water requiring cleanup from decades of improper waste disposal practices. EPA added the site to the National Priorities List in November 1989. In December 1995, 14,000 cubic yards of soil containing TCE and Total Petroleum Hydrocarbons (TPH) were removed from a former fire-fighting

[60] EPA. Superfund site: Camp Pendleton Marine Corps, CA. Basehttps://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.Cleanup&id=0902732

drill field. The contamination at Camp Pendleton would serve as **another source of bias toward the null** in comparisons of the health effects of groundwater contamination between the 2 bases.

Trichloroethylene (TCE)

Epidemiologic Studies

In the analysis internal to the Camp Lejeune cohort of military personnel with follow-up between 1979 and 2008, a nonmonotonic exposure-response trend was observed for PCE and kidney cancer, meaning that there was increased risk of kidney cancer among those exposed to PCE but the risk did not increase with higher levels of exposure (*Table 7*).[36] Compared to those with no exposure to TCE, the hazard ratios for the low, medium, and high exposure categories were, 1.54, 1.21, and 1.52, respectively.

Three meta-analyses evaluated the association between TCE exposure and subsequent kidney cancer and all observed significantly elevated summary relative risks (mRR), with point estimates ranging between 1.27 and 1.42.[61,62,63] The meta-analyses also found that higher cumulative exposures of TCE were associated with increased risk of kidney cancer, consistent with a dose-response relationship. The studies included in the meta-analyses, including individual relative risk estimates, are summarized in *Table 9*. The table also includes the mRR determined by each meta-analysis, as well as mRR for the cohort and case-control studies included. Appendix *Figures A1, A2, and A3* display these results graphically in forest plots.

Scott and Jinot found a mRR of 1.27 (95% CI, 1.13, 1.43) in the primary random-effects meta-analysis of 15 studies.[61]The studies of Pesch et al.,[64] Raaschou-Nielsen et al.,[65] and Dosemeci et al.[66] contributed about 75% of the weight, although no single study was overly influential. The random-effects model yielded mRR estimates of 1.16 (95% CI, 0.96, 1.40) for the cohort studies and 1.48 (95% CI, 1.15, 1.91) for the case-control studies, with mRR estimates not statistically significant different (p=0.12) between cohort or case-control studies. Restriction of the analysis to the highest

[61] Scott CS, Jinot J. Trichloroethylene and cancer: systematic and quantitative review of epidemiologic evidence for identifying hazards. Int J Environ Res Public Health. 2011;8(11):4238-72.
[62] Karami S, et al. Occupational trichloroethylene exposure and kidney cancer risk: a meta-analysis. Occup Environ Med. 2012;69(12):858-67.
[63] Kelsh MA, et al. Occupational trichloroethylene exposure and kidney cancer: a meta-analysis. Epidemiology. 2010;21(1):95-102.
[64] Pesch B, et al. Occupational risk factors for renal cell carcinoma: agent-specific results from a case-control study in Germany. MURC Study Group. Multicenter urothelial and renal cancer study. Int J Epidemiol. 2000;29(6):1014-24.
[65] Raaschou-Nielsen O, et al. Cancer risk among workers at Danish companies using trichloroethylene: a cohort study. Am J Epidemiol. 2003;158(12):1182-92
[66] Dosemeci M, et al. Gender differences in risk of renal cell carcinoma and occupational exposures to chlorinated aliphatic hydrocarbons. Am J Ind Med. 1999;36(1):54-9.

exposure groups yielded a higher mRR estimate of 1.58 (95% CI, 1.28, 1.96) and an analysis of only the 10 studies reporting results by exposure level, the mRR estimate was 1.64 (95% CI, 1.31, 2.04).

Karami and colleagues observed significantly elevated summary estimates for cohort studies (mRR, 1.26, 95% CI, 1.02, 1.56), case-control studies (mRR, 1.35, 95% CI, 1.17, 1.57), and cohort and case-control studies combined (mRR, 1.32, 95% CI, 1.17, 1.50).[62] Among the 3 cohort studies that examined duration of occupational TCE exposure, a significant summary risk estimate of 1.52 (95% CI, 1.08, 2.13) was observed among workers with the longest duration of exposure but not among workers with a shorter exposure duration (mRR, 0.90, 95% CI 0.56, 1.45).

Kelsh and coworkers considered 2 different groups of cohort studies as well as case-control studies in their meta-analysis.[63] The 10 group I studies specifically identified TCE as a workplace exposure through biomonitoring, industrial hygiene data, identified work practices, or job titles that involved TCE. The 7 group II cohort studies were more limited in that they lacked specific, detailed TCE exposure information. The mRR for group I studies was 1.34 (95% CI, 1.06, 1.68). Group II cohort studies yielded a mRR of 0.88 (95% CI, 0.58, 1.33) and for the case-control studies the mRR was 1.33 (95% CI, 1.02, 1.73). Restriction to only group I cohort studies and case-control studies resulted in a mRR of 1.42 (95% CI, 1.13, 1.77). Unlike the findings of the 2 more recent meta-analyses, analysis of 10 studies with data on exposure categories showed no apparent exposure response patterns by duration or cumulative exposure.

Table 9. Findings of studies evaluating the association between TCE exposure and subsequent kidney cancer (where available) and included in 3 meta-analyses. Summary relative risks, mRR.

Study author, publication year	RR	95% CI	design	Scott and Jinot (2011)[61]	Karami et al (2012)[62]	Kelsh et al (2010)[63]
Anttila, 1995	0.87	0.32, 1.89	CH	x	x	group I
Axelson, 1994[68]	1.16	0.42, 2.52	CH	x	x	group I
Boice, 1999	0.99	0.4, 2.04	CH	x		group I
Greenland, 1994	0.99	0.30, 3.32	CH/CC	x (CH)	x (CC)	x (CC)
Hansen, 2001	1.1	0.3, 2.8	CH	x	x	group I
Morgan, 1998	1.14	0.51, 2.58	CH	x	x	group I
Raaschou-Nielsen, 2003	1.2	0.94, 1.50	CH	x	x	group I
Radican, 2008[73]	1.18	0.47, 2.94	CH	x	x	
Zhao, 2005	1.7	0.38, 7.9	CH	x		
Ritz, 1999			CH		x	group I
Lipworth, 2011			CH		x	
Blair, 1998	1.6	0.5, 2.9	CH			group I
Boice, 2006			CH			group I

Study author, publication year	RR	95% CI	design	Scott and Jinot (2011)[61]		Karami et al (2012)[62]		Kelsh et al (2010)[63]	
mRR & 95% CI: Cohort studies (group I)				*1.16*	*0.96, 1.40*	*1.26*	*1.02, 1.56*	*1.34*	*1.07, 1.67*
Blair, 1989[79]			CH					group II	
Chang, 2003			CH					group II	
Costa, 1989			CH					group II	
Garabrant, 1988			CH					group II	
Henschler, 1995	7.97	2.59, 18.59	CH					group II	
Selden, 1991			CH					group II	
Sinks, 1992			CH					group II	
mRR & 95% CI: Cohort studies (group II)				*Not applicable*		*Not applicable*		*1.58*	*0.75, 3.32*
Brüning, 2003	2.47	1.36, 4.49	CC	x		x		x	
Charbotel, 2006[87]	1.88	0.89, 3.98	CC	x		x		x	
Dosemeci, 1999	1.3	0.9, 1.9	CC	x		x		x	
Moore, 2010	2.05	1.13, 3.73	CC	x		x			
Pesch, 2000	1.24	1.03, 1.49	CC	x		x		x	
Siemiatycki, 1991	0.8	0.3, 2.2	CC	x		x		x	
Asal, 1998			CC			x			
Harrington, 1998			CC			x		x	
Vamvakas, 1998			CC					x	
mRR & 95% CI: Case-control				*1.48*	*1.15, 1.91*	*1.35*	*1.17, 1.57*	*1.57*	*1.06, 2.30*
mRR: Overall				***1.27***	***1.13, 1.43***	***1.32***	***1.17, 1.50***	***1.42***	***1.13, 1.77***

Cohort studies (first author and publication year): Anttila 1995[67], Axelson 1994[68], Boice 1999[69], Greenland 1994[70], Hansen 2001[71], Morgan 1998[72], Raaschou-Nielsen 2003[65], Radican 2008[73], Zhao 2005[74], Ritz 1999[75],

[67]Anttila A, et al. Cancer incidence among Finnish workers exposed to halogenated hydrocarbons. J Occup Environ Med. 1995;37(7):797-806.

[68] Axelson O, et al. Updated and expanded Swedish cohort study on trichloroethylene and cancer risk. J Occup Med. 1994;36(5):556-62

[69] Boice JD Jr, et al. Mortality among aircraft manufacturing workers. Occup Environ Med. 1999;56(9):581-97.

[70] Greenland S, et al. A case-control study of cancer mortality at a transformer-assembly facility. Int Arch Occup Environ Health. 1994;66(1):49-54.

[71] Hansen J, et al. Cancer incidence among Danish workers exposed to trichloroethylene. J Occup Environ Med. 2001;43(2):133-9.

[72] Morgan RW, et al. Mortality of aerospace workers exposed to trichloroethylene. Epidemiology. 1998 ;9(4):424-31.

[73] Radican L, et al. Mortality of aircraft maintenance workers exposed to trichloroethylene and other hydrocarbons and chemicals: extended follow-up. J Occup Environ Med. 2008;50(11):1306-19.

[74] Zhao Y, et al. Estimated effects of solvents and mineral oils on cancer incidence and mortality in a cohort of aerospace workers. Am J Ind Med. 2005;48(4):249-58.

[75] Ritz B. Cancer mortality among workers exposed to chemicals during uranium processing. J Occup Environ Med. 1999 Jul;41(7):556-66. J Occup Environ Med. 1999 ;41(7):556-66. (abstract)

Lipworth 2011[76], Blair 1998[77], Boice 2006[78], Blair 1989[79], Chang 2003[80], Costa 1989[81], Garabrant 1988[82], Henschler 1995[83], Selden 1991[84], Sinks 1992[85]
Case-control studies: Brüning 2003[86], Charbotel 2006[87], Dosemeci 1999[66], Moore 2010[88], Pesch 2000[6464], Siemiatycki 1991[89], Asal 1998[90], Harrington 1998[91], Vamvakas 1998[92]

Two studies that were included in all 3 meta-analyses provided results relevant to the issue of exposure dose-response. In a cohort study of cancer risk among workers at Danish companies using TCE, Raaschou-Nielsen and colleagues demonstrated TCE dose-related elevations in risk for RCC among workers with either of 2 markers of higher TCE exposure.[65] For workers that were employed between 1 and 4.9 years, the standardized incidence ratio (SIR) was 1.1 (95% CI, 0.7, 1.7), while for workers employed 5 or more years the SIR was for RCC was 1.7 (95% CI, 1.1, 2.4). Similarly, in an occupational case-control study in Central Europe, Moore and associates showed increases in risk for renal cancer related to the number of years or hours worked with TCE.[88] Occupational TCE exposures of at least 13.5 years were associated with higher odds of renal cell cancer than those exposed for shorter durations (≥13.5 years: OR, 2.25; 95% CI, 0.95, 5.29 vs. <13.5 years: OD, 1.89;

[76] Lipworth L, et al. Cancer mortality among aircraft manufacturing workers: an extended follow-up. J Occup Environ Med. 2011 ;53(9):992-1007.
[77] Blair A, et al. Mortality and cancer incidence of aircraft maintenance workers exposed to trichloroethylene and other organic solvents and chemicals: extended follow up. Occup Environ Med. 1998;55(3):161-71.
[78] Boice JD Jr, et al. Mortality among Rocketdyne workers who tested rocket engines, 1948-1999. J Occup Environ Med. 2006;48(10):1070-92.
[79] Blair A, et al. Mortality among United States Coast Guard marine inspectors. Arch Environ Health. 1989;44(3):150-6.
[80] Chang YM, et al. A cohort mortality study of workers exposed to chlorinated organic solvents in Taiwan. Ann Epidemiol. 2003;13(9):652-60.
[81] Costa G, et al. A mortality cohort study in a north Italian aircraft factory. Br J Ind Med. 1989;46(10):738-43.
[82] Garabrant DH, et al. Mortality of aircraft manufacturing workers in southern California. Am J Ind Med. 1988;13(6):683-93.
[83] Henschler D, et al. Increased incidence of renal cell tumors in a cohort of cardboard workers exposed to trichloroethene. Arch Toxicol. 1995;69(5):291-9.
[84] Seldén A, Ahlborg G Jr. Mortality and cancer morbidity after exposure to military aircraft fuel. Aviat Space Environ Med. 1991 ;62(8):789-94. (abstract)
[85] Sinks T, et al. Renal cell cancer among paperboard printing workers. Epidemiology. 1992 ;3(6):483-9.
[86] Brüning T, et al Renal cell carcinomas in trichloroethene (TRI) exposed persons are associated with somatic mutations in the von Hippel-Lindau (VHL) tumour suppressor gene. Arch Toxicol. 1997;71(5):332-5.
[87] Charbotel B, et al. Case-control study on renal cell cancer and occupational exposure to trichloroethylene. Part II: Epidemiological aspects. Ann Occup Hyg. 2006;50(8):777-87.
[88] Moore LE, et al. Occupational trichloroethylene exposure and renal carcinoma risk: evidence of genetic susceptibility by reductive metabolism gene variants. Cancer Res. 2010;70(16):6527-36.
[89] Siemiatycki J. Risk Factors for Cancer in the Workplace. CRC Press; Boca Raton, FL, USA: 1991.
[90] Asal NR, et al. Risk factors in renal cell carcinoma. II. Medical history, occupation, multivariate analysis, and conclusions. Cancer Detect Prev. 1988;13(3-4):263-79. (abstract)
[91] Harrington JM, et al. Renal disease and occupational exposure to organic solvents: a case referent approach. Br J Ind Med. 1989;46(9):643-50.
[92] Vamvakas S, et al. Renal cell cancer correlated with occupational exposure to trichloroethene. J Cancer Res Clin Oncol. 1998;124(7):374-82.

95% CI, 0.84, 4.28). In addition, although occupational exposures to TCE for ≥1080 hours were associated with higher odds of renal cell cancer (OR, 2.86, 95% CI, 1.31, 6.23), the result demonstrated that **elevated risk of kidney cancer could occur with a short duration of exposure** (<1080 hours, approximately 6 months; OR, 1.22, 95% CI, 0.48, 3.12).

After publication of the 3 meta-analyses, 2 studies were published that did not show an association between TCE exposure and kidney cancer. These studies, however, had significant limitations. Vlaanderen and collaborators used a generic job-exposure matrix to classify TCE and PCE exposure that the authors admitted was likely to introduce considerable exposure misclassification.[93] Moreover, only a small percentage of the study population received high exposures to either TCE or PCE. The other study by Christensen and coworkers had very few exposed cases, 5 for TCE and 2 for PCE, resulting in unstable estimates and wide confidence intervals.[94]

In contrast, other more recent studies have been more reflective of the findings found in the studies evaluated as part of the 3 meta-analyses. Buhagen and colleagues evaluated a cohort of 997 male workers who had been occupationally exposed to TCE for many years.[95] During a 50-year observation period, 13 cases of kidney cancer were observed, versus 7.5 expected; standardized incidence ratio, 1.7; 95% CI, 1.0, 3.0.

In a study of 34,494 workers employed at a microelectronics and business machine facility, the cumulative TCE exposure score showed a positive association with kidney cancer, HR, 1.24, 95% CI, 0.87, 1.77.[96]

In a case-control study of occupational exposure to chlorinated solvents and kidney cancer, Purdue and coworkers found that kidney cancer risk was elevated, albeit not to a level of statistical significance, among workers with high cumulative hours exposed to TCE (OR, 1.7; 95% CI, 0.8, 3.8).[97] Among workers in jobs with high exposure intensity, high cumulative hours of exposure to PCE were associated with increased risk of kidney cancer, both overall (third tertile vs. unexposed: OR,

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[93] Vlaanderen J, et al. Occupational exposure to trichloroethylene and perchloroethylene and the risk of lymphoma, liver, and kidney cancer in four Nordic countries. Occup Environ Med. 2013 Jun;70(6):393-401.
[94] Christensen KY, et al. Risk of selected cancers due to occupational exposure to chlorinated solvents in a case-control study in Montreal. J Occup Environ Med. 2013;55(2):198-208.
[95] Buhagen M, et al. Association Between Kidney Cancer and Occupational Exposure to Trichloroethylene. J Occup Environ Med. 2016;58(9):957-9
[96] Silver SR, et al. Retrospective cohort study of a microelectronics and business machine facility. Am J Ind Med. 2014;57(4):412-24.
[97] Purdue MP, et al. Occupational exposure to chlorinated solvents and kidney cancer: a case-control study. Occup Environ Med. 2017;74(4):268-274.

3.1; 95% CI, 1.3,7.4) and after excluding participants with ≥50% exposure probability for TCE (OR, 3.0; 95% CI, 0.99, 9.0).

More recently, Andrew and associates used publicly available data on TCE levels in groundwater measured at contaminated sites in New Hampshire and then modeled the spatial dispersion and temporal decay.[98] They overlaid geospatial residential locations of kidney cancer cases and controls with yearly maps of estimated TCE levels to estimate median exposures over the 5, 10, and 15-year epochs before diagnosis. They found that the 50th-75th percentile of estimated residential exposure over a 15-year period was associated with increased kidney cancer risk (adjusted OR, 1.78; 95% CI, 1.05, 3.03), compared to less than the 50th percentile.

Animal studies and mechanistic information

The IARC Monographs Working Group concluded that there is sufficient evidence in experimental animals for the carcinogenicity of TCE.[99] Notably, in rats, modest increases in the incidence of kidney tumors were observed in both sexes of multiple strains exposed to TCE by either oral or inhalation routes; however, statistical significance was only achieved in male F344/N rats. Nonetheless, the rarity of renal tumor occurrence in unexposed rats (no kidney tumors observed in unexposed rats in all these studies) supports the biological significance of the findings.[100] Other tumor findings in rats exposed to TCE include leukemia in male Sprague-Dawley and female August rats, and testicular tumors of the Leydig cell type with inhalation exposure in the Sprague-Dawley strain.

The primary tumor finding with TCE exposure in mice has been statistically significant increases in liver tumors, reported in multiple inhalation and gavage bioassays of male Swiss and male and female B6C3F1 mouse strains.[99] TCE decreased mouse liver tumor latency in male B6C3F1 mice. Additional tumor findings in mice include increased malignant lymphomas observed in female B6C3F1 mice exposed to TCE via oral route.

The hypothesized modes of action for TCE-induced kidney carcinogenicity include key events attributed to GSH-conjugation-derived metabolites (genotoxicity and cytotoxicity) and those attributed

[98] Andrew AS, et al. Kidney Cancer Risk Associated with Historic Groundwater Trichloroethylene Contamination. Int J Environ Res Public Health. 2022;19(2):618.

[99] Guha N, et al. Carcinogenicity of trichloroethylene, tetrachloroethylene, some other chlorinated solvents, and their metabolites. Lancet Oncol. 2012;13(12):1192-3.

[100] Rusyn I, et al. Trichloroethylene: Mechanistic, epidemiologic and other supporting evidence of carcinogenic hazard. Pharmacol Ther. 2014;141(1):55-68.

to oxidative metabolites. The key events associated with each of these hypothesized modes of action are listed below.[101,102]

Genotoxicity

- GSH-conjugation-derived metabolites produced in situ or delivered systemically to kidney
- Genotoxic effects induced by metabolites in kidney (e.g., mutations, DNA damage, DNA strand breaks, micronuclei) that advance acquisition of multiple critical traits contributing to carcinogenesis

Cytotoxicity and regenerative proliferation

- GSH-conjugation-derived metabolites produced in situ or delivered systemically to kidney
- Cytotoxicity and compensatory cell proliferation
- Clonal expansion of initiated cells

Peroxisome proliferation activated receptor α (PPARα) activation

- Oxidative metabolites produced in the liver activate PPARα in the kidney
- Alterations in cell proliferation and apoptosis
- Clonal expansion of initiated cells

α2u-Globulin-related nephropathy

- Oxidative metabolites cause hyaline droplet accumulation and an increase in α2u-globulin resulting in nephrotoxicity
- Subsequent cytotoxicity, necrosis, and sustained regenerative tubule-cell proliferation
- Development of intraluminal granular casts from sloughed cellular debris associated with tubule dilation and papillary mineralization
- Foci of tubule hyperplasia in the convoluted proximal tubules
- Renal tubule tumors

Formic acid-related nephropathy

- Oxidative metabolites produced in the liver lead to increased formation and urinary excretion of formic acid
- Increased formic acid causes cytotoxicity in the kidney
- Compensatory cell proliferation
- Clonal expansion of initiated cells

[101] National Toxicology Program (NTP). 2015. Report on Carcinogens monograph on trichloroethylene. Research Triangle Park, NC: National Toxicology Program. RoC Monograph 05.
[102] U.S. Environmental Protection Agency (USEPA). 2011a. Toxicological review of trichloroethylene (CAS No. 79-01-6) in support of summary information on the integrated risk information system (IRIS). U.S. Environmental Protection Agency. EPA/635/R-09/011F. https://iris.epa.gov/static/pdfs/Intro_0199tr.pdf

Walker and coworkers used a metabolome-wide association study to identify dose-dependent metabolic changes in TCE-exposed workers and unexposed controls.[103] They observed a systemic metabolic response to TCE in exposed workers, which included many unidentified chlorinated chemicals and alterations in endogenous metabolism consistent with known toxic targets, including renal, liver, and immune systems. The metabolic changes were consistent with risk factors for disease associated with TCE exposure, even though most exposure levels were below the OSHA permissible limits of 100 ppm in air. Findings from this study provided insight into the underlying toxic mechanisms of TCE and exposure related changes to metabolic phenotype in an otherwise healthy population.

In addition to dose-related associations between exposure to TCE and subsequent kidney cancer demonstrated by the study by Moore and colleagues, the study was important because it evaluated the interaction between TCE exposure and genotypes for the GSTT1 and renal-CCBL1enzymes.[88] These enzymes are highly active in the kidney and involved in the bioactivation of TCE by the GSH-conjugation pathway. The study found that workers exposed to TCE with at least one intact GSTT1 allele had elevated risks for kidney cancer, but those with a functionally inactive GSTT1 enzyme with two deleted alleles had no elevated risk. Findings for the interaction between TCE exposure and minor alleles for the renal-CCBL1 enzyme supported the findings for the GSTT1 enzyme. The findings of this study agreed with the hypothesized mechanism for TCE-induced kidney cancer and provide strong evidence for causality.

A link between TCE exposure and a genetic variant linked to RCC was investigated by Brauch and collaborators.[104] The relationship between pathogenic variants in the von Hippel-Lindau tumor suppressor gene and exposure to TCE was evaluated in 44 patients with RCC and known exposure to TCE, 107 with RCC but no known exposure, and 97 healthy controls. A specific mutational hot spot in the VHL gene was found in RCC tumor tissue from 39% of those with TCE exposure, but not in any of those without exposure nor in any of the healthy individuals. Absence of this mutation in lymphocyte DNA of patients and control subjects ruled out the mutation as representing a polymorphism or a germline change.

Application of the Hill Criteria to the evidence to the cause of kidney cancer among plaintiffs exposed to TCE contaminated drinking water at Camp Lejeune

1. *Strength of association*

[103] Walker DI, et al. High-resolution metabolomics of occupational exposure to trichloroethylene. Int J Epidemiol. 2016;45(5):1517-1527.
[104] Brauch H, et al. Trichloroethylene exposure and specific somatic mutations in patients with renal cell carcinoma. J Natl Cancer Inst. 1999;91(10):854-61.

- The above-described analyses demonstrated abundant evidence that demonstrated substantial statistically significant associations between exposure to volatile organic compounds found in Camp Lejeune drinking water and kidney cancer, including the following:
    - Three meta-analysis that evaluated the association between TCE and kidney cancer all observed significantly elevated summary relative risks, with point estimates ranging between 1.27 and 1.42.[61,62,63]

2. *Consistency*
    - The narrow range of the summary relative risk estimates in the 3 meta-analyses just described provides strong evidence of consistency.
3. *Specificity*
    - Not applicable for kidney cancer and environmental exposures. This is common, as for most environmental exposures a high degree of specificity is relatively uncommon, as many exposures can cause various diseases, and many diseases can result from multiple exposures.
4. *Temporality*
    - The temporal relationship described in the literature is appropriate in sequence in that the exposures preceded kidney cancer diagnosis. A total of 524 members of the Camp Lejeune cohort developed renal cell or clear cell carcinoma during the follow-up period between 1996 and 2017 (average length of follow-up, 17.7 ± 6.0 [sd] years).[41]
5. *Biological gradient* - The outcome increases monotonically with increasing dose of exposure (also known as “dose-response”).
    - In analyses internal to the Camp Lejeune cohort, a monotonic exposure-response relationship for kidney cancer and the categorized cumulative exposure variable for total volatile organic compounds was observed; HR for high exposure category, 1.54; 95% CI, 0.63, 3.75.[36]
    - The occupational case-control study by Moore and associates showed increases in risk for renal cancer related to the number of years or hours worked with TCE (≥13.5 years: OR, 2.25; 95% CI, 0.95, 5.29 vs. <13.5 years: OD, 1.89; 95% CI, 0.84, 4.28; *P*-value for trend=0.02).[88]
6. *Plausibility*

The biologic plausibility of a link between exposure to TCE and kidney cancer has been established by laboratory animals and mechanistic studies.

- The IARC Monographs Working Group concluded that there is sufficient evidence in experimental animals for the carcinogenicity of TCE.
- Studies in male F344/N rats have shown that TCE exposure causes increases in the incidence of kidney tumors.[99]

- The findings of the study by Moore and coworkers related to TCE exposure and genotypes for the GSTT1 and renal-CCBL1enzymes agreed with the hypothesized mechanism for TCE-induced kidney cancer and therefore provided strong evidence for causality.[88]

7. *Coherence*
   - It certainly "makes sense" that exposure to VOCs that have been demonstrated to be carcinogens can result in cancers, including kidney cancer, in exposed people. This is exemplified by the strong association found between exposure to TCE and pathogenic non-germline variants in the von Hippel-Lindau tumor suppressor gene.[104]
8. *Experiment*
   - Controlled studies of laboratory animals that developed kidney tumors after exposure to TCE easily satisfy the experiment criterion.
9. *Analogy*
   - Analogy is exemplified by the studies involving exposure to VOCs by routes other than drinking water, including the numerous occupational studies summarized in this report.

TCE Causality opinion

It is my opinion that there is sufficient evidence for a causal relationship between TCE exposure associated with drinking water at Camp Lejeune and kidney cancer. There was sufficient evidence from human studies from the 3 meta-analyses. In addition, my evaluation of the Hill criteria provided additional support for my opinion.

Tetrachloroethylene (perchloroethylene or PCE)

Epidemiologic studies

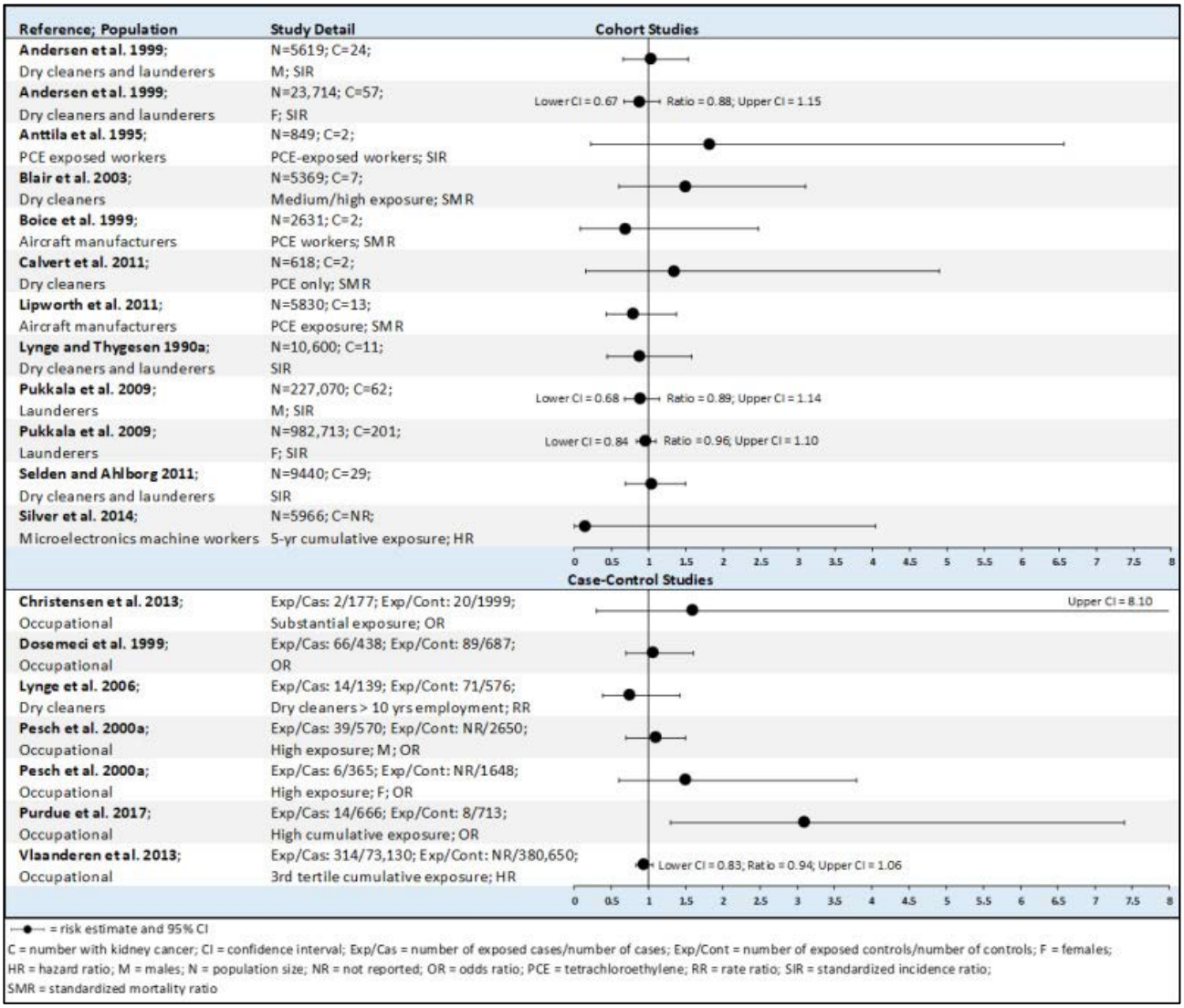
In the analysis internal to the Camp Lejeune cohort of military personnel a nonmonotonic exposure-response trend was observed in in the point estimates of the association between PCE and kidney cancer, meaning that the risk of kidney cancer increased with increasing levels of exposure (*Table 7*).[36] Compared to those with no exposure to PCE, the hazard ratios for the low, medium, and high exposure categories were, 1.40, 1.82, and 1.59, respectively.

No meta-analyses have been conducted for PCE and kidney cancer but the 2019 ATSDR toxicological profile for tetrachloroethylene summarized epidemiological studies that have evaluated associations between inhaled PCE and kidney cancer (*Figure 7*).[105] These studies did not consistently observe increased risk. Of the 19 studies (12 cohort, 7 case-control), 9 (7 cohort, 2 case-control) had

[105] Toxicological Profile for Tetrachloroethylene. Atlanta (GA): Agency for Toxic Substances and Disease Registry (US); 2019 Jun.

point estimates less than 1.0, 4 (2 cohort, 2 case-control) had point estimates at or slightly above 1.0, and 6 (3 cohort, 3 case-control) had point estimates greater than 1.1 suggesting increased risk. A major limitation of several of the studies was the small number of exposed cases. Only the study by Purdue and collaborators demonstrated elevated risk that was statistically significant.[97] In that study, among workers in jobs with high exposure intensity, high cumulative hours exposed to PCE were associated with increased risk of kidney cancer, both overall (third tertile vs. unexposed: OR, 3.1; 95% CI, 1.3,7.4) and after excluding participants with ≥50% exposure probability for TCE (OR, 3.0; 95% CI, 0.99, 9.0).

Figure 7. Summary of Epidemiological Studies Evaluating Associations between PCE and Kidney Cancer.



Andersen 1999,[106] Anttila 1995,[67] Blair 2003,[107] Boice 1999,[78] Calvert 2011,[108] Lipworth 2011,[76] Lynge 1990,[109] Pukkala 2009,[110] Selden 2011,[111] Silver 2014,[96] Christensen 2013,[94] Dosemeci 1999,[66] Lynge 2006,[112] Pesche 2000,[64] Purdue 2017,[97] Vlaanderen 2013.[93]

As stated above, urothelial/transitional cell carcinomas of the renal pelvis or upper tract have properties that are different from RCC. Transitional cell tumors in this area are more similar to bladder cancers. However, some epidemiologic studies have included these cancers with other kidney cancers including RCC. Epidemiologic investigations that have evaluated kidney cancer with and without the inclusion of upper tract transitional cell carcinomas have found similar risk ratios. Similarly, epidemiologic evaluations of only kidney cancer inclusive of RCC and evaluations focused more specifically on transitional cell carcinoma in the renal pelvis have found similar risk ratios.

It is therefore appropriate to use kidney cancer epidemiology for a causation analysis involving transitional cell carcinoma of the upper tract. Further, TCE, PCE, vinyl chloride, and benzene all have been associated with transitional cell carcinoma.[113] Given that transitional cell carcinomas of the renal pelvis are similar to bladder cancer, epidemiologic findings relating to bladder cancer could be a reasonable proxy to inform an analysis of this type of cancer.

In their 2014 meta-analysis Vlaanderen and coworkers assessed the epidemiological evidence for the association between PCE exposure and bladder cancer from published studies estimating occupational exposure to PCE or in workers in the dry-cleaning industry.[114] For employment as a dry cleaner, the overall mRR was 1.47 (95% CI; 1.16, 1.85), indicating that dry cleaning work was associated with a statistically significant increase in bladder cancer risk (*Figure 8*). The increased risk was seen for both cohort and case-control studies (mRR, 1.46 and mRR, 1.50, respectively), although only significant for cohort studies. The study authors discussed that although dry cleaners

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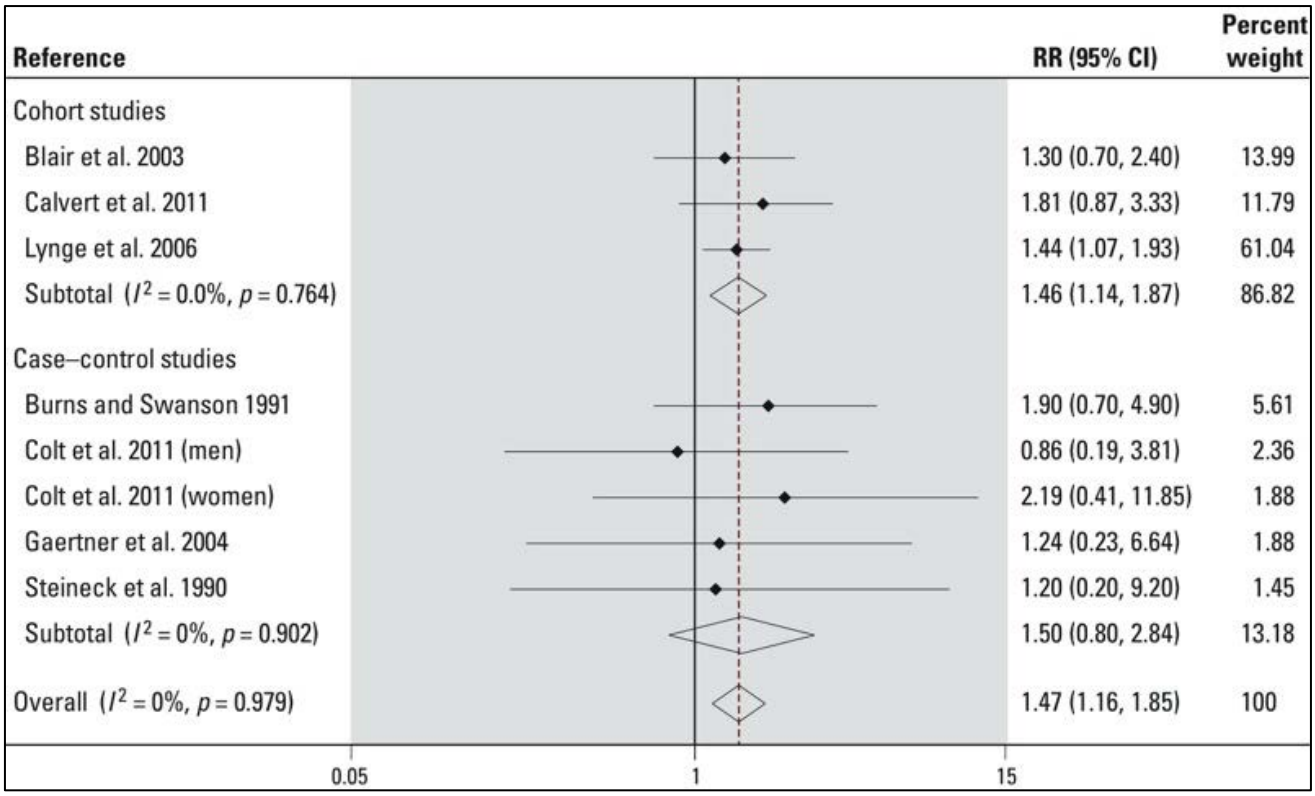
[106] Andersen A, et al. Work-related cancer in the Nordic countries. Scand J Work Environ Health. 1999;25 Suppl 2:1-116.
[107] Blair A, et al. Extended mortality follow-up of a cohort of dry cleaners. Ann Epidemiol. 2003;13(1):50-6.
[108] Calvert GM, et al. Mortality and end-stage renal disease incidence among dry cleaning workers. Occup Environ Med. 2011;68(10):709-16.
[109] Lynge E, Thygesen L. Primary liver cancer among women in laundry and dry-cleaning work in Denmark. Scand J Work Environ Health. 1990;16(2):108-12.
[110] Pukkala E, et al. Occupation and cancer - follow-up of 15 million people in five Nordic countries. Acta Oncol. 2009;48(5):646-790.
[111] Seldén AI, Ahlborg G Jr. Cancer morbidity in Swedish dry-cleaners and laundry workers: historically prospective cohort study. Int Arch Occup Environ Health. 2011;84(4):435-43.
[112] Lynge E, et al. Cancer in persons working in dry cleaning in the Nordic countries. Environ Health Perspect. 2006;114(2):213-9.
[113] Daneshmand S. Epidemiology and risk factors of urothelial carcinoma of the bladder. UpToDate.com
[114] Vlaanderen J, et al. Tetrachloroethylene exposure and bladder cancer risk: a meta-analysis of dry-cleaning-worker studies. Environ Health Perspect. 2014;122(7):661-6.

incur mixed exposures, PCE could be responsible for the excess risk of bladder cancer because it is the primary solvent used, and it is the only chemical commonly used by dry cleaners that is currently identified as a potential bladder carcinogen.

Figure 8. Forest plot of cohort and case–control studies included in the meta-analysis that assessed the risk of bladder cancer in relation to occupation as a dry cleaner.



Blair 2003,[107] Calvert 2011,[108] Lynge 2006,[109] Burns 1991,[115] Colt 2011,[116] Gaetner 2004,[117] Steineck 1990.[118]

In addition to the meta-analysis just described, Vlaanderen and collaborators also summarized exposure-response information from studies included (*Table 10*). The study of occupational risk factors for urothelial carcinoma by Pesch and colleagues progressively increased odd ratios with increasing levels of PCE exposure among men but not women.[59]

[115] Burns PB, Swanson GM. Risk of urinary bladder cancer among blacks and whites: the role of cigarette use and occupation. Cancer Causes Control. 1991;2(6):371-9.
[116] Colt JS, et al. Occupation and bladder cancer in a population-based case-control study in Northern New England. Occup Environ Med. 2011;68(4):239-49.
[117] Garetano G, Gochfeld M. Factors influencing tetrachloroethylene concentrations in residences above dry-cleaning establishments. Arch Environ Health. 2000;55(1):59-68.
[118] Steineck G, et al. Increased risk of urothelial cancer in Stockholm during 1985-87 after exposure to benzene and exhausts. Int J Cancer. 1990;45(6):1012-7.

In addition, the study by Calvert and coworkers found a higher standardized mortality ratio (SMR) for exposure greater than 5 years compared to <5 years (SMR, 4.08; 95% CI, 2.13, 7.12; vs. SMR 0.53; 95% CI, 0.03, 2.52, respectively).[108] The other studies summarized by Vlaanderen did not show evidence of a dose-response.

Table 10. Exposure-response information from studies included the Vlaanderen meta-analysis.

Study and exposure	Association	No. of cases
Pesch et al. 2000; tetrachloroethylene exposure index[a]		
Men[b]		
Medium	OR = 1.1 (0.9, 1.3)	162
High	OR = 1.2 (1.0, 1.5)	172
Substantial	OR = 1.4 (1.0, 1.9)	71
Men[c]		
Medium	OR = 1.0 (0.7, 1.5)	37
High	OR = 1.2 (0.8, 1.7)	47
Substantial	OR = 1.8 (1.1, 3.1)	22
Women[b]		
Medium	OR = 1.8 (1.0, 3.0)	21
High	OR = 1.0 (0.6, 1.9)	16
Substantial	OR = 0.7 (0.2, 2.5)	3
Christensen et al. 2013; tetrachloroethylene exposure		
Any exposure	OR = 0.5 (0.1, 3.0)	2
Substantial exposure[d]	OR = 0.9 (0.1, 7.3)	2
Blair et al. 2003; duration in the union		
< 4.4 years	SMR = 1.4	Not reported
> 4.4 years	SMR = 1.5	Not reported
Blair et al. 2003; level of exposure to dry-cleaning solvents		
Little/no	SMR = 1.4 (0.4, 3.2)	5
Medium/high	SMR = 1.5 (0.6, 3.1)	7
Lynge et al. 2006; duration of employment as dry cleaner (years)		
0–1[e]	RR = 1.50 (0.57, 3.96)	6
2–4	RR = 2.39 (1.09, 5.22)	10
5–9	RR = 0.91 (0.52, 1.59)	17
≥ 10	RR = 1.57 (1.07, 2.29)	53
Calvert et al. 2011; duration of exposure among workers for which time since exposure was > 20 years[f]		
< 5 years	SMR = 0.53 (0.03, 2.52)	1
> 5 years	SMR = 4.08 (2.13, 7.12)	9

Animal studies and mechanistic information

There is evidence that PCE can cause kidney tumors in laboratory animals. PCE exposure via inhalation resulted in an increase in the combined incidence of benign and malignant tubular-cell

kidney tumors in male F344/N rats.[119] A low incidence of kidney cancer has been observed in male rats following inhalation exposure to PCE.[120] Low incidences of renal tubular cell adenomas or adenocarcinomas (1/49, 3/49, and 4/50 in control, 200 ppm, and 400 ppm groups, respectively) occurred in male rats. Although the incidence of these tumors was not statistically significant, the fact that there was any increase was itself significant because these tumors are considered uncommon in untreated male rats.

As discussed in the section of this report describing the ways that the chemical contaminants of Camp Lejeune water are broken down (page 19; *Figure 4*), humans have 2 distinct pathways to metabolize TCE and PCE, by cytochrome P450-dependent oxidation (CYP), and by glutathione (GSH) conjugation. Several mechanisms may contribute to the renal carcinogenicity of PCE, including genotoxicity or cytotoxicity. Kidney cancer may in part be a result of the formation of genotoxic metabolites from either the CYP oxidation or GSH conjugation pathways or from cellular damage and regeneration due to glutathione depletion. Data from rat studies as well as in vitro studies of renal cells suggest that glutathione conjugation of PCE likely plays a significant role in PCE-induced renal toxicity. In contrast, modulation of cytochrome P450 activity had no significant effect on PCE-induced kidney toxicity.[121]

Application of the Hill Criteria to the evidence to the cause of kidney cancer among plaintiffs exposed to PCE contaminated drinking water at Camp Lejeune

Note: the discussion of the specificity, temporality, coherence, and analogy criteria in TCE section are applicable to the broader issue of kidney cancer etiology related to environmental exposures, not the specific compound being evaluated and therefore will not be repeated here or in the subsequent sections on VC and benzene.

1. *Strength of association*
   - The study by Purdue and collaborators demonstrated that among workers in jobs with high exposure intensity, high cumulative hours exposed to PCE were associated with increased risk of kidney cancer (third tertile vs. unexposed: OR, 3.1; 95% CI, 1.3,7.4).[97]

[119] Guyton KZ, et al. Human health effects of tetrachloroethylene: key findings and scientific issues. Environ Health Perspect. 2014;122(4):325-34.
[120] NTP. 1986. Toxicology and carcinogenesis studies of tetrachloroethylene (perchloroethylene) (CAS No. 127-18-4) in F344/N rats and B6C3F1 mice (inhalation studies). National Toxicology Program-technical report series no. 311. Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health. NIH publication no. 86-2567.
[121] Lash LH, et al. Modulation of hepatic and renal metabolism and toxicity of trichloroethylene and perchloroethylene by alterations in status of cytochrome P450 and glutathione. Toxicology. 2007;235(1-2):11-26.

- Using an analysis of bladder cancer epidemiology in the meta-analysis by Vlaanderen and coworkers, the association found between PCE and bladder cancer can be extended to urothelial carcinoma of the renal pelvis. That study demonstrated that dry cleaning work was associated with a statistically significant increase in bladder cancer risk, the overall mRR was 1.47 (95% CI; 1.16, 1.85). The study authors discussed that PCE could be responsible for the excess risk of bladder cancer because it is the primary solvent used in dry cleaning.[114]

2. *Consistency*
   - The 19 studies that have evaluated associations between inhaled PCE and kidney cancer as summarized in the 2019 ATSDR toxicological profile for tetrachloroethylene did not consistently observe increased risk.
   - The consistency criterion is met, however, by applying the Vlaanderen meta-analysis of bladder cancer as a proxy for urothelial carcinoma of the renal pelvis.
3. *Specificity* – see note above.
4. *Temporality* – see note above.
5. *Biological gradient*
   - The study of occupational risk factors for urothelial carcinoma by Pesch and colleagues progressively increased odd ratios with increasing levels of PCE exposure among men but not women.[59]
   - The study by Calvert and coworkers found a higher standardized mortality ratio (SMR) for exposure greater than 5 years compared to <5 years (SMR, 4.08; 95% CI, 2.13, 7.12; vs. SMR 0.53; 95% CI, 0.03, 2.52, respectively).[108]
6. *Plausibility* - The biologic plausibility of a link between exposure to PCE and kidney cancer has been established by laboratory animals and mechanistic studies.
   - Kidney cancer may in part be a result of the formation of genotoxic metabolites from either the CYP oxidation or GSH conjugation pathways or from cellular damage and regeneration due to glutathione depletion. Data from rat studies as well as in vitro studies of renal cells suggest that glutathione conjugation of PCE likely plays a significant role in PCE-induced renal toxicity.
   - PCE exposure via inhalation resulted in an increase in the combined incidence of benign and malignant tubular-cell kidney tumors in male F344/N rats.[119]
   - A low incidence of kidney cancer has been observed in male rats following inhalation exposure to PCE.[120]
7. *Coherence* – see note above
8. *Experiment*
   - Controlled studies of laboratory animals that developed kidney tumors after exposure to PCE easily satisfy the experiment criterion.
9. *Analogy* – see note above.

PCE Causality opinion

It is my opinion that there is equipoise and above evidence for a causal relationship between PCE exposure associated with drinking water at Camp Lejeune and kidney cancer. Although the 19 epidemiologic studies evaluated did not consistently demonstrate increased risk, the study by Purdue and collaborators demonstrated a strong and statistically significant association. In addition, elements of my evaluation of the Hill criteria including biologic plausibility by laboratory animals and mechanistic studies provided additional support for my opinion.

If an analysis were to apply bladder cancer epidemiology to transitional cell carcinoma of the renal pelvis, it is also my opinion that there is sufficient evidence for a causal relationship between PCE exposure associated with drinking water at Camp Lejeune and urothelial carcinoma of the renal pelvis. There was sufficient evidence from human studies from the Vlaanderen meta-analysis. In addition, elements of my evaluation of the Hill criteria including the dose-response observed in 2 studies provided additional support for my opinion.

Vinyl chloride (VC)

In the analysis internal to the Camp Lejeune cohort of military personnel with follow-up between 1979 and 2008), a nonmonotonic exposure-response trend was observed for VC and kidney cancer (*Table 9*).[36] Compared to those with no exposure to VC, the hazard ratios for the low, medium, and high exposure categories were, 1.66, 1.61, and 1.51, respectively.

The development of cancer in humans as a result of VC exposure was demonstrated in a number of studies of workers in the VC production industry.[122] The strongest evidence comes from the greater-than-expected incidences of liver angiosarcoma, a tumor type that is considered to be very rare in humans. The latency period for the development of hepatic angiosarcoma in workers exposed prior to 1974 ranges between 24 and 56 years.

IARC has determined that there is sufficient evidence in humans for the carcinogenicity of VC and that it causes angiosarcomas of the liver and hepatocellular carcinomas.[123]

[122] Toxicological Profile for Vinyl Chloride. Atlanta (GA): Agency for Toxic Substances and Disease Registry (US); 2024 Jan. Available from: https://www.ncbi.nlm.nih.gov/books/NBK601943/

[123] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. IARC monographs on the evaluation of carcinogenic risks to humans. Volume 97. 1,3-butadiene, ethylene oxide and vinyl halides (vinyl fluoride, vinyl chloride and vinyl bromide). IARC Monogr Eval Carcinog Risks Hum. 2008;97:3-471.

Two studies published in 2003, a review of epidemiologic literature and a meta-analysis, assessed cancer risk or cancer mortality associated with VC exposure but neither study included kidney or urothelial carcinoma of the renal pelvis in their evaluation.[124,125]

Hu and collaborators assessed the effect of occupational exposure to specific chemicals, including VC, on the risk of renal cell carcinoma in Canada.[126] They mailed questionnaires to obtain data on 1279 (691 male and 588 female) newly diagnosed, histologically confirmed RCC cases and 5370 population controls in 8 Canadian provinces, between 1994 and 1997. The study found an increased risk of RCC in males only associated with occupational exposure to benzene and vinyl chloride. Compared with no exposure to the specific chemical, the adjusted ORs were 1.8 (95% CI; 1.2, 2.6) and 2.0 (95% CI; 1.2, 3.3). The analysis for women was limited by the small number of cases and controls reporting the given chemical exposure. The study also found that the risk of RCC increased with duration of exposure to benzene and vinyl chloride (*Table 11*). Compared to study participants never exposed to VC, participants exposed for ≥20 years had the greatest odds of RCC (OR, 4.7; 95% CI, 1.9, 10.6) while for those exposed to VC for 1 to 4 years the odds of RCC were not significantly different than the never exposed (OR, 0.7; 95% CI, 0.2, 2.3).

Table 11. Adjusted odds ratios for RCC by years of exposure to benzene and vinyl chloride.[126]

Agent	*Cases (n)*	*Controls (n)*	*Adjusted OR[a] (95% CI)*	*P value for trend*
Benzene				
Never exposed	635	2582	1.0 (ref.)	0.001
1–5	11	39	1.1 (0.6–2.4)	
≥6	42	65	2.1 (1.3–3.2)	
Vinyl chloride				
Never exposed	661	2640	1.0 (ref.)	0.0006
1–4	4	20	0.7 (0.2–2.3)	
5–19	11	19	1.7 (0.8–3.8)	
≥20	14	10	4.5 (1.9–10.6)	

[a]Adjusted for 10 year age groups, province, education, BMI (<20, 20–27, >27), pack-years of smoking, alcohol use and total consumption of meat.

[124] Bosetti C, et al. Occupational exposure to vinyl chloride and cancer risk: a review of the epidemiologic literature. Eur J Cancer Prev. 2003;12(5):427-30.

[125] Boffetta P, et al. Meta-analysis of studies of occupational exposure to vinyl chloride in relation to cancer mortality. Scand J Work Environ Health. 2003;29(3):220-9.

[126] Hu J, et al. Renal cell carcinoma and occupational exposure to chemicals in Canada. Occup Med (Lond). 2002;52(3):157-64.

Animal studies and mechanistic information

The carcinogenicity of VC has been studied intensively and repeatedly in experimental animals and IARC has determined that there is sufficient evidence in experimental animals for the carcinogenicity of VC.[122,123]

In rats, chronic-duration exposure to 5–5,000 ppm VC vapors resulted in significantly increased incidence of mammary gland carcinomas, Zymbal's gland carcinomas, nephroblastoma, and liver angiosarcoma compared to controls.[127] Nephroblastoma, a kidney cancer also known as Wilms tumor, occurred with VC exposures as low as 25 ppm in a small number of animals (0.8%) but increased to effect approximately 10% of animals at higher doses (*Table 12*).

Table 12. Incidence of nephroblastoma in Sprague-Dawley rats in relation to concentration of VC administered by inhalation for 52 weeks.

Experiment	Concentration, ppm	Animals with NEPHRO-BL, %		
		M	F	Total
BT 6	30,000	–	–	–
BT 1	10,000	10.0	6.7	8.3
	6,000	13.8	3.3	8.5
	2,500	16.7	3.3	10.0
	500	6.7	13.3	10.0
	250	3.4	13.3	8.5
BT 2	200	8.3	3.3	5.8
	150	13.3	5.0	9.2
	100	13.3	3.3	8.3
BT 1, BT 9	50	–	1.1	0.6
BT 15	25	1.7	–	0.8
	10	–	–	–
	5	–	–	–
	1	–	–	–
Controls BT 1, BT 2, BT 9, BT 15	0	–	–	–

The metabolism of VC to its highly reactive metabolites, the observance of VC metabolites bound to DNA in mechanistic studies, and the observed carcinogenicity resulting from a single, high level inhalation exposure in animals, suggest that the primary mechanism for vinyl chloride carcinogenicity involves direct interaction with DNA rather than secondary responses to cytotoxicity.[122122] Two VC metabolites, 2-Chloroethylene oxide and 2-chloroacetaldehyde, can both react with DNA nucleotide bases. 2-Chloroethylene oxide is the more potent mutagen and may be the ultimate carcinogenic metabolite of VC.

[127]Maltoni C, et al. Carcinogenicity bioassays of vinyl chloride monomer: a model of risk assessment on an experimental basis. Environ Health Perspect. 1981;41:3-29.

Application of the Hill Criteria to the evidence to the cause of kidney cancer among plaintiffs exposed to VC contaminated drinking water at Camp Lejeune

1. *Strength of association*
   - The study by Hu and colleagues found that compared to study participants never exposed to VC, participants exposed for ≥20 years had 4.7 times the odds of renal cell carcinoma (OR, 4.7; 95% CI, 1.9, 10.6).[126]
2. *Consistency*
   - There was a paucity of studies conducted to investigate the relationship, so the consistency criterion was not met.
3. *Specificity*
   - Because kidney cancer arises from numerous known and unknown causes, there is not a high degree of specificity between VC exposure and kidney cancer.
4. *Temporality*
   - Temporality is met in that all studied cancers have arisen after exposure.
5. *Biological gradient*
   - In the Hu study, compared to study participants never exposed to VC, participants exposed for ≥20 years had the greatest odds of RCC (OR, 4.7; 95% CI, 1.9, 10.6) while for those exposed to VC for 1 to 4 years the odds of RCC were not significantly different than the never exposed (OR, 0.7; 95% CI, 0.2, 2.3).[126]
6. *Plausibility*
7. The biologic plausibility of a link between exposure to VC and kidney cancer has been established by laboratory animals.
   - In rats, chronic-duration exposure to 5–5,000 ppm VC vapors resulted in significantly increased incidence of nephroblastoma, a type of kidney cancer. Tumors occurred with VC exposures as low as 25 ppm in a small number of animals (0.8%) but increased to effect approximately 10% of animals at higher doses.[127]
8. *Coherence*
   - Kidney cancer is associated with other environmental causes, and thus it “makes sense” that VC exposure and kidney cancer would be associated.
9. *Experiment*
   - Controlled studies of laboratory animals that developed kidney tumors after exposure to VC easily satisfy the experiment criterion.
10. *Analogy*
    - As noted above, other environmental toxin exposures are associated with increased risk of kidney cancer, thus satisfying the analogy criterion.

VC Causality opinion

It is my opinion that there is equipoise and above evidence for a causal relationship between VC exposure associated with drinking water at Camp Lejeune and kidney cancer. Although there was a paucity of studies conducted to investigate the relationship, the study by Hu and colleagues demonstrated a strong and statistically significant association. In addition, elements of my evaluation of the Hill criteria including biologic plausibility by studies of laboratory animals provided additional support for my opinion.

Benzene

In the analysis of the Camp Lejeune cohort of military personnel, a nonmonotonic exposure-response trend was observed for benzene and kidney cancer (*Table 9*).[36] Compared to those with no exposure to benzene, the hazard ratios for the low, medium, and high exposure categories were, 1.31, 1.38, and 1.36, respectively.

The evidence available on the association between occupational exposure to benzene and cancer of the kidney was reviewed by IARC in 2012 and judged to be inadequate at that time.[128] Two studies were provided as examples: a case–control study among males in Germany by Pesch and associates found an association between exposure to benzene and an increased risk for kidney cancer (et al., 2000),[59] but in a study in Montreal, Canada by Gérin and coworkers, there was little evidence of an association.[129]

In the more recent IARC monograph on benzene in 2018 IARC the consensus was that the results of the studies that they reviewed generally do not show a consistent association, although several studies did report elevated but not statistically significant risks for cancer of the kidney.[130] A study by Greenland and colleagues was among studies highlight in the 2018 monograph in which an odds ratio of 4.29 (95% CI, 1.33, 13.8) for death from cancer of the kidney was reported for transformer manufacturing facility workers directly exposed to benzene compared with workers who were unexposed or indirectly exposed.[131]

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[128] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Chemical agents and related occupations. IARC Monogr Eval Carcinog Risks Hum. 2012;100(Pt F):9-562.

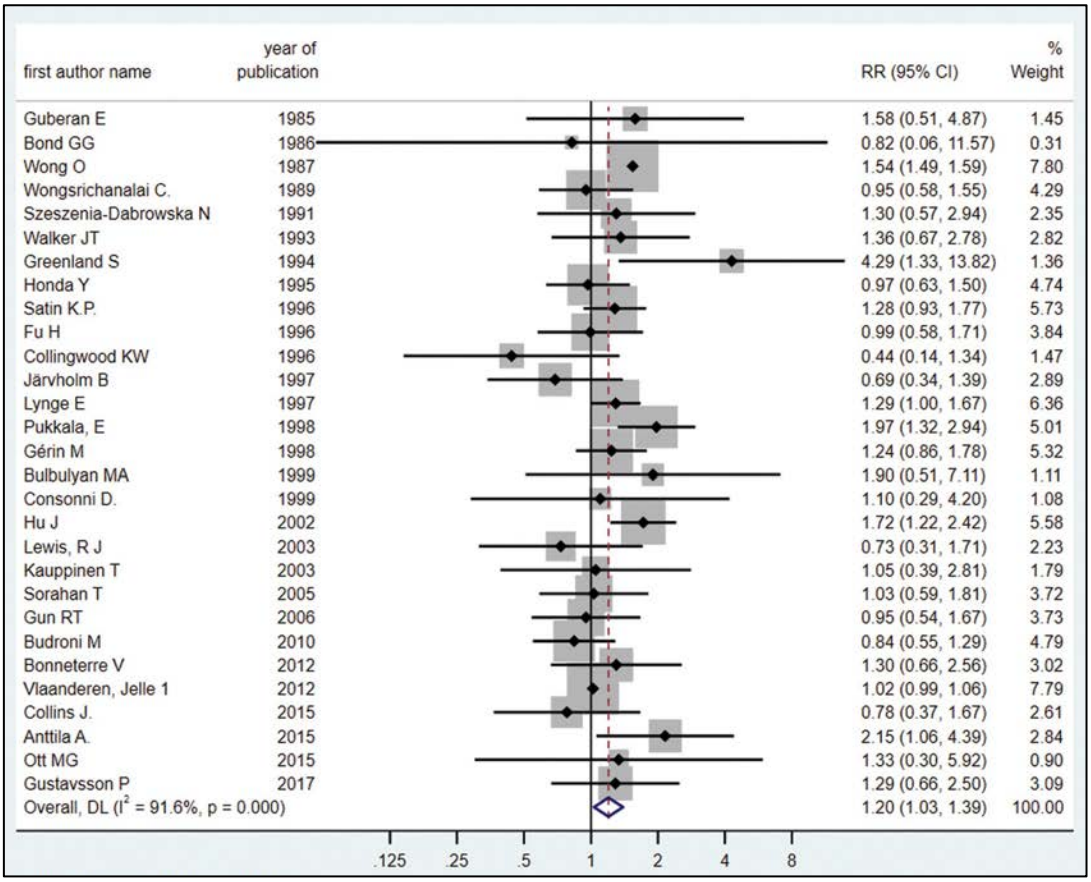
[129] Gérin M, et al. Associations between several sites of cancer and occupational exposure to benzene, toluene, xylene, and styrene: results of a case-control study in Montreal. Am J Ind Med. 1998;34(2):144-56.

[130] IARC Working Group on the Evaluation of Carcinogenic Risks to Humans. Benzene. Lyon (FR): International Agency for Research on Cancer; 2018. (IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, No. 120.)

[131] Greenland S, et al. A case-control study of cancer mortality at a transformer-assembly facility. Int Arch Occup Environ Health. 1994;66(1):49-54.

In contrast to the IARC consensus, a recent systematic review and meta-analysis of occupational cohort and case–control studies, Seyyedsalehi and coworkers evaluates the association between exposure to benzene and kidney, and urinary tract cancer incidence and mortality.[132] The study included all studies that were reported in the 2018 IARC monograph on benzene exposure as well as studies reported after that publication. A forest plot of the associations between benzene exposure and kidney and urinary tract cancer is shown in *Figure 9*. Their analysis revealed a significant association between exposure of occupational benzene and kidney and urinary tract cancer with summary relative risk of 1.20 (95% CI, 1.03, 1.39). Publication bias was excluded through the Egger test for kidney cancer studies ($P = 0.809$).

Figure 9. Forest plot of the associations between benzene exposure and kidney and urinary tract cancer.[132]



[132] Seyyedsalehi MS, et al. Occupational benzene exposure and risk of kidney and bladder cancers: a systematic review and meta-analysis. Eur J Cancer Prev. 2024 Aug 20. doi: 10.1097/CEJ.0000000000000911.

Guberan 1985,[133] Bond 1986,[134] Wong 1987,[135] Wongsrichanalai 1989,[136] Szeszenia-Dabrowska 1991,[137] Walker 1993,[138] Greenland 1994,[131] Honda 1995,[139] Collingwood 1996,[140] Fu 1996,[141] Satin 1996,[142] Järvholm 1997,[143] Lynge 1997,[144] Gérin 1998, Bulbulyan 1999,[145] Consonni 1999,[146] Hu 2002,[126] Kauppinen 2003,[147] Lewis 2003,[148] Sorahan 2005,[149] Gun 2006,[150] Budroni 2011,[151] Bonneterre 2012,[152] Vlaanderen 2013,[93] Anttila 2015,[153] Collins 2015,[154] Ott 1978,[155] Gustavsson 2017.[156]

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[133] Guberan E, Raymond L. Mortality and cancer incidence in the perfumery and flavour industry of Geneva. Br J Ind Med. 1985;42(4):240-5.
[134] Bond GG, et al. An update of mortality among chemical workers exposed to benzene. Br J Ind Med. 1986;43(10):685.
[135] Wong O. An industry wide mortality study of chemical workers occupationally exposed to benzene. II. Dose response analyses. Br J Ind Med. 1987;44(6):382-95.
[136] Wongsrichanalai C, et al. Mortality from leukemia and other diseases among workers at a petroleum refinery. J Occup Med. 1989;31(2):106-11.
[137] Szeszenia-Dabrowska N, et al. Cancer mortality among male workers in the Polish rubber industry. Pol J Occup Med Environ Health. 1991;4(2):149-57.
[138] Walker JT, et al. Mortality of workers employed in shoe manufacturing. Scand J Work Environ Health. 1993;19(2):89.
[139] Honda Y, et al. An updated study of mortality among workers at a petroleum manufacturing plant. J Occup Environ Med. 1995;37(2):194-200.
[140] Collingwood KW, et al. An updated cohort mortality study of workers at a northeastern United States petroleum refinery. Int Arch Occup Environ Health. 1996;68(5):277-88.
[141] Fu H, et al. Cancer mortality among shoe manufacturing workers: an analysis of two cohorts. Occup Environ Med. 1996;53(6):394-8.
[142] Satin KP, et al. A 50-year mortality follow-up of a large cohort of oil refinery workers in Texas. J Occup Environ Med. 1996;38(5):492-506.
[143] Järvholm B, et al. Cancer incidence of workers in the Swedish petroleum industry. Occup Environ Med. 1997;54(9):686-91.
[144] Lynge E, et al. Risk of cancer and exposure to gasoline vapors. Am J Epidemiol. 1997;145(5):449-58.
[145] Bulbulyan MA, et al. Cancer mortality among women in the Russian printing industry. Am J Ind Med. 1999;36(1):166.
[146] Consonni D, et al. Mortality study in an Italian oil refinery: extension of the follow-up. Am J Ind Med. 1999;35(3):287.
[147] Kauppinen T, et al. Exposure to chemical carcinogens and risk of cancer among Finnish laboratory workers. Am J Ind Med. 2003;44(4):343-50.
[148] Lewis RJ, et al. Mortality and cancer morbidity in a cohort of Canadian petroleum workers. Occup Environ Med. 2003;60(12):918-28.
[149] Sorahan T, et al. Cancer risks in a historical UK cohort of benzene exposed workers. Occup Environ Med. 2005;62(4):231-6.
[150] Gun RT, et al. Update of mortality and cancer incidence in the Australian petroleum industry cohort. Occup Environ Med. 2006;63(7):476-81.
[151] Budroni M, et al. [Cancer incidence among petrochemical workers in the Porto Torres industrial area, 1990-2006]. Med Lav. 2010;101(3):189-98. Italian.
[152] Bonneterre V, et al. Cancer incidence in a chlorochemical plant in Isère, France: an occupational cohort study, 1979-2002. Am J Ind Med. 2012;55(9):756-67.
[153] Anttila A, et al. Kidney cancer risk in oil refining in Finland: a nested case-referent study. J Occup Environ Med. 2015;57(1):68-72.
[154] Collins JJ, et al. Lymphatic and hematopoietic cancers among benzene-exposed workers. J Occup Environ Med. 2015;57(2):159-63.
[155] Ott MG, et al. Mortality among individuals occupationally exposed to benzene. Arch Environ Health. 1978;33(1):3-10.
[156] Gustavsson P, et al. Cancer incidence in female laboratory employees: extended follow-up of a Swedish cohort study. Occup Environ Med. 2017;74(11):823-826.

The results from 3 epidemiologic studies evaluated a possible dose-response relationship between benzene and kidney cancer are summarized in *Table 13*. Only the study by Wong and coworkers provided evidence suggesting a dose-dependent effect.[135] Seyyedsalehi and colleagues associated combined the findings from these studies and did not find a significant dose-related trend for kidney cancer (*P*-trend = 0.39).[132]

Table 13. Results from epidemiologic studies evaluating a possible dose-response relationship between benzene and kidney cancer. (MPE, maximum peak exposure)

Author, publication year	benzene exposure level	RR (95% CI)
Gérin, 1998[129]	Low Medium/High	1.2 (0.7, 1.9) 1.3 (0.7, 2.4)
Pesch, 2000[64]	Medium High	1.26 (1.05, 1.51) 1.24 (1.0, 1.54)
Vlaanderen, 2012[93]	Low (First Tertile) Medium (Second Tertile) High (Third Tertile)	1 (0.94, 1.06) 1 (0.95, 1.96) 1.06 (1, 1.12)
Wong, 1987[135]	Medium (25 to 100 ppm MPE) High (>100 ppm MPE)	0.83 (0.06, 5.94) 1.54 (0.15, 1.59)

As mentioned in the VC section above, Hu and colleagues found a dose-response increase in RCC risk with increased duration of self-reported benzene exposure (*Table 12*).[126] Compared to study participants never exposed to benzene, participants exposed for ≥6 years had the greatest odds of RCC (OR, 2.1; 95% CI, 1.3, 3.2) while for those exposed to benzene for 1 to 5 years the odds of RCC were not significantly different than the never exposed (OR, 1.1; 95% CI, 0.6, 2.4).

Animal studies and mechanistic information

Studies on the carcinogenesis of benzene in rats and mice after exposure by inhalation, intragastric gavage, skin application, and by intraperitoneal or subcutaneous injection have been reviewed in IARC Monographs and it was concluded that there is sufficient evidence in experimental animals for the carcinogenicity of benzene. Benzene has long been recognized as a cause of leukemia and has been classified as a group 1 carcinogen by the IARC.[130]

In male and female mice, several whole-body inhalation studies reported the induction of tumors of the hematopoietic and lymphoid tissues, Zymbal gland carcinoma, squamous cell carcinoma of the preputial gland, forestomach squamous cell carcinoma, and lung adenoma.[157] The oral administration studies reported the induction of tumors of the hematopoietic and lymphoid tissues, lung alveolar or

[157] Loomis D, et al. Carcinogenicity of benzene. Lancet Oncol. 2017;18(12):1574-1575.

bronchiolar adenoma and carcinoma, hepatocellular adenoma and carcinoma, squamous cell carcinoma of the Zymbal gland, adenoma and carcinoma of the Harderian gland, preputial gland carcinoma, ovarian tumors, malignant mammary gland tumors in females only, forestomach squamous cell tumors, and pheochromocytoma of the adrenal gland.[158] None of the studies of cancer in experimental animals reviewed in the 2018 IARC monograph on benzene described exposure-associated kidney tumors

Benzene is easily absorbed, widely distributed, and extensively metabolized, yielding a complexity of reactive electrophiles via multiple metabolic pathways in various tissues, including bone marrow (*Figure 5*, page 21).[157] Benzene exhibits many of the key characteristics of carcinogens. For example, there is evidence that benzene is metabolically activated, induces oxidative stress, is genotoxic, is immunosuppressive, and causes hepatotoxicity. In addition, strong evidence from experimental studies shows that benzene causes genomic instability, inhibiting topoisomerase II; modulates receptor-mediated effects relevant to aryl hydrocarbon receptor, and induces apoptosis.

In people that are exposed, benzene metabolite-protein adducts are formed in blood. Additionally, benzene induces oxidative stress in exposed humans, human cells, and mouse bone marrow. In studies of occupationally exposed humans, benzene induces oxidative DNA damage, DNA strand breaks, gene mutations, chromosomal aberrations, and micronuclei. Specific cytogenetic changes induced in exposed humans include aneuploidy, translocations, and various other structural chromosome changes. In the bone marrow of experimental animals exposed in vivo, benzene induces DNA adducts, chromosomal aberrations, and micronuclei. Similarly, in human cells in vitro, benzene or its metabolites induce DNA adducts, DNA damage, and chromosomal aberrations.

Application of the Hill Criteria to the evidence to the cause of kidney cancer among plaintiffs exposed to benzene contaminated drinking water at Camp Lejeune

1. *Strength of association*
   - A study by Greenland and colleagues found an odds ratio of 4.29 (95% CI, 1.33, 13.8) for death from cancer of the kidney for transformer manufacturing facility workers directly exposed to benzene compared with workers who were unexposed or indirectly exposed.
   - The meta-analysis Seyyedsalehi and coworkers found a significant association between exposure of occupational benzene and kidney and urinary tract cancer with summary relative risk of 1.20 (95% CI, 1.03, 1.39).[132]

[158] National Toxicology Program. NTP Toxicology and Carcinogenesis Studies of Benzene (CAS No. 71-43-2) in F344/N Rats and B6C3F1 Mice (Gavage Studies). Natl Toxicol Program Tech Rep Ser. 1986;289:1-277.

2. *Consistency*
   - The Seyyedsalehi meta-analysis of 29 studies satisfies the consistency criterion.
3. *Specificity*
   - Because kidney cancer arises from numerous known and unknown causes, there is not a high degree of specificity between benzene exposure and kidney cancer.
4. *Temporality*
   - Temporality is met in that all studied cancers have arisen after exposure.
5. *Biological gradient*
   - In the Hu study, compared to study participants never exposed to benzene, participants exposed for ≥6 years had the greatest odds of renal cell carcinoma (OR, 2.1; 95% CI, 1.3, 3.2) while for those exposed to benzene for 1 to 5 years the odds of RCC were not significantly different than the never exposed (OR, 1.1; 95% CI, 0.6, 2.4).).[126]
6. *Plausibility*
   - Although no studies were identified in which kidney tumors were induced by benzene exposure of laboratory animals, induction of tumors in many other organs and tissues has been demonstrated through multiple routes of exposure. These include cancers of hematopoietic and lymphoid tissues, lung alveolar or bronchiolar adenoma and carcinoma, hepatocellular adenoma and carcinoma, squamous cell carcinoma of the Zymbal gland, adenoma and carcinoma of the Harderian gland, preputial gland carcinoma, ovarian tumors, malignant mammary gland tumors in females, forestomach, squamous cell tumors, and pheochromocytoma of the adrenal gland.
7. *Coherence*
   - Kidney cancer is associated with other environmental causes, and thus it “makes sense” that benzene exposure and kidney cancer would be associated.
8. *Experiment*
   - Controlled studies of laboratory animals that developed tumors after exposure to benzene easily satisfy the experiment criterion.
9. *Analogy*
   - As noted above, other environmental toxin exposures are associated with increased risk of kidney cancer, thus satisfying the analogy criterion.

Benzene Causality opinion

It is my opinion that there is equipoise and above evidence for a causal relationship between benzene exposure associated with drinking water at Camp Lejeune and kidney cancer. Although the meta-analysis Seyyedsalehi and coworkers found a significant association, a review by IARC in 2012 that included most of the same studies judged the evidence to be inadequate at that time. In addition, the limited evidence of a dose-response from epidemiologic studies and well as the lack of animal studies

demonstrating kidney tumors induction by benzene exposure contributed to my decision not to opine sufficient evidence for causation.

Combined effect of the 4 volatile organic compounds (TVOCs) contaminating drinking water at Camp Lejeune

Epidemiologic studies have demonstrated associations between exposure to contaminated drinking water at Camp Lejeune and several cancers and chronic diseases. Because the water was contaminated by TCE, PCE, VC, and benzene, it is difficult to determine with certainty which chemical, or combination of chemicals, caused a given health outcome. Consequently, epidemiologic studies of populations with a single chemical exposure are reviewed for evidence of disease-specific causality. Laboratory and mechanistic studies of a given chemical provide additional insight. Evaluation of epidemiologic studies, animal models, and mechanistic studies were components of the methodology utilized in the chemical-specific causality assessments in the previous sections. In the following section, I will utilize the Hill criteria to evaluate evidence of a causal association between kidney cancer and exposure to Camp Lejeune drinking water contaminated with a combination of TCE, PCE, VC, and benzene.

Note: the discussion of the specificity, temporality, coherence, and analogy criteria in TCE section are applicable to the broader issue of kidney cancer etiology related to environmental exposures and therefore will not be repeated here.

Application of the Hill Criteria to the evidence to the cause of kidney cancer among plaintiffs exposed to the combination of 4 TVOCs that contaminated the drinking water at Camp Lejeune

1. *Strength of association*
   - As shown in *Table 5*, results for studies by Bove and collaborators demonstrated that for the follow-up period 1979-2018 Camp Lejeune military personnel had elevated risk for kidney cancer mortality compared to military personnel at Camp Pendleton (aHR, 1.21; 95% CI, 0.95, 1.54).
   - Similarly, civilian workers employed at Camp Lejeune had elevated risk for kidney cancer mortality compared to civilian workers at Camp Pendleton (aHR, 1.44; 95% CI, 0.73, 2.84). The precision of the aHR estimates, assessed by the width of the 95% CI, was higher when the sample size was greater (military vs. civilian) and when the follow-up period was longer.
   - The study of cancer incidence by Bove showed modest elevations in hazard ratios for kidney cancer among civilian workers at Camp Lejeune compared to those at Camp Pendelton (aHR, 1.12; 95% CI, 0.76, 1.67; CIR, 2.2).[41]

2. *Consistency*
   - The elevated risk of kidney cancer mortality was found for both military personnel and civilian workers at Camp Lejeune. These findings demonstrate consistency.
   - The elevated risk of kidney cancer mortality was found for both follow-up periods, further demonstrating consistency.
   - Less consistency was seen in kidney cancer incidence findings between civilian workers and military personnel. For military personnel, hazard ratios were below the 1.1 threshold but still elevated with a narrow confidence interval (aHR, 1.06; 95% CI, 0.95, 1.25; CIR, 1.2).[41]
3. *Specificity* – see note above.
4. *Temporality* – see note above.
5. *Biological gradient*
   - In analyses internal to the Camp Lejeune cohort, a monotonic exposure-response relationship for kidney cancer and the categorized cumulative exposure variable for total volatile organic compounds was observed (*Table 7*).The hazard ratios increased with increased exposure; 1.42, 1.44, and 1.54 for low, medium and high exposure groups, respectively (corresponding to low, >1-4,600 μg/L; medium, >4,600-12,250; and high, >12,250-64,016).
6. *Plausibility*
   - Plausibility was demonstrated by animal and mechanistic studies of the individual chemical contaminants and therefore also apply to the mixtures of contaminants found in Camp Lejeune water.
7. *Coherence* – see note above.
8. *Experiment*
   - The Camp Lejeune epidemiologic studies adjusted the analyses for confounding factors and performed sensitivity analyses. Both of these tools can be construed as experimental methods.
9. *Analogy* – see note above.

TVOC Causality opinion

It is my opinion that there is sufficient evidence for a causal relationship between exposure to the combination of contaminants (TVOCs) in the drinking water at Camp Lejeune and kidney cancer.

An additional consideration for the Camp Lejeune population is the potential impact of exposure to a combination of chemical contaminants and a possible synergistic effect. Mauderly and Samet reviewed selected published literature to determine whether synergistic effects of combinations of

pollutants on health outcomes has been demonstrated.[159] Fourteen of 36 studies demonstrated synergism, although synergistic, additive, and antagonistic effects were sometimes observed among different outcomes or at different times after exposure.

Plausibility of kidney cancer related to the level and duration of exposures among military personnel and civilian workers at Camp Lejeune

The preceding sections provide the details of my analysis of evidence for a general causal relationship between exposure to the volatile organic compounds found contaminating the drinking water at Camp Lejeune and the subsequent risk of kidney cancer among the exposed. Based upon the results of these analyses I have opined that there is equipoise or better evidence for a causal relationship. My analysis thus far, however, has not considered whether the contaminant-associated exposures experienced by the military personnel and civilian workers at Camp Lejeune occurred at sufficient levels and duration to cause kidney cancer. In the following section I will review that evidence.

Timing and location of exposure:[36]

Bove and coworkers summarized the estimated mean monthly contaminant concentrations between January 1975 and February 1985 in the Tarawa Terrace and Hadnot Point systems (*Table 14* and *Table 15*, respectively). The level of a given contaminant in the drinking water varied by the water system (Tarawa Terrace vs. Hadnot Point) and by calendar year.

Estimated monthly mean concentrations of PCE in the Tarawa Terrace distribution system during this period ranged from 0 to 158 ppb with a median of approximately 85 ppb (*Table 14*). PCE was the primary contaminant in the Tarawa Terrace system. The levels of PCE and VC exceeded the MCL in 89% of the months between 1975 and 1985.

Estimated mean monthly concentrations of TCE in the Hadnot Point distribution system during this period ranged from 0 to 783 ppb, with a median level of approximately 366 ppb (*Table 15*). TCE was the main contaminant in the Hadnot Point system although estimated monthly levels of PCE and vinyl chloride were often considerably above their MCLs, with median estimates during this period of 15 ppb and 22 ppb, respectively. The levels of PCE, TCE, VC, and benzene exceeded the MCL in 84%, 92%, 92%, and 48% of the months between 1975 and 1985, respectively.

[159] Mauderly JL, Samet JM. Is there evidence for synergy among air pollutants in causing health effects? Environ Health Perspect. 2009;117(1):1-6.

Table 14. Estimated monthly average contaminant concentrations in the Tarawa Terrace system, 1975 – 1985. Tetrachloroethylene (italicized) was the primary contaminant.

	contaminant concentrations (ppb)				
Contaminant	**Mean**	**Median**	**Range**	**# Months >MCL**	**# Months >100 ppb**
1975 – 1985 (132 months)					
Tetrachloroethylene	*75.7*	*84.9*	*0 - 158.1*	*117*	*16*
Trichloroethylene	3.1	3.5	0 - 6.6	11	0
Vinyl chloride	5.6	6.2	0 - 12.3	117	0
1975 – 1979 (60 months)					
Tetrachloroethylene	*68.3*	*68.2*	*43.8 - 94.8*	*60*	*0*
Trichloroethylene	2.8	2.9	1.7 - 3.9	0	0
Vinyl chloride	5.2	5.5	2.6 - 7.3	60	0
Jan 1980 – Jan 1985 (61 months)					
Tetrachloroethylene	*96.1*	*95.5*	*0 - 158.1*	*57*	*16*
Trichloroethylene	3.9	3.9	0 - 6.6	11	0
Vinyl chloride	7	7	0 - 12.3	57	0

Table 15. Estimated monthly average contaminant concentrations in the Hadnot Point system, 1975 – 1985. Trichloroethylene (italicized) was the primary contaminant.

	contaminant concentrations (ppb)				
Contaminant	**Mean**	**Median**	**Range**	**# Months >MCL**	**# Months >100 ppb**
1975 – 1985 (132 months)					
Tetrachloroethylene	15.7	15.4	0 - 38.7	111	0
Trichloroethylene	*358.7*	*365.9*	*0 - 783.3*	*122*	*113*
Vinyl chloride	24	22.2	0 - 67.3	122	0
Benzene	5.4	4.6	0 - 12.2	63	0
1975 – 1979 (60 months)					
Tetrachloroethylene	12.2	12	1.4 - 24.1	53	0
Trichloroethylene	*325.1*	*327.7*	*60.6 - 546.3*	*60*	*55*
Vinyl chloride	17.3	16.5	2.3 - 33.4	60	0
Benzene	3.5	3.4	0 - 5.8	4	0
Jan 1980 – Jan 1985 (61 months)					
Tetrachloroethylene	21.5	21.4	2.2 - 38.7	58	0
Trichloroethylene	*449.2*	*446.2*	*42.6 - 783.3*	*62*	*58*
Vinyl chloride	34.3	35.7	4.2 - 67.3	62	0
Benzene	7.6	7.6	1.6 - 12.2	59	0

I have reviewed the ATSDR water modeling that is publicly available, as well as the exhibits to Plaintiff's expert Morris Maslia, which have the same data. This data is consistent with the data I have seen in the studies from ATSDR and Bove.

Levels of contaminants that have been associated with hazards to humans and causal relationship to kidney cancer

Moore and coworkers showed that average exposures to TCE at levels at or exceeding 76 ppb were associated with a significantly increased risk of renal cancer (OR, 2.41; 95% CI, 1.05, 5.56).[88] The risk associated with TCE exposures <76 ppb was also elevated (OR, 1.73) but the difference was not statistically significant. The mean TCE concentration in the Hadnot Point system was 358.7 ppb between 1975 and 1985.

The Moore study also found that exposure to TCE for ≥1,080 hours (corresponding to 135 8-hour workdays) was also associated with a significantly increased risk of renal cancer (OR, 2.86; 95% CI, 1.31, 6.23). The risk associated with TCE exposures <1,080 hours was also elevated (OR, 1.22 but the difference was not statistically significant. Camp Lejeune military personnel residing in areas serviced by the Hadnot Point system were exposed to contaminated water for an average of approximately 1.5 years and civilian workers for an average of 4.7 years.

Andrew and associates found that the 50th-75th percentile of study participants were exposed to TCE at levels more than 0 but less than 27.3 ppb, over a 15-year period. That group was associated with increased kidney cancer risk (adjusted OR, 1.78; 95% CI, 1.05, 3.03), compared to less than the 50th percentile (0 ppb TCE).[98]

In a population-based case-control study Aschengrau and collaborators evaluated the relationship between cases of kidney cancer and exposure to PCE from public drinking water.[160] They reported that cumulative relative delivered dosages between 27.1 and 44.1 mg PCE were associated with elevated risk of kidney cancer (crude odds ratio, 1.36) compared to unexposed, although the difference was not statistically significant (95% CI, 0.45, 3.45).

[160] Aschengrau A, et al. Cancer risk and tetrachloroethylene-contaminated drinking water in Massachusetts. Arch Environ Health. 1993;48(5):284-92.

Conclusions

The results of the preceding comprehensive and critical review of the relevant scientific and epidemiologic evidence support a general causal relationship between exposure to drinking water contaminated with volatile organic compounds at Camp Lejeune and kidney cancer.

Furthermore, based upon the results of my analysis, it is my opinion that the military personnel and civilian workers at Camp Lejeune between 1953 and 1987 had the potential to be exposed to toxic volatile organic compounds in their drinking water at levels sufficient to cause kidney cancer. Factors impacting the level of exposure for a given person include the water system utilized at Camp Lejeune, the calendar years of exposure, the number of years on the base, and the amount of water consumed.

The following are my opinions regarding the specific contaminating volatile organic compounds:

- Sufficient evidence for a causal relationship between trichloroethylene exposure and kidney cancer.
- Equipoise and above evidence for a causal relationship between tetrachloroethylene exposure and kidney cancer.
- Sufficient evidence for a causal relationship between tetrachloroethylene exposure and urothelial carcinoma of the renal pelvis.
- Equipoise and above evidence for a causal relationship between vinyl chloride exposure and kidney cancer.
- Equipoise and above evidence for a causal relationship between benzene exposure and kidney cancer.
- Sufficient evidence for a causal relationship between exposure to the combination of 4 chemical contaminants in the water at Camp Lejeune and kidney cancer.
- Although MCL levels are useful as a *component* of the preceding analysis, they cannot nor are they intended to serve as a substitute for a thorough and balanced causal analysis utilizing the Hill criteria, as described throughout this report.

The preceding opinions were given as reasonable medical and scientific probabilities.

Very truly yours,

Michael D. Freeman, MedDr, PhD, MScFMS, MPH, FRCPath, FFFLM, FACE, FRSPH, DLM

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Clinical Professor of Forensic Psychiatry
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Fellow, Royal College of Pathologists (UK)
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Fellow, American College of Epidemiology
Fellow, Royal Society of Public Health (UK)

Appendix

Figure A1. Forest plot displaying the results of studies evaluating the association between TCE exposure and subsequent kidney cancer and included in the EPA meta-analysis by Scott and Jinot.[6161]

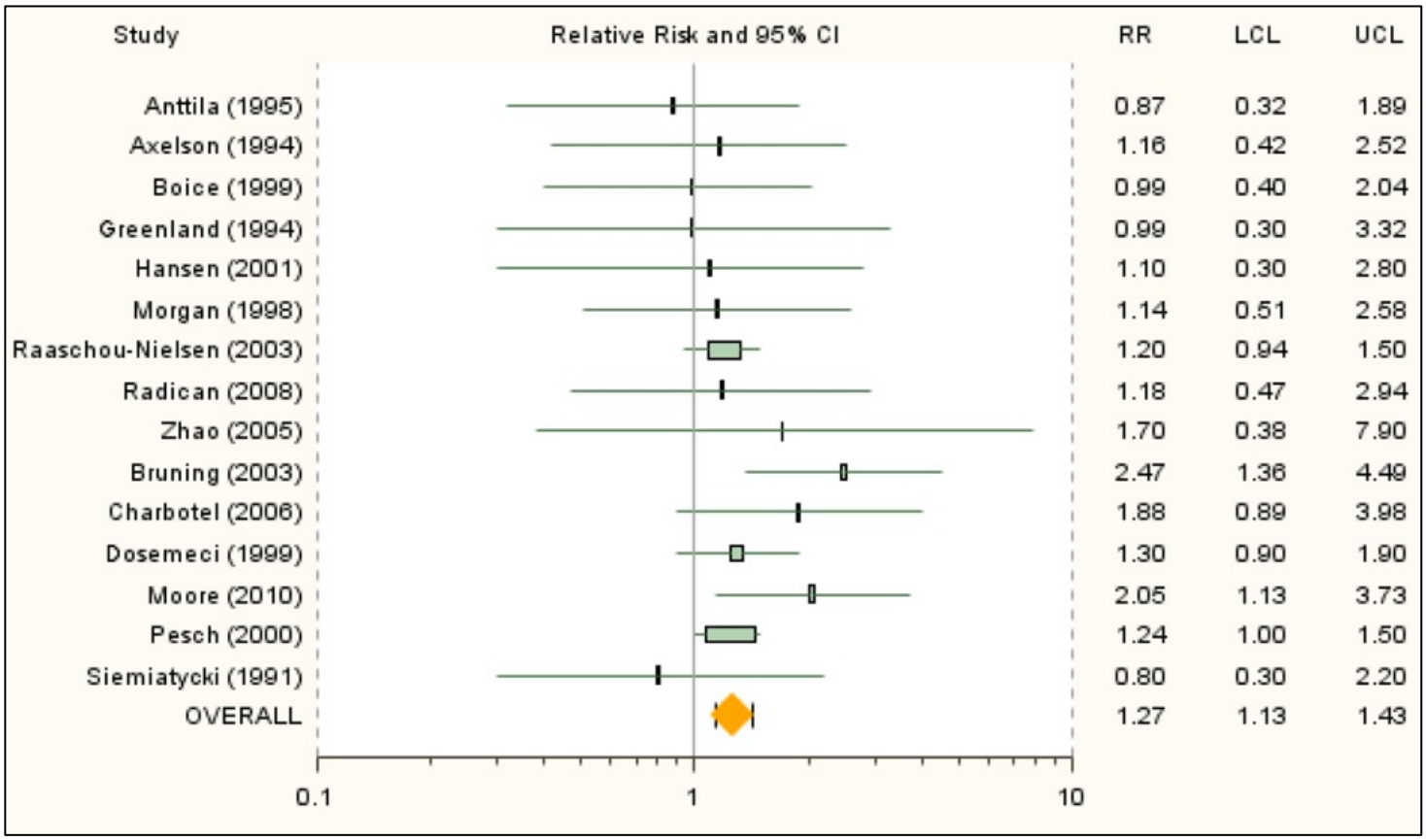


Figure A2. Forest plot displaying the results of studies evaluating the association between TCE exposure and subsequent kidney cancer and included in the meta-analysis by Karami and collaborators.[62]

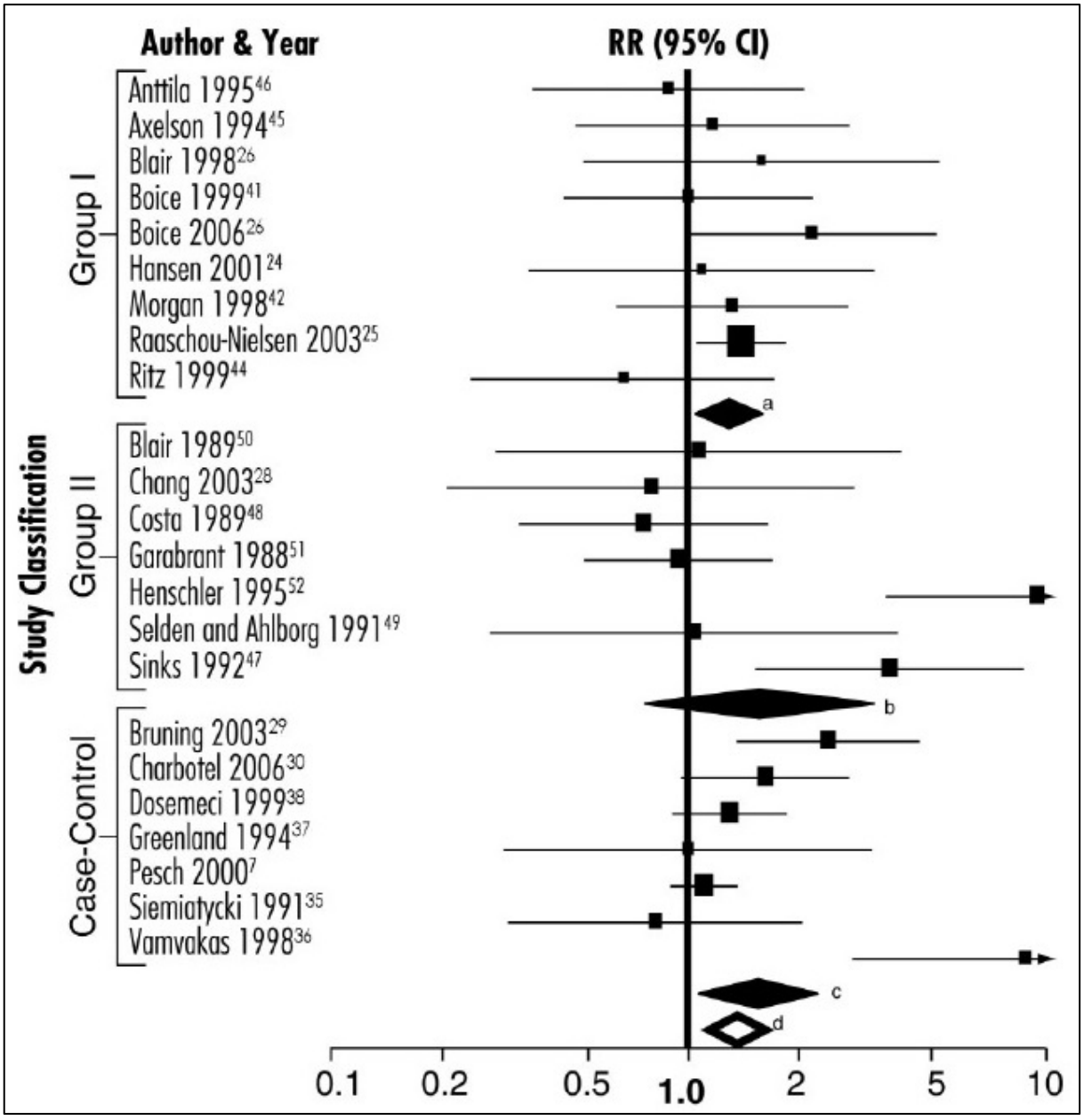
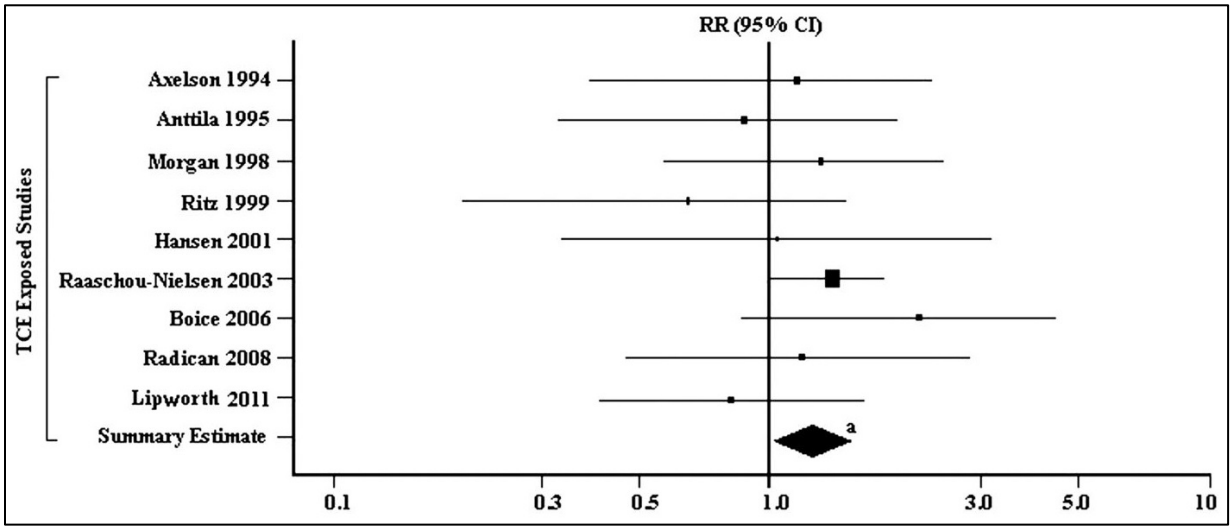
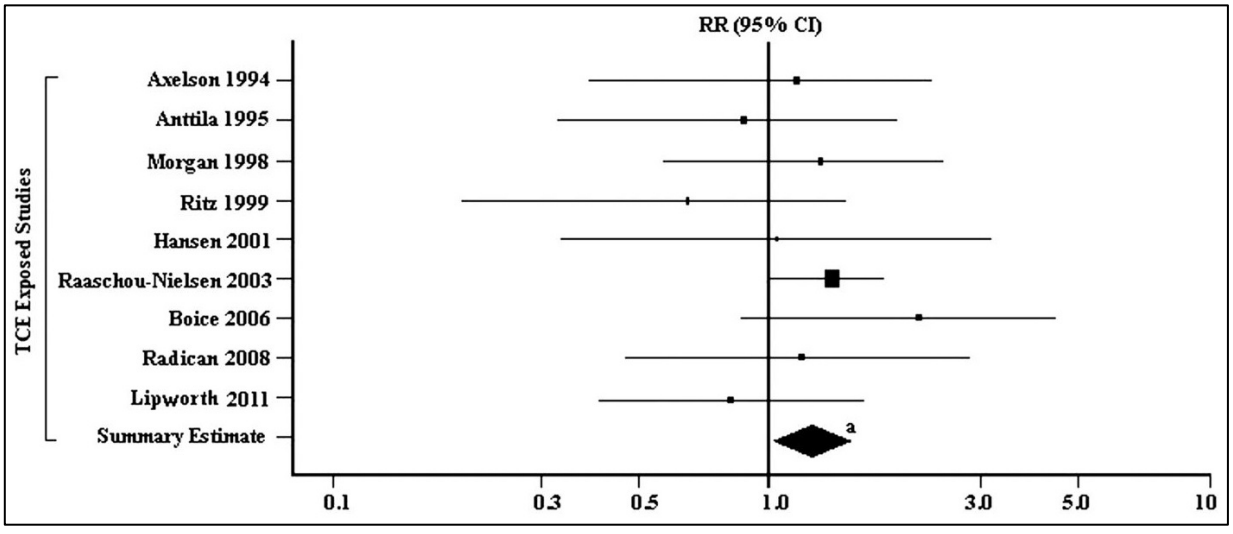


Figure A3. Forest plot displaying the results of studies evaluating the association between TCE exposure and subsequent kidney cancer and included in the meta-analysis by Kelsh and associates.[63]

a. Cohort studies



b. Case-control studies



DR. FREEMAN'S RELIANCE FILES

IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF NORTH CAROLINA
SOUTHERN DIVISION

IN RE:	)	
	)	
CAMP LEJEUNE WATER LITIGATION	)	
	)	
This Document Relates to:	)	Case Nos.:
	)	
ALL CASES	)	7:23-CV-897
	)	
DAVID DOWNS	)	7:23-CV-01145-BO
	)	
DAVID WILLIAM FANCHER	)	7:23-CV-00275-BO-BM
	)	
ALLAN WAYNE HOWARD	)	7:23-CV-00490-BO
	)	
FRANK W. MOUSSER	)	7:23-CV-00667-BO-RN
	)	
JACQUELINE JORDAN TUKES	)	7:23-CV-01553-BO-BM

PLAINTIFFS' DESIGNATION AND DISCLOSURE OF PHASE II EXPERT WITNESSES WITH RESPECT TO KIDNEY CANCER

MICHAEL D. FREEMAN'S RELIANCE FILES

Pursuant to Fed. R. Civ. P. 26(a)(2)(B)(ii) and the Stipulated Order Regarding Expert Discovery (Case Management Order No. 17) (D.E. 305), Plaintiffs hereby identify the facts, data, and publications considered by Michael D. Freeman ("Dr. Freeman") in forming his opinions concerning general causation and kidney cancer.

1. Dr. Freeman's report, produced contemporaneously herewith, contains a thorough statement of the facts, data, and publications that he considered in forming his opinions, and Plaintiffs incorporate all facts, data, and publications referenced in Dr. Freeman's report as if fully listed herein.

2. Dr. Freeman reserves the right to review and consider additional facts, data and publications.

3. Dr. Freeman reserves the right to consider the report of any other witness in this action.

4. Dr. Freeman reserves the right to supplement this list of reliance files.

DR. FREEMAN'S CV

CURRICULUM VITAE
MICHAEL D. FREEMAN

December 2024

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EDUCATION:
Doctor of Medicine (Med.Dr.)
Faculty of Medicine, Umeå University, Umeå, Sweden

Doctor of Philosophy (Ph.D.) Public Health/ Epidemiology
Oregon State University, Corvallis, Oregon

Master of Science in Forensic Medical Science (MScFMS)
Academy of Forensic Medical Sciences, London, England
University of Verona, Verona, Italy

Master of Public Health (MPH), Epidemiology/ Biostatistics
Oregon State University, Corvallis, Oregon

Doctor of Chiropractic (DC)
University of Western States, Portland, Oregon

Bachelor of Science (BS) General Science
University of Oregon, Eugene, Oregon

FORENSIC MEDICINE QUALIFICATIONS:
David Jenkins Memorial Professor and Chair in Forensic and Legal Medicine
Faculty of Forensic and Legal Medicine, Royal College of Physician (2024-25)

Fellow, Royal College of Pathologists (FRCPath)
Royal College of Pathologists, London, United Kingdom, 2023 to present

Fellow, Faculty of Forensic and Legal Medicine (FFFLM)
Royal College of Physicians, London, United Kingdom, 2022 to present (FRCP equivalent)

Member, Faculty of Forensic and Legal Medicine (MFFLM)
Royal College of Physicians, London, United Kingdom, 2021 to present (MRCP equivalent)

Member, British Association in Forensic Medicine, (elected professional association for forensic pathologists in the United Kingdom and Ireland), 2022 to present

Diploma of Legal Medicine (DLM)
Faculty of Forensic and Legal Medicine, Royal College of Physicians, London, United Kingdom, 2019

FELLOWSHIPS:
Fulbright Specialist Roster
Bureau of Educational and Cultural Affairs and World Learning,
United States Department of State, 2017-2020 tenure

Postdoctoral Fellowship
Forensic Pathology
Section of Forensic Medicine, Department of Community Medicine and Rehabilitation,
Umeå University, Umeå, Sweden, 2014-15

ACADEMIC POSITIONS:
Regular Faculty Appointments
Associate Professor of Forensic Medicine and Epidemiology – 2018 (permanent tenured appointment)
Department of Epidemiology
CAPHRI Research Institute for Public Health and Primary care
Faculty of Health, Medicine, and Life Sciences
Maastricht University Medical Centre+
Maastricht, The Netherlands
Associate Professor of Forensic Medicine – 2015-18
Department of Cell Biology and Complex Genetics
CAPHRI Research Institute for Public Health and Primary care
Faculty of Health, Medicine, and Life Sciences
Maastricht University Medical Centre+
Maastricht, The Netherlands

Clinical and Affiliate Appointments
Affiliate Professor of Psychiatry
Department of Psychiatry – 2023 to present
School of Medicine, Oregon Health & Science University
Portland, Oregon
Joint Clinical Professor, Psychiatry and Public Health & Preventive Medicine – 2016 to 2023
Department of Psychiatry
School of Medicine, Oregon Health & Science University
Portland, Oregon
Affiliate Professor of Epidemiology – 2010-15
Department of Public Health and Preventive Medicine
School of Medicine, Oregon Health & Science University
Portland, Oregon
Affiliate Professor of Psychiatry – 2011 to 2016
Department of Psychiatry
School of Medicine, Oregon Health & Science University
Portland, Oregon
Clinical/Affiliate Associate Professor – 2005-10
Department of Public Health and Preventive Medicine
School of Medicine, Oregon Health & Science University
Portland, Oregon
Clinical Assistant Professor – 1997-2005
Department of Public Health and Preventive Medicine
School of Medicine, Oregon Health & Science University
Portland, Oregon

Visiting Professorships
Visiting Professor of Medical Science – August 2020-April 2021
Faculty of Medicine, University of Indonesia
Jakarta, Indonesia

Adjunct Appointments
Adjunct Professor of Forensic Epidemiology and Traumatology – 2012-17
Department of Forensic Medicine, Faculty of Health Sciences, Aarhus University
Aarhus, Denmark

Adjunct/Honorary Associate Professor of Epidemiology and Traumatology – 2012-17
Department of Forensic Medicine, Faculty of Health Sciences, Aarhus University
Aarhus, Denmark

Adjunct Associate Professor of Forensic Medicine and Epidemiology – 2005-12
Institute of Forensic Medicine, Faculty of Health Sciences, Aarhus University
Aarhus, Denmark

Adjunct Professor – 2015-16
University of Western States
Portland, Oregon

EDITORIAL ACTIVITIES:

Editor in Chief: *Journal of Forensic and Legal Medicine,* 2025-present
Editor: Special Issue on Caribbean medicolegal issues
Journal of Forensic and Legal Medicine, 2025
Editor: Special Issue on death in custody
Journal of Forensic and Legal Medicine, 2025
Lead Guest Editor, Special Issue on Forensic Epidemiology:
International Journal of Environmental Research and Public Health, 2020
Co-Editor in Chief:
Journal of Whiplash-Related Disorders 1999-2006
Associate Editor:
Journal of Forensic and Legal Medicine, 2022 to present
BMC Musculoskeletal Disorders, 2019-present
The Spine Journal 2007-present
PM&R, official scientific journal of the American Academy of Physical Medicine and Rehabilitation, 2008 to 2023
Scandinavian Journal of Forensic Medicine, 2012 to present
J of Forensic Biomechanics, 2010-present
OA Epidemiology, 2014
Editorial Board Member:
Journal of Forensic and Legal Medicine, 2022 to present
International Journal of Environmental Research and Public Health, 2019-2023
Forensic Science International Reports, 2019 to present
Orthopedics, 2019 to present
Top 10 Reviewer 2019, *Orthopedics*
The Spine Journal, 2004 to present
International Research Journal of Medicine and Medical Sciences, 2015
Egyptian Journal of Forensic Sciences, 2010 to present
Journal of Case Reports in Practice 2014 to present
Austin Journal of Public Health & Epidemiology 2014-16
Edorium Journal of Public Health, 2014
Advisory Board Member:
Challenges 2020-present
Editorial Committee Member:
Spineline 2004-09
Peer reviewer:
Safety and Health at Work (Elsevier)
Journal of Vascular and Interventional Radiology
BMC Musculoskeletal Disorders
BMC Public Health
BMC Research Notes
Annals of Epidemiology (outstanding reviewer status 2015)
Orthopedics

Spine
The Spine Journal
Lancet
Mayo Clinic Proceedings
Annals of Biomechanical Engineering
Journal of the American Board of Family Medicine
Journal of Forensic and Legal Medicine
Acta Neurologica Scandanavica
Medical Science Monitor
Pain Research & Management
Journal of Back and Musculoskeletal Rehabilitation
American Society for Testing and Materials (ASTM)
Biosecurity & Bioterrorism
Annals of Medical and Health Sciences Research
Neurorehabilitation and Neural Repair
International Research Journal of Medicine and Medical Sciences
Jurimetrics
Law, Probability, and Risk
International Journal of Molecular Sciences
Journal of Rehabilitation Medicine
Arthritis
BMC Pediatrics
Journal of Back and Musculoskeletal Rehabilitation
Diagnostic and Interventional Radiology
Healthcare
Expert Review of Medical Devices
BMC Cancer

COURSES TAUGHT:

PHPM 574 Forensic & Trauma Epidemiology
Department of Public Health and Preventive Medicine
Oregon Health & Science University School of Medicine
Portland, Oregon 2006-2013

Principles of Forensic Medicine and Forensic Epidemiology
Forensic Psychiatry Fellowship
Department of Psychiatry
Oregon Health & Science University School of Medicine
Portland, Oregon – 2011 to present

PHPM 503 Thesis Advising
Department of Public Health and Preventive Medicine
Oregon Health & Science University School of Medicine
Portland, Oregon 2005-present

PHPM 507 Injury and Trauma Epidemiology
Department of Public Health and Preventive Medicine
Oregon Health & Science University School of Medicine
Portland, Oregon 1999 – 2005

Forensic Epidemiology and Bioterrorism
Charles County Department of Public Health
College of Southern Maryland, Waldorf, Maryland 2014

ACTIVITIES and HONORS:

David Jenkins Memorial Trust Professor and Chair of Forensic and Legal Medicine, Faculty of Forensic and Legal Medicine, Royal College of Physicians - 2024-5

Chair, Research subcommittee, Faculty of Forensic and Legal Medicine, London, UK, 2021-present

Vice Chair, American Academy of Forensic Sciences Standards Board Medicolegal Death Investigation Consensus Body – 2016-2023
Member, Academic committee, Faculty of Forensic and Legal Medicine, Royal College of Physicians, London, UK, 2021-present
Member, Academic advisory board, Academy of Forensic Medical Sciences, UK. 2021-present.
Member, Human factors subcommittee, Organization of Scientific Area Committees (OSAC) for Forensic Science, United States National Institute of Science and Technology (NIST), 2023-present
Appointed member, Office of Chief Medical Examiner death in custody audit design team, Maryland Attorney General, Baltimore, MD, 2021-present.
Affiliate Member, Faculty of Forensic and Legal Medicine, Royal College of Physicians, London, UK, 2016-2021
Chair, Maastricht Science in Court (MSiC) conference, Faculty of Law, Maastricht University, Maastricht, NL, September 29, 2023
Faculty, course designer and keynote speaker, "*When Science Meets Law: Forensic Epidemiology in Medicolegal Practice."* Summer school course, Radboud Medical Center, Nijmegen, Netherlands, August 13-17, 2018.
Fulbright fellowship, US Department of State, *Forensic Epidemiology in Forensic Medicine*, March 2018, Maastricht, Netherlands.
Senatorial letter of commendation, Louisiana Senate (Sen. Jon Milkovich), January 25, 2017.
Keynote speaker, Gran Sesión de Epidemiología Forense. November 18, 2016 Universidad Libre, Seccional Cali, Colombia.
Member, American Academy of Forensic Sciences Standards Board Medicolegal Death Investigation Consensus Body – 2016 to 2023
Affiliate Medical Examiner, Allegheny County, Pennsylvania, 2014 to 2024
Member, Scientific Advisory Board, International Conference on Forensic Inference and Statistics. August 2014, Leiden, The Netherlands
Reviewer, National Aeronautical Space Administration (NASA) 2011
Past president, International Cellular Medicine Society, 2009 to 2012
Founding member, International Cellular Medicine Society, 2009
Member, Research Planning Committee, North American Spine Society 2007-2009
Member, Complementary Medicine Committee, North American Spine Society 2007-2009
Special Deputy Sheriff (Forensics), Vehicular Homicide Investigator, Clackamas County, Oregon, 2007-2009
Member, Crash Reconstruction and Forensic Technology (CRAFT) multidisciplinary law enforcement fatal crash investigation team, Clackamas County, Oregon, 2002-2013
Consultant Forensic Trauma Epidemiologist to the Medical Examiner Division of the Oregon Department of State Police – Occupant Kinematics, 1999-2006
Deputy Medical Examiner, Marion County, Oregon. 2000-2005
Moderator, Engineering sciences section, American Academy of Forensic Sciences 62nd Annual Meeting, Seattle, WA 2010
Co-Chair, International Whiplash Trauma Congress V, Lund, Sweden. 2011
Co-Chair, International Whiplash Trauma Congress IV, Miami, FL. October 2007.
Co-Chair, International Whiplash Trauma Congress III, Portland, OR. June 2006.
Co-Chair, International Whiplash Trauma Congress II, Breckenridge, CO. February 2005.
Co-Chair, International Whiplash Trauma Congress I, Denver, CO. October, 2003
Co-Chair, Forensic Section, International Traffic Medicine Association. Budapest, Hungary. September, 2003
Member, Blue Ribbon Panel Congressional Task Force on roller coaster-induced brain injury. Funded by a grant from the National Institute of Child Health and Human Development 2002-2003
President, Spinal Injury Foundation. Denver, CO 2002-2009
Member, Marion-Polk County C.R.A.S.H. Team - Occupant Kinematics Consultant 1999-2004
Scientific Chair, North American Whiplash Trauma Congress. Victoria, British Columbia 1999

BOARD CERTIFICATION AND ORGANIZATIONS:

Royal College of Pathologists, London, (UK)
- Fellow 2023 - present

Faculty of Forensic & Legal Medicine, Royal College of Physicians, London, UK
- Fellow 2022 - present
- Member 2021 - 2022
- Affiliate Member 2018 - 2021

American Academy of Forensic Sciences, Pathology/ Biology section
- Fellow 2016 - present
- Member 2008 - 2016

Academy of Forensic Medical Sciences, UK
- Fellow 2021-present

American College of Epidemiology
- Fellow 2019 - present
- Member 2007 – 2019

Royal Society for Public Health, UK
- Fellow 2022 - present

Royal College of Physicians, London UK
- Associate member 2021 - present

British Association in Forensic Medicine
- Member 2022 - present

American Society of Biomechanics
- Member #6845 2023 - present

Accreditation Commission on Traffic Accident Reconstruction (ACTAR)
- Accredited #1581 2005 - 2024

Basic and Advanced Cardiac Life Support (BLS and ACLS) certified (exp. June 2026)
Crash Data Retrieval Technician I & II
Certification in basic and advanced crash reconstruction - Northwestern University
Diplomate, American Academy of Pain Management
Member, Fulbright Association
Member, American College of Epidemiology (2007-2019)
Member, Association for the Advancement of Automotive Medicine
Member, Sigma Xi Scientific Honor Society
Member, Society of Automotive Engineers
Past member, International Traffic Medicine Association
Fellow, International College of Chiropractic
Inactive member, North American Spine Society
Past member, Forensic Accident Reconstructionists of Oregon

GRANTS:

2020-present Unrestricted grant, private donor. Evaluation of upper cervical CSF flow alterations in retired NFL players with chronic head injury. $250,000.

2017-2020 Fulbright scholarship, Fulbright Specialist program, Bureau of Educational and Cultural Affairs and World Learning, United States Department of State.

2015 National Science Foundation Industry/University Cooperative Research Centers Program, NSF 13-594 Planning Grant: I/UCRC for Advanced Research in Forensic Science, National Center for Research on Forensic Epidemiology. Principal Investigator.

2011-2013 World Health Organization – research grant for Rwandan study of relationship between genocide and suicide and homicide victimization and offending. $50,000. Project No: AFRWA 1005685, Award No: 53975.

2010-2015 Centers for Disease Control (Administered by National University of Rwanda and OHSU) SPH/CDC $200,000 over 4 years.

2002-2003 National Institute of Child Health and Human Development – Blue Ribbon Task Force on Roller Coaster Associated Brain Injury. $75,000.

DISSERTATION SUPERVISION:

Joshua Goldenberg – PhD candidate, School for Public Health and Primary Care, Maastricht University Medical Center (2023 to present)

Rebecca Rodrigues MSc – PhD candidate, School for Public Health and Primary Care, Maastricht University Medical Center (2022 to present)

Ellen Strömmer MPH – PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2018 to present)

David Brunarski MSc - PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2019 to 2021)

Wendy Leith MS MPH – PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2018 to present)

Paul Nolet MPH, MSc – PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2017 to present)

Huijie Wang M.Med. – PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2017-2018)

Dritan Bijko MD MSc – PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2017)

Putri Dianita MD MSc – PhD candidate, CAPHRI School for Public Health and Primary Care, Maastricht University Medical Center (2015 to 2022)

Frank Franklin Ph.D., J.D. (2013), Earle Mack School of Law, Drexel University

Bonnie Colville-Ebeling MD – PhD candidate (2012-15) University of Copenhagen, Faculty of Health Sciences, Department of Forensic Medicine

Dimitrios Papadakis BSc, MRes, Dr.rer.nat. (2012-2015) independent mentoring

Wendy Leith MS – MPH (2015) Department of Public Health & Preventive Medicine, Oregon Health & Science University School of Medicine

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Apostolo Alexandridis – MPH (2011) - Department of Public Health & Preventive Medicine, Oregon Health & Science University School of Medicine

Wilson Rubanzana MD – PhD (2016) National University of Rwanda, School of Public Health, Kigali, Rwanda

Catherine Maddux-Gonzalez – MPH (2009) – Department of Public Health & Preventive Medicine, Oregon Health & Science University School of Medicine

Laura Criddle MS, RN – PhD (2008) Oregon Health & Science University School of Medicine, School of Nursing

Peter Harmer PhD – MPH (2006) Department of Public Health & Preventive Medicine, Oregon Health & Science University School of Medicine

PUBLICATIONS:

Peer-reviewed journal articles

1. Rodrigues R, Wootten J, Anderson KK, Stranges S, Wilk P, **Freeman MD**, Zeegers MP. Forensic mental health service use in early psychosis: a scoping review. *Epidem Psych Sci* (in review)

2. Goldenberg J, Batson RD, Pugh MJ, Zwickey H, Beardsley J, Zeegers MP, **Freeman MD.** The cumulative incidence of post-traumatic epilepsy after mild traumatic brain injury: a systematic review and individual-participant data meta-analysis protocol. *J Neurotrauma Reports* 2024 (in press)

3. **Freeman MD**. Reflections on editorial and peer review in the forensic medical literature. *J For Leg Med* 2024 (in press)

4. **Freeman MD,** Strömmer EMF, Leith WM, Zeegers MP. Response to “More on the role of restraint in fatal excited delirium. *For Sci Med Path* 2024 https://doi.org/10.1007/s12024-023-00736-w.

5. Strömmer EMF, Leith WM, Zeegers MP, **Freeman MD.** Injuries due to police use of force in the United States, 2006-2015: Trends in severity and by race. *J Racial Ethn Health Disparities*. 2023 https://doi.org/10.1007/s40615-023-01733-z

6. **Freeman MD,** Strömmer EMF, Leith WM, Zeegers MP. Response to "Scrutinizing the causal link between excited delirium syndrome and restraint – A commentary on: 'The role of restraint in fatal excited delirium: a research synthesis and pooled analysis' by E.M.F. Strömmer, W. Leith, M.P. Zeegers and M.D. Freeman." *For Sci Med Path* 2023 https://doi.org/10.1007/s12024-023-00616-3.

7. Leith WM, Zeegers MP, **Freeman MD.** A predictive model for perinatal hypoxic ischemic encephalopathy using linked maternal and neonatal hospital data. *Annals Epidemiol* https://doi.org/10.1016/j.annepidem.2023.11.011

8. **Freeman MD,** Mittner BS. Prone Restraint and Excited Delirium; policy recommendations to reduce preventable deaths in police custody. *J Forensic Leg Med* (in press)

9. Kaale BR, McArthur TJ, Barbarosa MH, **Freeman MD.** Post-traumatic atlanto-axial instability: A combined clinical and radiological approach for the diagnosis of pathological rotational movement in the upper cervical spine. *J Clin Med* 2023, *12*, 1469. https://doi.org/10.3390/1469.

10. Katz E, Katz S, **Freeman MD.** Non-surgical management of upper cervical instability via improved cervical lordosis: a case series. *J Clin Med* 2023, 12, 1797.https://doi.org/10.3390/jcm12051797

11. **Freeman MD**, Strömmer EMF. re: Dror and Kukucka, Linear Sequential Unmasking–*Expanded* (LSU-*E*): A general approach for improving decision making as well as minimizing noise and bias. *For Sci Int Syn* 2021 https://doi.org/10.1016/j.fsisyn.2021.10 019.

12. **Freeman MD.** Principles and methods for evidence-based quantification of the effect of seatbelt non-use in crash-related litigation. *Int J Environ Res Public Health* 2021:18,9455. https://doi.org/10.3390/18189455.

13. Dianita Ika Melia P, Zeegers MP, Herkutanto H, **Freeman MD**. Medicolegal causation investigation of bacterial endocarditis associated with an oral surgery practice using the INFERENCE approach. *Int J Environ Res Public Health* 2021:18,7530. https://doi.org/10.3390/ijerph18147530.

14. Nolet PS, Nordhoff L Kristman KL, Croft AC, Zeegers MP, **Freeman MD.** Is acceleration a valid proxy for injury risk in minimal damage traffic crashes? A comparative review of volunteer, ADL and real-world studies. *Int J Environ Res Public Health* 2021;18:2901; https://doi.org/10.3390/ijerph18062901.

15. Dianita Ika Melia P, Zeegers MP, Herkutanto H, **Freeman MD**. Development of the INFERENCE (**IN**tegration of **F**orensic **E**pidemiology and the **R**igorous **E**valuatio**N** of **C**ausation **E**lements) approach to causal inference in forensic medicine. *Int J Environ Res Public Health* 2020;17:8353; doi:10.3390/ijerph17228353.

16. Strömmer EMF, Leith WM, Zeegers MP, **Freeman MD.** The role of restraint in fatal excited delirium: a research synthesis and analysis of the literature. *For Sci Med Path* 2020: doi.org/10.1007/s12024-020-00291-8.

17. **Freeman MD.** Forensic epidemiologic analysis of the cause of an unexpected teen suicide following ingestion of mis-dispensed isosorbide mononitrate. *For Sci Int Rep* 2020: doi.org/10.1016/j.fsir.2020.100093

18. Tønner G, **Freeman MD,** Rubenstein S. De waarde van chiropractie bij lagerugklachten. *Huisarts Wet* [Dutch Journal of General Practice Medicine] 2020:10.1007/s12445-020-0964-3.

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8. **Freeman MD**. Concussion risk associated with head impact; an analysis of pooled data from helmeted sports. *Proceedings of the 12th Annual Conference of the North American Brain Injury Society* J Head Trauma Rehab 2015;30(3):E72-3.

9. Franklin F, **Freeman MD.** An analysis of the causal relationship between maternal/ prenatal cocaine use and stillbirth: results of a national hospital database study**.** *Proceedings of 67th Annual Meeting of the American Academy of Forensic Sciences* 2015 Feb 16-21: Orlando, FL H154:975-6.

10. **Freeman MD**. Biomechanical, Mechanical, and Epidemiologic Characteristics of Low Speed Rear Impact Collisions. *Proceedings of 67th Annual Meeting of the American Academy of Forensic Sciences* 2015 Feb 16-21: Orlando, FL. D11:517-8.

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22. **Freeman MD**, Uhrenholt L. Self-defense or attempted murder? A combined ballistic and traffic crash reconstruction of a Texas shooting. *Scand J Forens Med* (2012;18(1):51.

23. **Freeman MD.** Applied forensic epidemiology: the evaluation of individual causation in wrongful death cases using relative risk. *Scand J Forens Med* (2012;18(1):25.

24. Uhrenholt L, Webb A, Pedersen M, Christensen HW, **Freeman MD.** Does whiplash trauma result in somatic injury. *Scand J Forens Med* (2012;18(1):121

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40. **Freeman MD**, Uhrenholt L, Newgard C. Head injuries in lower speed collinear collisions; an analysis of the National Automotive Sampling System database. *Proceedings of 62nd Annual Meeting of the American Academy of Forensic Sciences* Feb 2010, Seattle, Washington.

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43. Uhrenholt L, Schumacher B, **Freeman MD**. A cross-sectional study of road traffic fatalities and vehicular homicide investigation practices in Denmark for 2000-2004. *Proceedings of 61st Annual Meeting of the American Academy of Forensic Sciences.* Feb 2009, Denver, Colorado.

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47. **Freeman MD**. Injury Pattern Analysis as a means of driver determination in a vehicular homicide investigation. *Proceedings of 16th Nordic Conference on Forensic Medicine* Turku, Finland June 15-17 2006:38-9.

48. **Freeman MD**. Injury Pattern Analysis in Fatal Traffic Crash Investigation. *Proceedings of 57th Annual Meeting of American Academy of Forensic Sciences* New Orleans, Louisiana. February 24, 2005.

49. **Freeman MD**, Croft AC, Centeno C. Fatal head injury cases in a rural Oregon county. *Proceedings of the 19th World Congress of the International Traffic Medicine Association* Budapest, Hungary, September 14-17, 2003.

50. Croft AC, Haneline MT, **Freeman MD**. Differential Occupant Kinematics and Forces Between Frontal and Rear Automobile Impacts at Low Speed: Evidence for a Differential Injury Risk,

International Research Council on the Biomechanics of Impact (IRCOBI) Munich, Germany September 18-20, 2002:365-6.

51. Sparr L, **Freeman MD**. The Uses and Abuses of Psychiatric IMEs: An Ethical Dilemma? *American Psychiatric Association Annual Meeting* San Francisco, California May 2003.

52. Croft AC, Haneline MT, **Freeman MD**. Low speed frontal crashes and low speed rear crashes: is there a differential risk for injury? *Proceedings of the 46th Association for the Advancement of Automotive Medicine (AAAM) Annual Scientific Conference* Tempe, Arizona, September 29-October 2, 2002:79-91.

53. Croft AC, Lord S, **Freeman MD**. Whiplash Injury: Mechanisms of Injury, Pathophysiology, and Treatment *10th World Congress on Pain, International Association for the Study of Pain* San Diego, August 17-22, 2002:482.

54. **Freeman MD**, Centeno C, Croft AC, Nicodemus CN: Significant spinal injury resulting from low-level accelerations: a comparison with whiplash. *International Congress on Whiplash-Associated Disorders* Berne, Switzerland, March 9-10, 2001.

55. Croft AC, Haneline MT, **Freeman MD**. Differential occupant kinematics and head linear acceleration between frontal and rear automobile impacts at low speed: evidence for a differential injury risk. I*nternational Congress on Whiplash-Associated Disorders* Berne, Switzerland, March 9-10, 2001.

56. Croft AC, Haneline MT, **Freeman MD**. Automobile crash reconstruction in low speed rear impact crashes utilizing a momentum, energy, and restitution (MER) method. *International Congress on Whiplash-Associated Disorders* Berne, Switzerland, March 9-10, 2001.

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58. **Freeman MD**, Sapir D, Boutselis A, Gorup J, Tuckman G, Croft AC, Centeno C, Phillips A. Whiplash injury and occult vertebral fracture: a case series of bone SPECT imaging of patients with persisting spine pain following a motor vehicle crash. *Cervical Spine Research Society 29th Annual Meeting* Monterey, CA, Nov 29-Dec 1, 2001.

59. Johansson BH, **Freeman MD**. The prevalence of symptomatic cervical disc herniation in the Swedish population with asymptomatic degenerative disc disease (a cross-sectional study). *International Congress on Whiplash Associated Disorders* March, 2001. Berne, Switzerland.

60. **Freeman MD**, Centeno C, Croft AC, Nicodemus C. Significant spinal injuries resulting from low-level accelerations: a case series of roller coaster injuries. *Proceedings of Cervical Spine Research Society 28th Annual Meeting,* November 30-December 2, 2000:110-1.

61. Croft AC, **Freeman MD**. An evaluation of the neck injury criterion; recommendations for future consideration. *Association for the Advancement of Automotive Medicine*, San Antonio, TX October, 2000.

62. **Freeman MD**. Meta-analysis of whiplash prognosis studies. Proceedings of Whiplash 2000, Bath, England. May 16-18, 2000. pp 102-24.

63. **Freeman MD**. The epidemiology of acute and chronic whiplash injury in the U.S. Proceedings of HWS-Distorsion (Schleudetrauma) & Leichte Traumatische, Hirnverletzung. Invaliditat und Berufliche Reintegration. Basel, Switzerland. June 29-30, 2000.

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65. **Freeman MD**, Croft AC, Rossignol AM. Late whiplash risk factor analysis of a random sample of patients with chronic spine pain. *World Whiplash Associated Disorders Congress*, February 8-10, 1999, Vancouver, British Columbia

Scientific Letters

1. Nystrom NA, **Freeman MD**. Authors' Response. *Pain Med* 2018;19(4):816-7.
2. Uhrenholt L, Webb A, **Freeman MD**. Letter to the Editor regarding "Do X-ray-occult fractures play a role in chronic pain following a whiplash injury?" *Eur Spine J* DOI 10.1007/s00586-014-3362-3.
3. **Freeman MD**, Centeno CJ, Katz E. MR imaging of whiplash injury in the upper cervical spine; controversy or confounding? *Spine J* 2009 Sep;9(9):789-90. Epub 2009 Jun 17
4. Centeno CJ, **Freeman M**. Re: Are smooth pursuit eye movements altered in chronic whiplash-associated disorders? A cross-sectional study. *Clin Rehabil* 2008 Apr;22(4):377-8.
5. Centeno CJ, **Freeman MD**. Editorial Submission on Kongsted, A., et al., Are smooth pursuit eye movements altered in chronic whiplash associated disorders? A cross-sectional study. *Clin Rehabil* 2007;21(11):1038-49.
6. **Freeman MD**. Crash Test Dummy? *New Scientist* June 23, 2007:22-3.
7. **Freeman MD**, Centeno CJ, Merskey H, Teasell R, Rossignol AM. Greater injury leads to more treatment for whiplash: no surprises here. *Arch Int Med* 2006;166(11):1238-9.
8. Centeno C, **Freeman MD**. Alberta rodeo riders do not develop late whiplash. *J Rheumatol* 2007 Feb;34(2):451-2.
9. **Freeman MD**, Centeno C. Alar, Transverse and Apical Ligament Strain due to Head-Turned Rear Impact. *Spine* 2006;31(17):2030.
10. **Freeman MD**. Cervical disc herniation following motor vehicle crash trauma. Invited commentary. *Spine J* 2005 Nov-Dec;5(6):644.
11. **Freeman MD**, Centeno C. Whiplash and Peer Review *JWRD* 2003;2(2):1-3.
12. **Freeman MD**, Centeno C. Whiplash and Secondary Gain *JWRD* 2003;2(1):1-4.
13. **Freeman MD**, Centeno C. "Placebo" Collisions and Whiplash *JWRD* 2002;1(2):1-8.
14. **Freeman MD**. Biomechanics of minor automobile accidents. *J South Orthop Assoc* 2001 Summer;10(2):95-6.
15. **Freeman MD**. Are demolition derby drivers a valid proxy for the population at risk for whiplash injury? *Arch Neurol* 2001 Apr;58(4):680-1.
16. **Freeman MD**, Rossignol AM. Effect of eliminating compensation for pain and suffering on the outcome of insurance claims. *NEJM* 2000 Oct 12;343 (15):1118-9.
17. **Freeman MD**. Letter to the editor. *Cranio* 1999;17(3):160-1.
18. Croft AC, **Freeman MD**. Commentary on "Pain after whiplash: a prospective controlled inception cohort study." *The Back Letter* 1999;14(4):43-5.
19. **Freeman MD**, Croft AC. Late Whiplash Syndrome, 3rd reply. *Lancet* 1996 Jul 13;348(9020):125.

NATIONAL PRACTICE STANDARDS/ GOVERNMENT PUBLICATIONS:

American National Standards Institute (ANSI)/ American Standards Board (ASB) Standard 125-2021: Organizational and Foundational Standard for Medicolegal Death Investigation (Committee vice chair and co-author).

O'Shanick G, Varney N, **Freeman MD**, et al. Blue Ribbon Panel Review of the Correlation Between Brain Injury and Roller Coaster Rides (Report to US Congress, Funded by the National Institute of Child Health and Human Development). February 25, 2003.

MEDIA:

October 6, 2024 - https://www.seattletimes.com/seattle-news/law-justice/two-wa-men-were-arrested-in-mental-health-crises-only-one-survived/

October 6, 2024 - https://www.seattletimes.com/seattle-news/times-watchdog/wa-death-was-natural-until-the-times-asked-why-heres-what-to-know/

June 10, 2023 – The secret death of Darryl Dean Mefferd. *Open Vallejo.* https://openvallejo.org/2024/06/10/the-secret-death-of-darryl-dean-mefferd/

June 3, 2023. – St. Denis J. https://thetyee.ca/News/2023/06/02/Despite-Inquest-Evidence-Police-Use-Force-VPD-Stands-Ground/

April 17, 2023 – Lindsay B. Canadian coroners starting to reject excited delirium as cause of police-related deaths. *Canadian Broadcast Corporation.*

May 14, 2022 - Hollingsworth H. From 'crisis to death': probing teen's last, desperate hours. *The Associated Press.*

February 12, 2022 - Mannix, A. Minneapolis Police Department still teaching controversial 'excited delirium' syndrome — despite claiming it had stopped**.** *Minneapolis Star Tribune*.

January 2, 2022 - Wiggins, O. Review of cases under former Maryland medical examiner expected to get underway this year. *Washington Post.*

October 2, 2021 - Dewan, S. Subduing suspects face down isn't fatal, research has said. Now the research is on trial. *The New York Times.*

September 20, 2021 - Sernoffsky, E. 'Excited delirium' denounced long before controversial Antioch in-custody death. *FOX 2 KTVU.*

July 13, 2021 - Porter, C and Lopez, O. Haitians hope president's funeral is a moment of unity. *The New York Times.*

July 12, 2021 - Porter, C and Lopez O. Haitian officials say U.S.-based suspect in president's killing was seeking power. *The New York Times*.

April 11, 2021. Laughland, O. 'Excited delirium': the controversial defense that could be used in the Chauvin trail. *The Guardian.*

April 19, 2021 - Karnowski, S. EXPLAINER: Why 'excited delirium' came up at Chauvin trail? *The Associated Press.*

November 15, 2020 - Lyden, T. Excited Delirium dilemma: Explanation or excuse for in-custody deaths? *FOX 9 KMSP.*

August 25, 2020 - Cushing, T. Law enforcement training: People saying 'I can't breathe' are just suffering from 'Excited Delirium.' *TechDirt.*

June 8, 2020 - Koerth M. The two autopsies of George Floyd aren't as different as they seem. *FiveThirtyEight.*

SCIENTIFIC PRESENTATIONS and INVITED LECTURES:

1. Forensic epidemiology and death investigation in Forensic Medicine: Methods for Evidence-Based Practice. Core course lecture, Diploma of Forensic Medical Sciences curriculum, Academy of Forensic Medical Sciences, London. October 10, 2024.
2. The role of forensic epidemiology in injury and death investigation. International webinar: The role of forensic medicine in preventive medicine. Department of Forensic Medicine, Dr. Hasan Sadikin General Hospital, Bandung, Indonesia. October 11, 2024.
3. Principles and practice of forensic epidemiology in death investigation. Department of Epidemiology, Faculty of Medicine, Health, and Life Sciences, Maastricht University. June 19, 2024.
4. Research integrity in forensic medicine. 22nd Nordic Conference on Forensic Medicine, The Arctic University of Norway (UIT), Trømso, Norway. June 12-14, 2024
5. Principles and applications of Forensic Epidemiology in forensic death investigation: Keynote lecture. 22nd Nordic Conference on Forensic Medicine, The Arctic University of Norway (UIT), Trømso, Norway. June 12-14, 2024.
6. The role of *counterfactual causation* in the investigation of death in custody following prone restraint. Faculty of Forensic and Legal Medicine, Royal College of Physicians, 17th Annual Conference 2024. London, UK. May 10, 2024.
7. Challenges to improving research integrity in forensic medicine. 7th Annual Caribbean Medicolegal and Forensic Symposium, "*C.S.I.: Caribbean Solutions and Innovations for Regional Medicolegal and Forensic Issues.*" Bridgetown, Barbados. November 16-18, 2023.
8. Forensic epidemiology and causation in forensic medicine: methods for evidence-based practice in cause of death investigation. British Association in Forensic Medicine, Summer Meeting 2023, Harrogate, UK. June 23-24, 2023.
9. Domains of research integrity in forensic medicine. British Association in Forensic Medicine, Summer Meeting 2023, Harrogate, UK. June 23-24, 2023.
10. Research integrity in forensic medicine; do we have a problem? Faculty of Forensic and Legal Medicine, 16th Annual Conference 2023. York, UK. May 13, 2023
11. Forensic epidemiology and death investigation in Forensic Medicine: Methods for Evidence-Based Practice. Core course lecture, Diploma of Forensic Medical Sciences curriculum, Academy of Forensic Medical Sciences, London. November 12, 2022.
12. Forensic epidemiology and death investigation in Forensic Medicine: Methods for Evidence-Based Practice. "Dying to meet you," 40th Anniversary Conference of the Dutch Forensic Medical Society, September 15-16, 2022, Rotterdam, NL.
13. Forensic Epidemiology: Advances in Methods and Applications. Department of Epidemiology, Care and Primary Health Research Institute, Faculty of Health, Medicine, and Life Sciences, Maastricht University, Maastricht, NL, May 24, 2022.
14. Forensic Epidemiology and Causation in Forensic Medicine: Methods for Evidence-Based Practice. Faculty of Forensic and Legal Medicine, 15th Annual Conference 2022. Royal College of Pathologists, Aldgate, London UK. May 7, 2022
15. Introduction to Forensic Epidemiology. Core course lecture, Diploma of Forensic Medical Sciences curriculum, Academy of Forensic Medical Sciences, London. November 12, 2021.
16. Introduction to Forensic Epidemiology: An evidence-based approach to causal analysis in forensic medicine. Faculty of Forensic and Legal Medicine, Royal College of Physicians,

London. October 13, 2021.

17. Forensic Epidemiology: The use of population-based data and methods in the evaluation of specific causation in a medicolegal setting. American College of Epidemiology, Plenary lecture. September 10, 2021.

18. The role of epidemiology in evidence-based investigation of injury and death. 1st International Forensic Science e-Conference. National Forensic Sciences University, India. July 10-11, 2021.

19. Medico-legal causation in auto litigation. International Orthopedic Foundation. January 30, 2021.

20. Medico-legal investigation of suicide. Lecture at Mental Illness Research Education Clinical, Centers of Excellence NW (MIRECC CoE), Veteran's Affairs Medical Center, Portland Oregon. December 16, 2020.

21. The role of epidemiology in evidence-based forensic medical investigation of death and injury. Faculty of Medicine, Universitas Indonesia. December 15, 2020.

22. Does Excited Delirium cause death, or does death cause Excited Delirium? A systematic review and statistical analysis of the world literature. Presented at *Deaths in Custody 3: Judicial Considerations.* Department of Pathology and Laboratory Medicine, of the Faculty of Medicine, in conjunction with the Office of the Chief Medical Examiner, Washington DC, September 27, 2020.

23. Medico-legal investigation of suicide. Grand Rounds in Psychiatry, Department of Psychiatry, Oregon Health & Science University School of Medicine. March 24, 2020.

24. Forensic investigation of unexplained death. University of Business, Technology, and Science (UBT), October 9, 2018: Pristina, Kosovo.

25. Causation analysis in medical negligence. Radboud Summer School. Radboud Medical Center, August 14, 2018: Nijmegen, Netherlands.

26. Injury causation analysis. Radboud Summer School. Radboud Medical Center, August 14, 2018: Nijmegen, Netherlands.

27. Criminal applications of Forensic Epidemiology. Radboud Summer School. Radboud Medical Center, August 14, 2018: Nijmegen, Netherlands.

28. Introduction to Forensic Epidemiology. Radboud Summer School. Radboud Medical Center, August 13, 2018: Nijmegen, Netherlands.

29. Ballistic analysis of an attempted murder using a porcine model. *Proceedings of 70th Annual Meeting of the American Academy of Forensic Sciences* 2018 Feb 19-23: Seattle, WA.

30. Evidence-based practice in Forensic Medicine; Principles of Forensic Epidemiology. Radboud Medical Center, October 9, 2017: Nijmegen, Netherlands.

31. Incidence and risk factors for neonatal falls US Hospitals, 2003-2012. *Health Science Research,* Doernbecher Childrens' Hospital, Oregon Health & Science University, March 13, 2017, Portland, Oregon.

32. Incidence and risk factors for neonatal falls US Hospitals, 2003-2012. *Research in Progress,* Department of Internal Medicine, Oregon Health & Science University School of Medicine, January 31, 2017, Portland, Oregon.

33. Evidence-based practice in Forensic Medicine. Invited presentation to the Dutch National Forensic Institute (NFI). December 6, 2016 Maastricht University, Maastricht, Netherlands.

34. Forensic Epidemiology: Principals & Practice Part 2: Investigation of specific causation. Gran Sesión de Epidemiología Forense. November 18, 2016 Universidad Libre, Cali, Colombia.

35. Forensic Epidemiology: Principals & Practice Part 1: Investigation of specific causation. Gran

Sesión de Epidemiología Forense. November 18, 2016 Universidad Libre, Cali, Colombia.

36. Fatal crash investigation. World Reconstruction Exposition (WREX 2016). May 2-6, 2016. Orlando, Florida.

37. Trends in police use-of-force related hospitalizations; an analysis of Nationwide Inpatient Sample data for 1998-2012. *Research in Progress,* Department of Internal Medicine, Oregon Health & Science University School of Medicine, November 10, 2015, Portland, Oregon.

38. Concussion risk associated with head impact; an analysis of pooled data from helmeted sports. *12th Annual Conference of the North American Brain Injury Society*, April 29-May 1, 2015 San Antonio, Texas

39. The role of risk in assessing cause in forensic investigation of injury and death. *American Medical Response biennial EMS training*. April 17, 2015, Mt. Hood, Oregon.

40. Development of a pediatric fatal head trauma registry. *Research in Progress,* Department of Internal Medicine, Oregon Health & Science University School of Medicine, April 7, 2015, Portland, Oregon.

41. Fatal crash investigation: methods and case presentations. Washington County CART Team training lecture. Tualatin Police Department, Tualatin, Oregon. March 4, 2015.

42. An analysis of the causal relationship between maternal/ prenatal cocaine use and stillbirth: results of a national hospital database study. *67th Annual Meeting of the American Academy of Forensic Sciences* 2015 Feb 16-21: Orlando, FL

43. Biomechanical, Mechanical, and Epidemiologic Characteristics of Low Speed Rear Impact Collisions. *67th Annual Meeting of the American Academy of Forensic Sciences* 2015 Feb 16-21: Orlando, FL.

44. Sexual abuse in the Boy Scouts: a preliminary analysis of Boy Scout ineligible volunteer files from 1945 to 2004. *Research in Progress,* Department of Sociology, Portland State University. December 18, 2014.

45. Understanding chronic pain after whiplash trauma. *Lund University Hospital, Department of Rehabilitation Medicine.* December 11, 2014, Lund, Sweden.

46. Forensic Applications of Epidemiology in Criminal and Civil Settings. *Richard Doll Building, Nuffield College, Oxford University.* December 10, 2014, Oxford, UK.

47. The Efficacy of tPA in Preventing Long Term Poor Outcome After Ischemic Stroke: A Reanalysis of NINDS Data. *Research in Progress,* Department of Internal Medicine, Oregon Health & Science University School of Medicine, November 25, 2014, Portland, Oregon.

48. Forensic Epidemiology and Bioterrorism. Full day course for public health and law enforcement. A joint training for public health, law enforcement, and emergency services. Sponsored by Charles County Department of Public Health and funded through a grant from the Centers for Disease Control and Prevention, Public Health Preparedness Cooperative Agreement. College of Southern Maryland. June 10, 2014. Waldorf, Maryland.

49. Maternal cocaine exposure and still-birth risk. *Research in Progress,* Department of Internal Medicine, Oregon Health & Science University School of Medicine, May 20, 2014, Portland, Oregon.

50. Forensic Applications of Epidemiology in Civil and Criminal Litigation. *9th International Conference on Forensic Inference and Statistics* August 19-22, 2014

51. Investigation of a disputed mechanism of diffuse axonal injury following a low speed frontal crash. *65th Annual Meeting of the American Academy of Forensic Sciences,* Feb 21, 2014, Seattle, Washington.

52. Public defense of dissertation for Doctor of Medicine degree, "The role of forensic epidemiology in evidence based forensic medical practice." *Section of Forensic Medicine,*

Department of Community Medicine and Rehabilitation, Faculty of Medicine, Umeå University. November 6, 2013, Umeå, Sweden.

53. Case studies in applied forensic epidemiology. Invited lecture, *University of Maastricht, Department of Complex Genetics and Epidemiology,* Maastricht, The Netherlands. October 31, 2013.

54. The relationship between Chiari malformation, trauma, and chronic pain. *Karolinska Institute,* September 27, 2012, Stockholm, Sweden.

55. Serious head and neck injury as a predictor of occupant position in fatal rollover crashes. *18th Nordic Conference on Forensic Medicine*, June 13-16, 2012 Aarhus Denmark.

56. Self-defense or attempted murder? A combined ballistic and traffic crash reconstruction of a Texas shooting. *18th Nordic Conference on Forensic Medicine*, June 13-16, 2012 Aarhus Denmark.

57. Applied forensic epidemiology: the evaluation of individual causation in wrongful death cases using relative risk. *18th Nordic Conference on Forensic Medicine*, June 13-16, 2012 Aarhus Denmark.

58. Forensic Epidemiologic Investigation of Traffic Crash-Related Homicide. *Årsmøde i Dansk Selskab for Retsmedicin og Dansk Selskab for Ulykkes- og Skadeforebyggelse* [The Danish Traffic Medicine Society of the Danish Society for Forensic Medicine] November 3-5, 2011] Grenå, Denmark.

59. Traffic Crash Injuries 1960 to the present; how far we've come. Keynote address, *Årsmøde i Dansk Selskab for Retsmedicin og Dansk Selskab for Ulykkes- og Skadeforebyggelse* [The Danish Traffic Medicine Society of the Danish Society for Forensic Medicine] November 3-5, 2011] Grenå, Denmark.

60. Is there a place for forensic biomechanics in evaluation of Probability of Causation? *8th International Conference on Forensic Inference and Statistics (ICFIS),* July 19-21, 2011; University of Washington, Seattle, Washington.

61. Case studies in forensic epidemiology. *8th International Conference on Forensic Inference and Statistics (ICFIS)*, July 19-21, 2011; University of Washington, Seattle, Washington.

62. The Error Odds method of objectively assessing bioengineering based claims of causation; a Bayesian approach to test validity quantification. Invited lecture; joint session of Jurisprudence and Engineering Sciences. *62nd Annual Meeting of the American Academy of Forensic Sciences* Feb 25, 2010, Seattle, Washington.

63. The effect of restraint use on skull vault fractures in rollover crashes. Engineering Sciences section, *62nd Annual Meeting of the American Academy of Forensic Sciences* Feb 26, 2010 Seattle, Washington.

64. Head injuries in lower speed collinear collisions; an analysis of the National Automotive Sampling System database. Engineering Sciences section, *62nd Annual Meeting of the American Academy of Forensic Sciences* Feb 26, 2010 Seattle, Washington.

65. The Error Odds assessment of accuracy for tests in forensic medicine; a simple application of Bayes' Law. Invited presentation; *XXI Congress of the International Academy of Legal Medicine* May 2009, Lisbon, Portugal

66. Forensic Epidemiology and Traumatic Brain Injury. Invited presentation; *VII World Congress on Brain Injury, International Brain Injury Association* April 2008 Lisbon, Portugal.

67. Bayesian analysis of predictive characteristics in suicidal versus homicidal hanging deaths: A case study in forensic epidemiology. *59th Annual Meeting of the American Academy of Forensic Sciences* February 19-24, 2007, San Antonio, Texas.

68. Probability and pathologic findings in suicidal versus homicidal hanging deaths; a case study *16th Nordic Conference on Forensic Medicine* June 15, 2006, Turku, Finland.

69. Pattern Analysis as a means of driver determination in a vehicular homicide investigation *16th Nordic Conference on Forensic Medicine* June 16, 2006, Turku, Finland.

70. Probability and pathologic findings in suicidal versus homicidal hangings; a case study. Grand Rounds *Institute of Forensic Medicine, Aarhus University, Aarhus, Denmark*. October 27, 2005.

71. Road Traffic Crashes- mechanisms, injuries and analysis. Invited lecture (Keynote address) *Danish Society for Automotive Medicine* Aarhus, Denmark. October 27, 2005.

72. The Defense Medical Evaluation: Issues, Ethics and Pitfalls. *2nd Annual International Whiplash Trauma Congress* Breckenridge, Colorado. February 26, 2005.

73. Injury Pattern Analysis in Fatal Traffic Crash Investigation *American Academy of Forensic Sciences' 57th Annual Meeting* New Orleans, Louisiana. February 24, 2005.

74. Independent Medical Evaluations and secondary gain. Grand Rounds, *Department of Psychiatry, Oregon Health & Science University School of Medicine* November 2, 2004.

75. The epidemiology of crash-related trauma. Invited lecture. Grand Rounds *Peace Health Hospital* Longview, Washington. March 30, 2004.

76. Injury pattern analysis: the practical application to the investigation of crash related death. Grand Rounds Department of Pathology, *Oregon Health Sciences University* Portland, Oregon. January 21, 2004.

77. Literature critique, Whiplash Updates. Invited lecture. *British Columbia Chiropractic Association* Vancouver, British Columbia, Canada. October 23, 2003.

78. Catastrophic crash cases and probability. Invited lecture. *Paris American Legal Institute* Florence, Italy. September 22, 2003.

79. Injury pattern analysis as a means of driver identification in a vehicular homicide; a case study. *International Traffic Medicine Association Annual Meeting*. Budapest, Hungary. September 17, 2003.

80. Fatal head injury crashes in a rural Oregon county, 1990-1999. *International Traffic Medicine Association Annual Meeting*. Budapest, Hungary. September 16, 2003.

81. Crash reconstruction and forensic science. Invited lecture. *CRASH 2003* Spine Research Institute of San Diego. San Diego, California. August 22, 2003.

82. The uses and abuses of psychiatric IMEs: an ethical dilemma. *American Psychiatric Association Annual Meeting*. San Francisco, California. May 21, 2003.

83. Crash-related trauma. Invited lecture. THRI Neuroscience meeting. *Texas Back Institute* St. Mary's Hospital. Plano, Texas. February 28, 2003.

84. Whiplash injury and occult spinal fracture. *International Association for the Study of Pain* 10th World Congress on pain. San Diego, California. August 20, 2002.

85. Crash Reconstruction and forensic science. *CRASH 2002* Spine Research Institute of San Diego. San Diego, California. August 8, 2002.

86. Epidemiologic and medical aspects of whiplash injury. *Swedish Orthopedic Society* Stockholm, Sweden. May 17, 2002.

87. Epidemiologic considerations of whiplash injuries. Invited lecture. *European Chiropractic Union Annual Congress* Oslo, Norway. May 9, 2002.

88. The role of cervical manipulation in neck pain. Invited lecture. *Cervical Spine Research Society 29th Annual Meeting* Instructional Course, Monterey, CA, Nov 29-Dec 1, 2001

89. Whiplash injury and occult vertebral fracture: a case series of bone SPECT imaging of patients with persisting spine pain following a motor vehicle crash. *Cervical Spine Research Society 29th Annual Meeting* Monterey, CA, Nov 29-Dec 1, 2001

90. Interpreting the medical literature with a focus on bias and confounding/Minimal Damage Crash Reconstruction. Invited lecture. *CRASH 2001* Spine Research Institute of San Diego. San Diego, CA. August 2001.

91. Injury Pattern Analysis and Forensic Trauma Epidemiology in vehicular homicide investigation. *Washington State Patrol* Lacy, WA, June 20, 2001

92. Case studies in multidisciplinary spine care. *Chiropractic Association of Oregon* Portland OR, April 28, 2001

93. Injury Pattern Analysis and Forensic Trauma Epidemiology in vehicular homicide investigation. *Washington State Patrol* Vancouver, WA, February 13, 2001

94. The role of cervical manipulation in neck pain. Invited lecture. *Cervical Spine Research Society 28th Annual Meeting* Instructional Course. Charleston, South Carolina, December 1, 2000

95. Significant spinal injuries resulting from low-level accelerations: a case series of roller coaster injuries. *Cervical Spine Research Society 28th Annual Meeting* Charleston, South Carolina, December 1, 2000

96. Injury Pattern Analysis and Forensic Trauma Epidemiology in vehicular homicide investigation. *Medical Examiner Division, Oregon State Police*. Salem, OR. November 28, 2000

97. Minimal damage motor vehicle crash reconstruction. Invited lecture. Spine Research Institute of San Diego. *CRASH 2000* Spine Research Institute of San Diego. San Diego CA. August 11-13, 2000

98. Analysis of the whiplash literature with emphasis on research out of Quebec and Saskatchewan. *Saskatchewan Medical Group and Coalition Against No-Fault*. Saskatoon, Saskatchewan. September 2000.

99. Forensic applications of crash reconstruction. Invited lecture. *CRASH 2000* Spine Research Institute of San Diego. San Diego, CA. August 11, 2000.

100. Injury Pattern Analysis and Forensic Trauma Epidemiology; practical application in the forensic setting. Washington County CART Team training lecture, on behalf of *Medical Examiner Division, Oregon State Police*. Lake Oswego, Oregon. July 13, 2000.

101. The epidemiology of acute and chronic whiplash injury in the U.S. Invited lecture. *HWS-Distorsion (Schleudetrauma) & Leichte Traumatische, Hirnverletzung. Invaliditat und Berufliche Reintegration*. Basel, Switzerland. June 29-30, 2000.

102. Whiplash injury risk factors. Invited lecture. *Whiplash 2000*. Bath, England. May 18, 2000.

103. How many whiplash injuries could there be? Invited lecture. *Whiplash 2000* Bath, England. May 17, 2000.

104. Whiplash injury and occupant kinematics; the results of human volunteer crash testing. Invited lecture. *Society for Road Traffic Injuries (LFT)*. Oslo, Norway. April 3, 2000.

105. Epidemiology of Whiplash Injuries. Invited lecture. *Swedish Orthopedic Society* Stockholm, Sweden. March 31, 2000.

106. Methodologic pitfalls in epidemiological and clinical research, with examples from whiplash research. Invited lecture. *Arvetsinstitut (Institute for Musculoskeletal Medicine Research) Umeå University,* Umeå, Sweden. March 30, 2000.

107. The prevalence of whiplash-associated chronic cervical pain among a random sample of patients with chronic spine pain. *Cervical Spine Research Society 27th Annual Meeting* Seattle, WA December 13-15, 1999.

108. High speed videography of occupant movement during human volunteer crash testing; searching for an injury threshold. *North American Whiplash Trauma Congress* November 12, 1999.

109. Scientific Chair Address. *North American Whiplash Trauma Congress* November 12, 1999.

110. The science of whiplash injuries: common mistakes in the reconstruction of low speed crashes. Invited lecture. *Forensic Accident Reconstructionists of Oregon* Eugene, Oregon, April 1, 1999.

111. Late whiplash risk factor analysis of a random sample of patients with chronic spine pain. *Whiplash Associated Disorders World Congress* Vancouver, B.C. February 9, 1999.

112. The epidemiology of whiplash injuries; critiquing the literature. Grand rounds, *Department of Public Health and Preventive Medicine, Oregon Health Sciences University* Portland, Oregon. December 17, 1998.

113. The scientific appraisal of motor vehicle crash-related injuries. Invited lecture. *Managing the Cost of Auto Injuries*. Orlando, FL. December 8, 1998.

114. Risk factors for chronic pain following acute whiplash injury. Invited lecture. *Managing the Cost of Auto Injuries* Orlando, FL. December 7, 1998.

115. The epidemiology of whiplash injuries. Current Issues in Public Health, *Department of Public Health and Preventive Medicine, Oregon Health Sciences University* Portland, Oregon. October 7, 1998

116. The epidemiology of whiplash - is there a reliable threshold for whiplash injury? Invited lecture. *HWS-Distortion (Schleudetrauma) & Leichte Traumatische Medico-Legal Congress*. Basel, Switzerland, June 26, 1998.

117. The Epidemiology of Late Whiplash. Invited lecture. *HWS-Distortion (Schleudetrauma) & Leichte Traumatische Medico-Legal Congress.* Basel, Switzerland, June 25, 1998.

118. Methodologic error in the whiplash literature. Invited lecture. *Whiplash '96* Brussels, Belgium, November 15-16, 1996

119. Conservative therapy for spinal disorders *St. Francis Hospital*, San Francisco, CA. September 1994

120. The history of chiropractic. Invited lecture. *White Plains Hospital*, White Plains, NY. December 1993

DR. FREEMAN'S TESTIMONY HISTORY

2020-2024 RULE 26 DISCLOSURE
MICHAEL D. FREEMAN, MedDr PhD MScFMS MPH FRCPath FFFLM FACE DLM

November 2020-November 2024

2020

November 3, 2020: Deposition via video conference in Salem, Oregon. Attorney: Paderewski, Max. Case: Joseph, London v Giddens. Case # 2018CI10516. In the District Court of Bexar County, Texas.

December 7, 2020: Deposition via video conference in Salem, Oregon. Attorney: Kolodinsky, Rick. Case: Watkins, S v Livingston et al. Case # 2018-30269-CICI. In the Circuit Court of the Seventh Judicial Circuit in and for Volusia County, Florida.

December 14, 2020: Deposition via video conference in Salem, Oregon. Attorney: Steffen, John. Case: Spooner, L v Cinnappan. Case # 14 L 428. In the Circuit Court of Kane County, Illinois, Sixteenth Judicial Circuit.

December 15, 2020: Deposition via video conference in Salem, Oregon. Attorney: Warner, Thomas. Case: Nuessen, Patrick v Butler. Case # 18-CV-2078. In the Eighteenth Judicial District, District Court, Sedgwick County, Kansas Civil Department.

December 22, 2020: Continued Deposition via video conference in Salem, Oregon. Attorney: Joyce, Robert. Case: Thomas, Ashlyn v Mitchell. Case # 18-CA-001654. In the Circuit Court of the Sixth Judicial Circuit in and for Pasco County, State of Florida Civil Division.

2021

January 5, 2021: Testimony at hearing via video conference in Salem, Oregon. Attorney: Joyce, Robert. Case: Thomas, Ashlyn v Mitchell. Case # 18-CA-001654. In the Circuit Court of the Sixth Judicial Circuit, in and for Pasco County, State of Florida Civil Division.

January 5, 2021: Deposition via video conference in Salem, Oregon. Attorney: Tramuto, Robert. Case: Fraire, J v Basic Energy Services. Case # 18-11-22703-CVR. In the District Court 143rd Judicial District, Reeves County, Texas.

January 20, 2021: Deposition via video conference in Salem, Oregon. Attorney: Murphy, Jason. Case: Reynolds, A v CR Bard. Case # 3:19-cv-00762-WMC. In the United States District Court for the Western District of Wisconsin.

January 25, 2021: Deposition via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Garrahan, M v Publix. Case # 19-CA-00106-M. In the Circuit Court of the Sixteenth Judicial Circuit, in and for Monroe County, Florida.

January 27, 2021: Deposition via video conference in Salem, Oregon. Attorney: Brazzeal, Chad. Case: Reyes v Coastal Living Electrical LLC. Case # 19-CA-0702. In the Circuit Court of the Twentieth Judicial Circuit, in and for Collier County, Florida.

February 11, 2021: Deposition via video conference in Salem, Oregon. Attorney: Winder, Donald. Case: Lands' End, Inc. Case # 3:19-cv-00823-jdp. In the United States District Court for the Western District of Wisconsin.

February 23, 2021: Trial testimony via video conference in Salem, Oregon. Attorney: Brown Lee, Deborah. Case: State of Washington v Haile. Case # 17-1-03939-6-KNT. In the Superior Court for the State of Washington, King County.

February 24, 2021: Trial testimony via video conference in Salem, Oregon. Attorney: McGregor, Shelagh. Case: Yost, K v Bahler. Case # 1103-14108. In the Court of Queen's Bench of Alberta.

March 2, 2021: Trial testimony via video conference in Salem, Oregon. Attorney: Harte, Paul. Case: Levac v James. Case # CV-14-511333-00CP. In the Ontario Superior Court of Justice.

March 4, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Machler, Susan. Case: Seymour v Children's Hospital. Case # 20-2-07733-0 SEA. In the Superior Court of the State of Washington In and for the county of King.

March 9, 2021: Deposition via Zoom in Salem, Oregon. Attorney: DiSilvio, Marilena. Case: Mann, A v Air Methods Corporation. Case #19 CV 911942. In the Court of Common Pleas Cuyahoga County, Ohio.

March 10, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Ladah, Ramzy. Case: Marin, N v Clark. Case # A-18-776332-C. In the District Court Clark County, Nevada.

March 16, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Steffan, John. Case: Spooner, L v Chinnappan. Case # 14 L 428. In the Circuit Court of the Sixteenth Judicial Circuit, Kane County, Illinois.

March 19, 2021: Deposition via video conference in Salem, Oregon. Attorney: Smith, Alicia. Case: Wilson v Home Depot. Case # 2018-CA-000243-0. In the Circuit Court of the Ninth Judicial Circuit, in and for Orange County, Florida.

March 22, 2021: Deposition via video conference in Salem, Oregon. Attorney: Williams, Don. Case: Esco, J v Mendoza. Case # 45382. In the 18th Judicial District Court, Parish of West Baton Rouge, State of Louisiana.

March 24, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Crosley, Tom. Case: Lambaria-Gonzalez v United Parcel Service, Inc. Case # 2018CI08525. In the District Court, 408th Judicial District Bexar County, Texas.

March 25, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Swope, Scott. Case: Weckerle, L v State Farm. Case # 20-000137-CI. In the Circuit Court of the Sixth Judicial Circuit, in and for Pinellas County, Florida.

March 26, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Stephens, Joe. Case: Beck, Amy v Hoelscher. Case # 308,657-B. In the District Court 146th Judicial District, Bell County, Texas.

March 29, 2021: Continued deposition via Zoom in Salem, Oregon. Attorney: Hermida, Andres. Case: Garrahan, M v Publix. Case # 19-CA-00106-M. In the Circuit Court of the Sixteenth Judicial Circuit, in and for Monroe County, Florida.

March 30, 2021: Deposition via video conference in Salem, Oregon. Attorney: Goldberg, Tyler. Case: Diaz, G v University of Washington Medical Center. Case # 16-2-11790-2 SEA. In the Superior Court of Washington for King County.

April 7, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Carter, David. Case: Hughes, T v Indian River Memorial Hospital, Inc. Case # 312018CA000344. In the Circuit Court of the Nineteenth Judicial Circuit, in and for Indian River County, Florida.

April 9, 2021: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Sallies v Portuguese Management Corporation. Case # 312019CA000421. In the Circuit Court of the 19th Judicial Circuit, in and for Indian River County, Florida.

April 13, 2021: Deposition via video conference in Salem, Oregon. Attorney: Wise, Jared. Case: Gonzalez, J v Behel. Case # 2019-CA-000983-08-K. In the Circuit Court of the Eighteenth Judicial Circuit, in and for Seminole County, Florida.

April 14, 2021: Deposition via video conference in Salem, Oregon. Attorney: Kohler, Alison. Case: Parker v Matz. Case # C03CV19004232. In the Circuit Court for Baltimore County.

April 15, 2021: Deposition via video conference in Salem, Oregon. Attorney: Velez, Harold. Case: Hernandez- Miyashiki v Beau Living. Case # 16-032706 CA 01. In the Circuit Court of the 11th Judicial Circuit, in and for Miami-Dade County, Florida, General Jurisdiction Division.

April 16, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Russo, Nick. Case: Watson v Ranger. Case # 2019 10352 CIDL. In the Circuit Court, of the Seventh Judicial Circuit, in and for Volusia County, Florida.

April 19, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Dunn, Joseph. Case: Marino, John v Nordfors. Case # 05-2020-CA-013498. In the Circuit Court, of the Eighteenth Judicial Circuit, in and for Brevard County, Florida.

April 21, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Goldberg, Tyler. Case: Diaz, G v University of Washington Medical Center. Case # 16-2-11790-2 SEA. In the Superior Court of Washington for King County.

April 29, 2021: Testimony at hearing via video conference in Salem, Oregon. Attorney: Perez, Karina. Case: Saffold, M v Spitznagel. Case # 17-CA-003497. In the Circuit Court of the 13th Judicial Circuit, in and for Hillsborough County, Florida, Civil Division.

April 30, 2021: Testimony at hearing via video conference in Salem, Oregon. Attorney: Kohler, Alison. Case: Parker v Matz. Case # C03CV19004232. In the Circuit Court for Baltimore County.

May 6, 2021: Deposition via video conference in Salem, Oregon. Attorney: Hevia, Anthony. Case: Wilson v Amspoker. Case # 42-2019-CA-000917-CAAXXX. In the Circuit Court of the Fifth Judicial Circuit, in and for Marion County, Florida.

May 12, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Velez, Harold. Case: Hernandez-Miyashiki v Beau Living. Case # 16-032706 CA 01. In the Circuit Court of the 11th Judicial Circuit, in and for Miami-Dade County, Florida, General Jurisdiction Division.

May 13, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Hevia, Anthony. Case: Wilson v Amspoker. Case # 42-2019-CA-000917-CAAXXX. In the Circuit Court of the Fifth Judicial Circuit, in and for Marion County, Florida.

May 14, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Roberts, James. Case: Parker v Smith County. Case # 6:19CV212. In the United States District Court, for the Eastern District of Texas, Tyler Division.

May 26, 2021: Deposition via video conference in Salem, Oregon. Attorney: Hamilton, Alexandra. Case: Farrell v Hongo. Case # CGC-17-560982. In the Superior Court of California, County of San Francisco.

June 3, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Williams, Don. Case: Esco, John. Case # 00001045382. In the 18th Judicial District Court for the Parish of West Baton Rouge.

June 10, 2021: Continued deposition via Zoom in Salem, Oregon. Attorney: Hamilton, Alexandra. Case: Farrell. V Hongo. Case # CGC-17-560982. Superior Court of the State of California, For the County of San Francisco.

June 11, 2021: Continued deposition via Zoom in Salem, Oregon. Attorney: Hamilton, Alexandra. Case: Farrell. V Hongo. Case # CGC-17-560982. Superior Court of the State of California, For the County of San Francisco.

June 14, 2021: Deposition via video conference in Salem, Oregon. Attorney: Roberts, James. Case: Parker, C v Smith County. Case # 6:19-CV-212. In the United States District Court, Eastern District of Texas, Tyler Division.

June 15, 2021: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Rosales-Gutierrez. Case # 2017-CA-9511-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

June 22, 2021: Deposition via video conference in Salem, Oregon. Attorney: Engelhardt, Chad. Case: Streeter, M. Case # 16-0557-NH. State of Michigan, In the Circuit Court for The County of Kalamazoo.

June 25, 2021: Deposition via video conference in Salem, Oregon. Attorney: Collins, Moseley. Case: McEntyre v University of Washington Medical Center. Case # 20-2-08342-9 SEA. In the Superior Court of the State of Washington, In and For the County of King.

July 12, 2021: Deposition via video conference in Salem, Oregon. Attorney: Fernandez, Jennifer. Case: Wilson v Scruggs. Case # 2019-CA-003543. In the Circuit Court of the Twelfth Judicial Circuit, In and For Manatee County, Florida.

July 13, 2021: Deposition via video conference in Salem, Oregon. Attorney: Scofield, Graham. Case: Tally, N v Old Republic Insurance Co. Case # 2021CV00050. In the State Court of Clayton County, State of Georgia.

July 16, 2021: Deposition in Salem, Oregon. Attorney: Williams, Burgess. Case: Gonzalez, H v Leroy's Excavating. Case # D-117-CV-2020-00284. In the State of New Mexico, County of Rio Arriba, First Judicial District Court.

July 28, 2021: Deposition via Zoom in Salem, Oregon. Attorney: Midlo, Bennett. Case: Hernandez v Miller. Case # 2019-60983. In the District Court of Harris County, Texas, 152nd Judicial District.

August 2, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Scofield, Graham. Case: Tally, N v Old Republic Insurance Co. Case # 2021CV00050. In the State Court of Clayton County, State of Georgia.

August 3, 2021: Deposition via video conference in Salem, Oregon. Attorney: Lopez, Fermin. Case: Lindblad, L v Adventist Health Systems. Case # 2020-CA-72-MP. In the Circuit Court of the Ninth Judicial Circuit, In and For Osceola County, Florida.

August 3, 2021: Deposition via video conference in Salem, Oregon. Attorney: Mills, Laura. Case: Carr v Cleveland Clinic Union Hospital. Case # 2020 CM 03 0206. In the Court of Common Pleas, Tuscarawas County, Ohio.

August 4, 2021: Deposition via video conference in Salem, Oregon. Attorney: Dingwall, Jeffrey. Case: Adkins v CSX. Case # 3:18-CV-00321. In the United States District Court, For the Southern District of West Virginia At Huntington.

August 11, 2021: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Robitaille. Case # 15-CA-006639. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida, Civil District.

August 12, 2021: Deposition via video conference in Salem, Oregon. Attorney: Maucher, Michael. Case: Kodama v State Farm. Case # 2020-CP-08-00203. In the State of South Carolina, In the Court of Common Pleas, County of Charleston.

August 12, 2021: Deposition via video conference in Salem, Oregon. Attorney: Kaludi, Ike. Case: Aldaik v Larkins. Case # CGC-20-583539. In the Superior Court of California, City and County of San Francisco.

August 16, 2021: Deposition via video conference in Salem, Oregon. Attorney: Connick, Thomas. Case: Reichart v NVR, Inc. Case # CV 2019 10 2113. In the Common Pleas Court of Butler County, Ohio, General Division.

August 17, 2021: Deposition via video conference in Salem, Oregon. Attorney: Hendler, Scott. Case: Koen v Monsanto. Case # 3:20-cv-03074-VC. In the United States District Court, Northern District of California.

August 18, 2021: Deposition via video conference in Salem, Oregon. Attorney: Henderson, David. Case: Brooks, K. Case # 3AN-19-06624 CI. In the Superior Court for the State of Alaska, Third Judicial District at Anchorage.

August 20, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Robitaille. Case # 15-CA-006639. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida, Civil District.

August 23, 2021: Preserved deposition for trial in Salem, Oregon. Attorney: Lyon, Robert. Case: Rivera. Case # 471-00026-2019. In the District Court, 471st Judicial District, Collin County, Texas.

August 24, 2021: Trial testimony via video conference in Salem, Oregon. Attorney: Hutchinson, Ryan. Case: Bovinett v Berman. Case # 2018-CA-004480-NC. In the Circuit Court of the Twelfth Judicial Circuit, In and For Sarasota County, Florida.

August 25, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Hendler, Scott. Case: Koen v Monsanto. Case # 3:20-cv-03074-VC. In the United States District Court, Northern District of California.

August 30, 2021: Preserved deposition for trial in Salem, Oregon. Attorney: Allen, Robert. Case: Ramirez, Shirley v USAA. Case # 2019C114670. In the District Court, 45th Judicial District, Bexar County, Texas.

August 31, 2021: Deposition via video conference in Salem, Oregon. Attorney: Trujillo, John. Case: Meinsen. Case # 19-CA-010782. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

September 1, 2021: Deposition via video conference in Salem, Oregon. Attorney: Morgan, Daniel. Case: Stenson. Case # 2018-31051-CICI. In the Circuit Court of the 7th Judicial Circuit, In and For Volusia County, Florida.

September 2, 2021: Deposition via video conference in Salem, Oregon. Attorney: Degenhart, William. Case: Soper-Chacon v Chipotle. Case # 4:20-cv-00324-RSB-CLR. In the United States District Court, For the Southern District of Georgia, Savannah Division.

September 7, 2021: Deposition via video conference in Salem, Oregon. Attorney: Fiol, Alejandro. Case: Torres, Emily. Case # 19-CA-11907. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida, Civil Division.

September 9, 2021: Deposition via video conference in Salem, Oregon. Attorney: Fernandez, Jennifer. Case: Wilson v Scruggs. Case # 2019-CA-003543. In the Circuit Court of the Twelfth Judicial Circuit, In and For Manatee County, Florida.

September 13, 2021: Deposition via video conference in Salem, Oregon. Attorney: Duncan, Brian. Case: West v Springhill. Case # CV-16-901045. In the Circuit Court of Mobile County, Alabama.

October 5, 2021: Preserved deposition via video conference in Salem, Oregon. Attorney: Henderson, David. Case: Brooks, K. Case # 3AN-19-06624 CI. In the Superior Court for the State of Alaska, Third Judicial District at Anchorage.

October 6, 2021: Deposition via video conference in Salem, Oregon. Attorney: Tucker, Robert. Case: Gamble. Case # LACL144149. In the Iowa District Court for Polk County.

October 6, 2021: Deposition via video conference in Salem, Oregon. Attorney: Malarkey, Emily. Case: Taylor, R. Case # C-12-CV-19-001075. In the Circuit Court for Harford County.

October 12, 2021: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Brasseaux. Case # 20-CA-002932. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

October 19, 2021: Deposition via video conference in Salem, Oregon. Attorney: Luckey, Kent. Case: Zmrzel v Lyft. Case # 34-2018-00234895. In the Superior Court of the State of California, County of Sacramento.

October 22, 2021: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Rosales-Gutierrez. Case # 2017-CA-9511-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

October 26, 2021: Deposition preserved for trial in Salem, Oregon. Attorney: Brown, Paula. Case: Hobbs v KCSR. Case # 41CV-16-80. In the Circuit Court of Little River County, Arkansas.

October 27, 2021: Deposition via video conference in Salem, Oregon. Attorney: Roof, Colby. Case: Farmer, C. Case # 18-CA-00128. In the Circuit Court of the Fifth Judicial Circuit, In and For Sumter County, Florida.

October 27, 2021: Deposition via video conference in Salem, Oregon. Attorney: Amaro, James. Case: Ochoa v Master Construction. Case # 20-DCV-273123. In the District Court of Fort Bend County, Texas.

October 28, 2021: Deposition via video conference in Salem, Oregon. Attorney: Paderewski, Max. Case: Haynes, L. Case # DC-18-14848. In the District Court, 191st Judicial District, Dallas County, Texas.

October 29, 2021: Continued deposition via video conference in Salem, Oregon. Attorney: Paderewski, Max. Case: Haynes, L. Case # DC-18-14848. In the District Court, 191st Judicial District, Dallas County, Texas.

November 2, 2021: Deposition via video conference in Salem, Oregon. Attorney: Shapiro, Steven. Case: Mitchell v Rosenthal. Case # 20-CV-778. In the United States District Court, For the District of Colorado.

November 3, 2021: Deposition in Salem, Oregon. Attorney: Hoggard, Denise. Case: Edwards v Thomas. Case # 4:19-CV-4018-SOH. In the United States District Court, Western District of Arkansas, Texarkana Division.

November 8, 2021: Hearing via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Garrahan v Publix. Case # 19-CA-000106-M. In the Circuit Court of the Sixteenth Judicial Circuit, In and For Monroe County, Florida.

November 9, 2021: Deposition via video conference in Salem, Oregon. Attorney: Reifschneider, Meranda. Case: Bonnin. Case # 2020-008237-CA-31. In the Circuit Court of the 11th Judicial Circuit, In and For Miami-Dade County, Florida.

November 10, 2021: Deposition via video conference in Salem, Oregon. Attorney: Gilbert, Ronald. Case: Southwell v Sherr. Case # 2018-CA-00452-J. In the Circuit Court of the Eighth Judicial Circuit, In and For Alachua County, Florida.

November 10, 2021: Preserved deposition via video conference in Salem, Oregon. Attorney: Malarkey, Emily. Case: Taylor v Harford Memorial Hospital, Inc. Case # C-12-CV-19-001075. In the Circuit Court for Harford County.

November 15, 2021: Deposition via video conference in Salem, Oregon. Attorney: Gibbons, Robert. Case: Anderson v Dang. Case # 180905610. In the District Court of the Third Judicial District, In and For Salt Lake County, State of Utah.

November 16, 2021: Deposition via video conference in Salem, Oregon. Attorney: Kemp, Adam. Case: Bennett, Patrick v Bob Evans. Case # 19-CA-002653. In the Circuit Court of the Tenth Judicial Circuit, In and For Polk County, Florida Civil Division.

November 22, 2021: Deposition via video conference in Salem, Oregon. Attorney: Dunn, Joseph. Case: Robison, A. Case # 2019-CA-000906-AN. In the Circuit Court of the Ninth Judicial Circuit, In and For Osceola County, Florida.

November 29, 2021: Trial testimony via video conference in Salem, Oregon. Attorney: Luckey, Kent. Case: Zmrzel v Lyft. Case # 34-2018-00234865. In the Superior Court of California, County of Sacramento.

December 14, 2021: Deposition via video conference in Salem, Oregon. Attorney: Bollier, Jack. Case: De Sousa. Case # CGC-19-577258. In the Superior Court of the State of California, County of San Francisco.

December 15, 2021: Deposition via video conference in Salem, Oregon. Attorney: Jacobus, Bruce. Case: Turner, Lynn v Hansen. Case # 05-2019-CA-051586-XXXX-XX. In the Circuit Court of the 18th Judicial Circuit, In and For Brevard County, Florida.

December 16, 2021: Trial testimony via video conference in Salem, Oregon. Attorney: Morgan, Daniel. Case: Stenson, L v Bogle. Case # 2018-31051-CICI. In the Circuit Court, Seventh Judicial Circuit, In and For Volusia County, Florida.

December 21, 2021: Deposition via video conference in Salem, Oregon. Attorney: Connick, Thomas. Case: Platz, S v Karpinecz. Case # 20P000218. In the Court of Common Pleas, Geauga County, Ohio.

December 27, 2021: Deposition via video conference in Salem, Oregon. Attorney: Dollar, Tim. Case: Guthrie v Powell. Case # 20LW-CC00045. In the Circuit Court of Lawrence County, Missouri.

2022

January 7, 2022: Deposition via video conference in Salem, Oregon. Attorney: Kopacz, Joseph. Case: Sikorske, Jeffrey. Case # 2020-CA-000994. In the Circuit Court of the Sixth Judicial Circuit, In and For Hillsborough County, Florida, Civil Division.

January 8, 2022: Deposition via video conference in Salem, Oregon. Attorney: St Phalle, Eustace. Case: Mota, R v Huey. Case # CGC-20-582482. In the Superior Court of the State of California, County of San Francisco/ Unlimited Jurisdiction.

January 9, 2022: Deposition via video conference in Salem, Oregon. Attorney: Bowen, Lisha. Case: Klinge, Daryl. Case # 18-4429-CI-7. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, State of Florida, Civil Division.

January 27, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Porter, Laura. Case: Zuniga, Santa v Tri- National. Case # SA-20-CV-01417-ESC. In the United States District Court For the Western District of Texas, San Antonio Division.

January 31, 2022: Deposition via video conference in Salem, Oregon. Attorney: Pajcic, Seth. Case: Yapa, Dayana. Case # 2020-CA-000335. In the Circuit Court of the Fourth Judicial Circuit, In and For Clay County, Florida.

February 1, 2022: Preserved deposition via videoconference in Salem, Oregon. Attorney: Krebs, Ryan. Case: Hawkins, T v Banchs. Case # 20-0283-C26. In the District Court, 26th Judicial District, Williamson County, Texas.

February 2, 2022: Deposition via video conference in Salem, Oregon. Attorney: Machler, Susan. Case: Strauss v Premera Blue Cross. Case # 13-2-28143-1 SEA. In the Superior Court of the State of Washington, In and For the County of King.

February 4, 2022: Deposition via video conference in Salem, Oregon. Attorney: Warner, Thomas. Case: Gould, Richard. Case # 19-CV-000054. In the Fifth Judicial District, District Court of Lyon County, Kansas Civil Department.

February 7, 2022: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Clemons, A v Mother Kombucha. Case # 21-CA-000255. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

February 8, 2022: Deposition via video conference in Salem, Oregon. Attorney: Downs, Craig. Case: Deepwater Horizon Belo Cases. Case # 3:19-cv-963. In the United States District Court, Northern District of Florida, Pensacola Division.

February 9, 2022: Continued deposition via video conference in Salem, Oregon. Attorney: Downs, Craig. Case: Deepwater Horizon Belo Cases. Case # 3:19-cv-963. In the United States District Court, Northern District of Florida, Pensacola Division.

February 10, 2022: Deposition via video conference in Salem, Oregon. Attorney: Crockett, Brian. Case: Lewis, N. Case # DC-20-10519. In the District Court of Dallas County, Texas, 116th Judicial District.

February 15, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Kopacz, Joseph. Case: Sikorske, Jeffrey. Case # 2020-CA-000994. In the Circuit Court of the Sixth Judicial Circuit, In and For Hillsborough County, Florida, Civil Division.

February 18, 2022: Deposition via video conference in Salem, Oregon. Attorney: Thompson, Jim. Case: Griffey, C v True Home Value, Inc. Case # 20CY-CV07013. In the Circuit Court of Clay County, Missouri Associate Circuit Division Liberty, Missouri.

February 22, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Jones, Henry. Case: Sky Valley ED v Monsanto. Case # 21-2-14302-1 SEA. In the Superior Country of the State of Washington, For the County of King.

February 28, 2022: Deposition via video conference in Salem, Oregon. Attorney: McLaughlin, Robert. Case: Bedel, P. Case # 20-CA-003453. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

March 3, 2022: Deposition in Salem, Oregon. Attorney: Gibbons, Roberts. Case: Gallegos, Jerry Brewski's on Historic 25th Street. Case # 200902686. In the Second Judicial District Court, In and For Weber County, State of Utah.

March 7, 2022: Deposition via video conference in Salem, Oregon. Attorney: Paulson, Jane. Case: Villagomez, K v PeaceHealth. Case # 18-2-01491-7. In the Superior Court of the State of Washington, In and For the County of Clark.

March 8, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Gibbs, Christopher. Case: Peeples, Dana v Hernstein Auto Group. Case # 920-cv-04463-RMG. In the United States District Court for the District of South Carolina, Beaufort Division.

March 11, 2022: Hearing via video conference in Salem, Oregon. Attorney: Roof, Colby. Case: Farmer, C v Tredwell. Case # 18-CA-00128. In the Circuit Court of the Fifth Judicial Circuit, In and For Sumter County, Florida.

March 14, 2022: Deposition via video conference in Salem, Oregon. Attorney: Jaffe, Martin. Case: Brooks, Oralia v Buchanan. Case # 2019-31480 CICI. In the Circuit Court of the Seventh Judicial Circuit, In and For Volusia County, Florida.

March 15, 2022: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Valdez, M v Central Freight Lines. Case # 2020-CVA-000764-D3. In District Court, 341st Judicial District, Webb County, Texas.

March 23, 2022: Hearing via video conference in Salem, Oregon. Attorney: Trujillo, John. Case: Meinsen, Tara v Esurance Property and Casualty Insurance Company. Case # 19-CA-010782. In the Circuit Court of the 13th Judicial Circuit, In and For Hillsborough County, Florida.

March 25, 2022: Deposition via video conference in Salem, Oregon. Attorney: Biggart, James. Case: Blanchette, V v Florida Trails. Case # 2020-CA-0482. In the Circuit Court of the Eighth Judicial Circuit, In and For Alachua County, Florida.

April 5, 2022: Deposition via video conference in Salem, Oregon. Attorney: Coats, Elizabeth. Case: Simpson, C v Harris. Case # A-19-799090-C. In the District Court, Clark County, Nevada.

April 7, 2022: Deposition via video conference in Salem, Oregon. Attorney: Hornbuckle, Stephen. Case: Parker v PeaceHealth. Case # 19-2-02043-37. In the Superior Court of the State of Washington, In and For the County of Whatcom.

April 8, 2022: Continued deposition via video conference in Salem, Oregon. Attorney: Dunn, Joseph. Case: Robison, Angela. Case # 2019 CA 000906 AN. In the Circuit Court of the Ninth Judicial Circuit, In and For Osceola County, Florida.

April 12, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Peacock, Malorie. Case: Vasquez, G v San Jose Fruit. Case # 7:20-cv-355. In the United States District Court, For Southern District of Texas, Mcallen Division.

April 14, 2022: Deposition via video conference in Salem, Oregon. Attorney: Pilon, Chad. Case: Roberts v Dodd. Case # 19-007430-CI. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, Florida Civil Division.

April 15, 2022: Deposition via video conference in Salem, Oregon. Attorney: Coletti, John. Case: Hart, Linda v Legacy Health. Case # 20-2-01672-06. In the Superior Court of the State of Washington, For Clark County.

April 20, 2022: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Barrera, Rene v Arch Transport. Case # 20-08-00143-CVL. In the District Court of La Salle County, Texas.

April 22, 2022: Deposition via video conference in Salem, Oregon. Attorney: Bell, Alfred. Case: Willis, D v Asplundh Tree Expert. Case # 562020CA000614. In the Circuit Court of the 19th Judicial Circuit, In and For St. Lucie County, Florida.

April 25, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Dugas, Clay. Case: Layfield, Kylie v Richard. Case # A-203680. In the District Court, Jefferson County, Texas, 58th Judicial District.

April 26, 2022: Hearing via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Robitaille v State Farm Insurance. Case # 15-CA-006639. In the Circuit Court of the Thirtieth Judicial Circuit, In and For Hillsborough County, State of Florida., Civil Division.

April 28, 2022: Deposition via video conference in Salem, Oregon. Attorney: Johnson, Jordan. Case: Daigle v Cook. Case # 20CV369832. In the Superior Court of California, County of Santa Clara.

April 28, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Machler, Susan. Case: Hamilton, Z. Case # 20-2-00543-21. In the Superior Court of the State of Washington, In and For the County of Lewis.

April 29, 2022: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Elbert, J v Henocque. Case # 2018-CA-017312. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Brevard County, Florida, Civil Division.

May 12, 2022: Deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Fornek v Sterigenics. Case # 2018-L-010475. In the Circuit Court of Cook County, County Department, Law Division.

June 3, 2022: Continued deposition via video conference in Salem, Oregon. Attorney: Russo, Nick. Case: Esaine, A v Conquering Lion Trucking, LLC. Case # 2020-CA-003208-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, State of Florida, Civil Division.

June 6, 2022: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Fernandez, Ramiro. Case # 5:21-cv-123. In the United States District Court, For the Southern District of Texas, Laredo Division.

June 8, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Warner, Thomas. Case: Nuessen, P v Butler. Case # 18-CV-2078. In the Eighteenth Judicial District, District Court, Sedgwick County, Kansas, Civil Department.

June 8, 2022: Deposition via video conference in Salem, Oregon. Attorney: Perkins, Paul. Case: Hart, R v Miley. Case # 2017-CA-008612-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

June 9, 2022: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Tenery, D. Case # 2018-CA-013196-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

June 17, 2022: Deposition via video conference in Salem, Oregon. Attorney: Hirshman, Tobias. Case: Vanecek, C v REM Ohio, Inc. Case # CV 20 930687. In the Court of Common Pleas, Cuyahoga County, Ohio.

June 27, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Machler, Susan. Case: Hamilton, S. Case # 20-2-00543-21. In the Superior Court of the State of Washington, In and For the County of Lewis.

June 28, 2022: Deposition in Salem, Oregon. Attorney: Levin, Mick. Case: Rodriguez-Gamez v Lytle. Case # CV2019-010440. Superior Court of the State of Arizona, County of Maricopa.

June 30, 2022: Deposition via video conference in Salem, Oregon. Attorney: Aversano, Donna. Case: Sain, R v Texas Health Resources. Case # 048-318205-20. In the District Court, Tarrant County, Texas, 48th Judicial District.

July 1, 2022: Deposition via video conference in Salem, Oregon. Attorney: Maxwell, Mike. Case: Hunter, C v City of Tukwila. Case # 20-2-02397-3 KNT. IN the Superior Court of Washington, King County.

July 14, 2022: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Barrera, R v Arch Transport, LLC. Case # 20-08-00143-CVL. In the District Court of La Salle County, Texas, 81st Judicial District.

July 18, 2022: Deposition via video conference in Salem, Oregon. Attorney: Panagakis, Nick. Case: Moore, P v Papa John's USA, Inc. Case # 2018-CA-002908-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

July 19, 2022: Deposition via video conference in Salem, Oregon. Attorney: Crockett, Brian. Case: Terry, J. Case # B-20-01-0072-CV. In the District Court of Ector County, Texas, 161st Judicial District.

July 20, 2022: Hearing via video conference in Salem, Oregon. Attorney: Bell, Alfred. Case: Willis, D v Asplundh Tree Expert, LLC. Case # 562020-CA-000614. In the Circuit Court of the 19th Judicial Circuit, In and For Port St. Lucie, Florida.

July 20, 2022: Deposition via video conference in Salem, Oregon. Attorney: Felice, Timothy. Case: Martinez-Echeverri v Wal-Mart Stores East, LP. Case # 502017CA000259XXXXMB AK. In the Circuit Court of the Fifteenth Judicial Circuit, In and For, Palm Beach County, Florida.

July 21, 2022: Deposition in Salem, Oregon. Attorney: Albright, Paul. Case: Ortal, N v Mazur. Case # A-19-794214-C. in the District Court, Clark County, Nevada.

July 25, 2022: Deposition via video conference in Salem, Oregon. Attorney: Amaro, James. Case: Ruiz, G v Wal-Mart Stores Texas. Case # 2019-79822-7. In the District Court of Harris County, Texas, 234th Judicial District.

July 26, 2022: Deposition via video conference in Salem, Oregon. Attorney: Carr, Patrick. Case: Gregg, J v Gimenez. Case # 2020-CP-07-00479. In the Circuit Court of Common Pleas, The Fourteenth Judicial Circuit.

July 28, 2022: Deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Schumacher v Sterigenics. Case # 2018-L-010475. In the Circuit Court of Cook County, Illinois, County Department, Law Division.

July 29, 2022: Deposition via video conference in Salem, Oregon. Attorney: Finn, Larry. Case: Edwards, L v BJ's Oil Field Construction, Inc. Case # CJ-2018-1425. In the District Court of Cleveland County, State of Oklahoma.

August 1, 2022: Deposition via video conference in Salem, Oregon. Attorney: Goss, Ady. Case: Bernstein, Emily. Case # 2019-CA-003808-08-W. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Seminole County, Florida.

August 2, 2022: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Hughley, B v Lachance. Case # 2020-CA-388-O. In the Circuit Court, Ninth Judicial Circuit, In and For Orange County, Florida.

August 3, 2022: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Thompson, Y v Sullins. Case # 2020-CA-000400. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, Florida, Civil Division.

August 8, 2022: Deposition via video conference in Salem, Oregon. Attorney: Adams, Will. Case: Varnadore, K. Case # MO:20-CV-00271-DC. United States District Court, Western District of Texas, Midland Division.

August 9, 2022: Deposition via video conference in Salem, Oregon. Attorney: Moran, Mary. Case: Simmonds, Gary. Case # 2020-CA-000703. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Seminole County, Florida Civil Division.

August 12, 2022: Hearing via video conference in Salem, Oregon. Attorney: Salter, Brad. Case: Carpenter, J v 21st Century Centennial Insurance Company. Case # 16-000008-CI. In the Circuit Court of the 6th Judicial Circuit, In and For Pinellas County, Florida.

August 16, 2022: Deposition via video conference in Salem, Oregon. Attorney: Vasquez, James. Case: Lembert, V. Case # BER-L120-21. Superior Court of New Jersey, Law Division, Bergen County.

August 17, 2022: Deposition via video conference in Salem, Oregon. Attorney: McKenna, Kenneth. Case: Rocher, Darline. Case # 2016-CA-4209. In the Circuit Court of the Seventeenth Judicial Circuit, In and For Broward County, Florida.

August 18, 2022: Deposition via video conference in Salem, Oregon. Attorney: Dugas, Clay. Case: Layfield, Kylie v Richard. Case # A-203680. In the District Court, Jefferson County, Texas, 58th Judicial District.

August 19, 2022: Deposition via video conference in Salem, Oregon. Attorney: Hevia, Anthony. Case: Hernandez, Y v Castro. Case # 2020-022573-CA-O1. In the Circuit Court of the 11th Judicial Circuit, In and For Miami-Dade County, Florida.

August 19, 2022: Deposition via video conference in Salem, Oregon. Attorney: Holland, James. Case: Hancock, E v Cantillo. Case #11-2020-CA-002477-00001. In the Circuit Court of the Twentieth Judicial Circuit, In and For Collier County, Florida, Civil Division.

August 24, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Holland, James. Case: Hancock, E v Cantillo. Case #11-2020-CA-002477-00001. In the Circuit Court of the Twentieth Judicial Circuit, In and For Collier County, Florida, Civil Division.

August 29, 2022: Deposition via video conference in Salem, Oregon. Attorney: Dingwall, Jeffrey. Case: Carey, D v CSX Transportation, Inc. Case # 18-CI-00348. Commonwealth of Kentucky, Greenup Circuit Court.

September 1, 2022: Deposition via video conference in Salem, Oregon. Attorney: Trask, Thomas. Case: Palmer, D v Simmons. Case # 18A69623. In the State Court of Dekalb County, State of Georgia.

September 7, 2022: Deposition via video conference in Salem, Oregon. Attorney: Slater, Thomas. Case: Kenyon, N v Travelers. Case # 16-2021-CA-003332. In the Circuit Court, Fourth Judicial Circuit, In and For Duval County, Florida.

September 8, 2022: Deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Fornek v Sterigenics. Case # 2018-L-010475. In the Circuit Court of Cook County, Illinois County Department, Law Division.

September 9, 2022: Hearing via video conference in Salem, Oregon. Attorney: McKenna, Kenneth. Case: Rocher, D v Memorial West. Case # 16-004209. In the Circuit Court of the 17th Judicial Circuit, In and For Broward County, Florida.

September 13, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Machler, Susan. Case: Strauss v Premera Blue Cross. Case # 13-2-28143-1 SEA. In the Superior Court of the State of Washington, King County.

September 14, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Garrahan v Publix. Case # 2019-CA-000106-M. In the Circuit Court of the 16th Judicial Circuit, In and For Monroe County, Florida.

October 10, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: McDougal, Mark. Case: Prentice, K & Rader, E v Loy Clark Pipeline Co. Case #18cv40481 & # 18cv44865. In the Circuit Court of the State of Oregon, In and for the county of Multnomah.

October 11, 2022: Deposition via video conference in Salem, Oregon. Attorney: Case: Deep Water Horizon Belo Cases. Case # 3:19cv963. In the United States District Court, Northern District of Florida, Pensacola Division.

October 13, 2022: Deposition via video conference in Salem, Oregon. Attorney: Drew, Noah. Case: Bauer, L v Living Alternatives. Case # 21-1501-NO- W. In the Circuit Court for the County of Berrien, State of Michigan.

October 13, 2022: Deposition via video conference in Salem, Oregon. Attorney: Fine, Julie. Case: Walters, M v Willis. Case # 2020-CA-2966. In the Circuit Court of the Eighth Judicial Circuit, In and For Alachua County, Florida.

October 14, 2022: Deposition via video conference in Salem, Oregon. Attorney: Bates, Will. Case: Fuguet, S. Case # 2018 11863 CIDL. In the Circuit Court of the 17th Judicial Circuit, In and For Volusia County, Florida.

October 17, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Wise, Jared. Case: Ward, C v Morris. Case # 2019-CA-003242. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

October 19, 2022: Testimony via video conference in Salem, Oregon. Attorney: LeBoeuf, Dean. Case: Johnson, Dillion v Pensacola Care Inc.

October 20, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Bates, Will. Case: Fuguet, S. Case # 2018 11863 CIDL. In the Circuit Court of the 17th Judicial Circuit, In and For Volusia County, Florida.

October 20, 2022: Deposition via video conference in Salem, Oregon. Attorney: Henderson, David. Case: Martinez, M v Providence Health & Services. Case # 3AN-20-4308CI. IN the Superior Court for the State of Alaska, Third Judicial District at Anchorage.

October 24, 2022: Preserved deposition via video conference in Salem, Oregon. Attorney: Rosenberg, Case: Hill, J v Frew. Case # 20EV002660. In the State Court of Fulton County, State of Georgia.

October 25, 2022: Deposition via video conference in Salem, Oregon. Attorney: Moran, Jack. Case: Valladares-Narvaez, G v Mystic Waters & Pool Services, LLC. Case # 2017-CA-5655. In the Circuit Court, Fourth Judicial Circuit, in and For Duval County, Florida.

October 25, 2022: Deposition via video conference in Salem, Oregon. Attorney: Peterson, Justin. Case: Trebus, M v State Farm. Case # 2020-CA-000737-CAAXWS. In the Circuit Court for Pasco County, Florida.

October 27, 2022: Deposition via video conference in Salem, Oregon. Attorney: Toomey, Ryan. Case: Nunez, G v FedEx. Case # 2021DCV0768. In the District Court, 34th Judicial District, El Paso County, Texas.

October 31, 2022: Deposition via video conference in Salem, Oregon. Attorney: Flynn, Ned. Case: McKinnon, J v Byrd. Case # 19-C-09168-S2. In the State Court of Gwinnett County, State of Georgia.

October 31, 2022: Deposition via video conference in Salem, Oregon. Attorney: Matthews, Marc. Case: Dennis, T v State Farm. Case # 2020-CA-003039. In the Circuit Court of the Twelfth Judicial Circuit, In and For Manatee County, State of Florida, Civil Division.

November 01, 2022: Deposition in Salem, Oregon. Attorney: Bauermeister, Don. Case: Galligan, Johnny. Case # 2020 CV 090. In the State of Wisconsin, Circuit Court, Bayfield County.

November 04, 2022: Deposition in Salem, Oregon. Attorney: Coletti, John. Case: Thomsen, T v Naphcare. Case # 3:19-cv-00969-AR. In the United States District Court, District of Oregon, Portland Division.

November 07, 2022: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Della Rosa, D v Tarpon Springs Assisted Living. Case # 20-004839-CI. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, State of Florida, Civil Division.

November 08, 2022: Trial testimony via video conference in Salem, Oregon. Attorney: Ladah, Ramzy. Case: Marin, N v Clark. Case # A-18-776332-C. In the District Court, Clark County, Nevada.

November 14, 2022: Deposition via video conference in Salem, Oregon. Attorney: Spagnolia, Case: Mercado, J v Penske. Case # 2020-CA-009610. In the Circuit Court of the 13th Judicial Circuit, In and For Hillsborough County, Florida.

November 15, 2022: Deposition via video conference in Salem, Oregon. Attorney: Crockett, Brian. Case: Vinklarek, W v Harper. Case # 110869-CV. In the District Court of Brazoria County, Texas, 412th Judicial District.

November 16, 2022: Deposition preserved for trial in Salem, Oregon. Attorney: Hirshman, Tobias. Case: Vanecek, C v Rem Ohio Inc. Case # CV-20-930687. In the Court of Common Pleas of Cuyahoga County, Ohio.

November 21, 2022: Deposition via video conference in Salem, Oregon. Attorney: Dunn, Joseph. Case: Francois, R v Amanda Auto Transport, LLC. Case # 2021-CA-003288-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

November 29, 2022: Deposition via video conference in Salem, Oregon. Attorney: Wade, Jodi. Case: Belcher, A v Aramark Uniform. Case # 3:21-CV-00375-MMH-JRK. In the United States District Court, Middle District of Florida, Jacksonville Division.

December 06, 2022: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: White, W v Amezquita. Case # 2018-CA-006372-0. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

December 08, 2022: Deposition via video conference in Salem, Oregon. Attorney: Sahadeo, Ravin. Case: Sweezea, A v Drotar. Case # 35-2020-CA-001733-AX. In the Circuit Court of the Fifth Judicial Circuit, In and For Lake County, Florida.

December 09, 2022: Deposition via video conference in Salem, Oregon. Attorney: Panagakis, Nick. Case: Kleizo, M v Booth's Cobblestones, Inc. Case # 2020-CA-010977-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida Civil Division.

December 13, 2022: Deposition via video conference in Salem, Oregon. Attorney: Roof, Colby. Case: Montoya, K v Skanska Granite. Case # 2021-CA-000502-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

December 14, 2022: Deposition in Salem, Oregon. Attorney: Hevia, Anthony. Case: Mays, J v City of Jacksonville. Case # 3:21-cv-474-TJC-PDB. In the United States District Court, Middle District of Florida, Jacksonville Division.

December 15, 2022: Continued deposition in Salem, Oregon. Attorney: Hevia, Anthony. Case: Mays, J v City of Jacksonville. Case # 3:21-cv-474-TJC-PDB. In the United States District Court, Middle District of Florida, Jacksonville Division.

December 15, 2022: Deposition in Salem, Oregon. Attorney: Vasquez, James. Case: Floramin-Paulino, W v Hodges. Case # ESX-L-8597-20. In the Superior Court of New Jersey, Law Division, Essex County.

December 21, 2022: Deposition via video conference in Salem, Oregon. Attorney: Moran, John. Case: Valladares-Narvaez, G v Mystic Waters. Case # 2017-CA-5655. In the Circuit Court, Fourth Judicial Circuit, In and For Duval County, Florida.

January 03, 2023: Deposition via video conference in Salem, Oregon. Attorney: Hosseinzadeh, Kristin. Case: Bean, S v Meritus Medical Center, Inc. Case # C-21-CV-21-000050. In the Circuit Court for Washington County, Maryland.

January 04, 2023: Deposition via video conference in Salem, Oregon. Attorney: Badagliacca, John. Case: Del Guercio, E v Mendham. Case # MRS-L-2316-19. In the Superior Court of New Jersey, Law Division: Morris County.

January 05, 2023: Deposition via video conference in Salem, Oregon. Attorney: Stern, Kevin. Case: Triplett, B v Frederick Health Hospital, Inc. Case # C-10-CV-21-000056. In the Circuit Court of Maryland for Frederick County.

January 06, 2023: Deposition via video conference in Salem, Oregon. Attorney: Roof, Colby. Case: Morgan, M v Metropolitan Casualty Insurance Company. Case # 2019-CA-015329-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

January 06, 2023: Deposition via video conference in Salem, Oregon. Attorney: Maxwell, Mike. Case: Hunter, C v City of Tukwila. Case # 20-2-02397-3 KNT. In the Superior Court of The State of Washington, In and For the County of King.

January 09, 2023: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Heredia, A v Cuffee. Case # 21-CA-005974 (D). In the Circuit Court of the 13th Judicial Circuit, In and For Hillsborough County, Florida.

January 10, 2023: Deposition via video conference in Salem, Oregon. Attorney: Grant, Javan. Case: Brantley, L v Welch. Case # 21-CA-004505. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

January 12, 2023: Deposition via video conference in Salem, Oregon. Attorney: Kaludi, Ike. Case: Gil, J v Alvarado. Case # RG20070873. In the Superior Court of The State of California, County of Alameda, Unlimited Jurisdiction.

January 24, 2023: Trial testimony in Beaumont, Texas. Attorney: Dugas, Clay. Case: Layfield, K v Richard. Case # A-203680. In the District Court, Jefferson County, Texas, 58th Judicial District.

January 26, 2023: Trial testimony in Salt Lake City, Utah. Attorney: Bertch, Caleb. Case: Mague, A v Kupu. Case # 200903669. In the Third Judicial District Court, Salt Lake County, State of Utah.

January 30, 2023: Deposition via video conference in Salem, Oregon. Attorney: Robbins, Joel. Case: Rodrigues v Wellpath. Case # CV-2020-006273. In the Superior Court of The State of Arizona, In and For the County of Maricopa.

January 31, 2023: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Gomez, D v Tradex. Case # 2021CVA001412D2. In the District Court, 11th Judicial District, Webb County, Texas.

February 02. 2023: Hearing via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Thompson, Y v Sullins. Case # 2020-CA-000400. In the Circuit Court of the Sixth Judicial Circuit, In and for Pinellas County, Florida, Civil Division.

February 09, 2023: Trial testimony via video conference in Salem, Oregon. Attorney: Midlo, Bennett. Case: Hernandez, M v Miller. Case # 2019-60983. In the District Court of Harris County, Texas, 152nd Judicial District.

February 16, 2023: Deposition preserved for trial in Salem, Oregon. Attorney: Peacock, Malorie. Case: Garcia, V v S&F Logistics. Case # 5:21- cv- 04062-JMG. In the United States District Court for the Eastern District of Pennsylvania.

February 20, 2023: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Escobedo, J v Suarez. Case # 2021CVA000013-D3. In the District Court, Webb County, Texas, 341st Judicial District.

February 23, 2023: Deposition via video conference in Salem, Oregon. Attorney: Bush, Charles. Case: Lewter, N v Lewis. Case # DC-20-11120. In the District Court, 193rd Judicial District, Dallas County, Texas.

February 27, 2023: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Alvarez, T v Rodriguez Express. Case # 2021CVA000445D3. In the District Court, 341st Judicial District, Webb County, Texas.

March 02, 2023: Deposition via video conference in Salem, Oregon. Attorney: Ronstadt, Erin. Case: Finkelstein, S. Case # CV-21-00657-MTL. In the United States District Court, For the District of Arizona.

March 03, 2023: Deposition via video conference in Salem, Oregon. Attorney: Jaffe, Martin. Case: Jones v Tilley. Case # 2021CA000046. In the Circuit Court of the Eighteenth Judicial Circuit, in and for Seminole County, Florida.

March 13, 2023: Deposition via video conference in Salem, Oregon. Attorney: Tavares, Cesar. Case: Pena, M v Cutler Repaving Inc. Case # 2021-17554. In the District Court of Harris County, Texas, 270th District Court.

March 14, 2023: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Aguilar, F v Regal Cinemas, Inc. Case # 5:20-cv-1029-JKP-HJB. In the United States District Court for the Western District of Texas, San Antonio Division.

March 15, 2023: Deposition via video conference in Salem, Oregon. Attorney: Roof, Colby. Case: Holt, M v Nelson. Case # 2020-CA-005088-O. In the Circuit Court of the Ninth Judicial Circuit, in and for Orange County, Florida.

March 15, 2023: Deposition via video conference in Salem, Oregon. Attorney: D'Aguanno, Joseph. Case: Strozier, K v City of Phoenix. Case # CV2020-013102. In the Superior Court of the State of Florida, in and for the County of Maricopa.

March 20, 2023: Deposition via video conference in Salem, Oregon. Attorney: Dugas, Clay. Case: Moran, F v Genesis Energy, LP. Case # 2021-47416. In the District Court of Harris County, Texas, 269th Judicial District.

March 28, 2023: Deposition via video conference in Salem, Oregon. Attorney: Villaruel, Karen. Case: Fisher, K v Johnson Controls, Inc. Case # 2019-CI-15764. In the District Court, 408th Judicial District, Bexar County, Texas.

April 03, 2023: Deposition in Salem, Oregon. Attorney: Henderson, David. Case: Lehe, M v USA. Case # 3:21-cv-00265-TMB. In the United States District Court, for the District of Alaska.

April 04, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Villaruel, Karen. Case: Fisher, K v Johnson Controls, Inc. Case # 2019-CI-15764. In the District Court, 408th Judicial District, Bexar County, Texas.

April 05, 2023: Deposition via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Grooms, T. Case # 22-CA-002185. In the Circuit Court of the Thirteenth Judicial Circuit, in and for Hillsborough County, Florida Civil Division.

April 06, 2023: Deposition preserved for trial via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Salas. N v Energy Lease Services, Inc. Case # 21-07-00063-CVL. In the District Court, 81st Judicial District, La Salle County, Texas.

April 07, 2023: Deposition via video conference in Salem, Oregon. Attorney: Kaiser, Lorne. Case: Demarco, A v Gaspari. Case # 0568491. In the Circuit Court of the Seventeenth Judicial Circuit, in and for Broward County, Florida.

April 07, 2023: Deposition via video conference in Salem, Oregon. Attorney: Kaludi, Ike. Case: Davila, J v Munoz. Case # MSC19-00612. In the Superior Court of the State of California, for the county of Contra Costa.

April 10, 2023: Deposition via video conference in Salem, Oregon. Attorney: Stern, Jesse. Case: Kennon, L. Case # 2018-CA-013445-O. In the Circuit Court of the Ninth Judicial Circuit, in and for Orange County, Florida.

April 13, 2023: Hearing via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Grooms, T. Case # 22-CA-002185. In the Circuit Court of the Thirteenth Judicial Circuit, in and for Hillsborough County, Florida Civil Division.

April 17, 2023: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Bush-Radomski, N v Krisan. Case # 2019-CA-117. In the Circuit Court 5th Judicial Circuit, in and for Lake County, Florida.

April 17, 2023: Deposition via video conference in Salem, Oregon. Attorney: Ladah, Ramzy. Case: King, L v Discount Tire. Case # A-21-838896-C. In the District Court, Clark County, Nevada.

April 18, 2023: Trial testimony via video conference in Salem, Oregon. Attorney: Kaludi, Ike. Case: Davila, J v Munoz. Case # MSC19-00612. In the Superior Court of the State of California, for the county of Contra Costa.

April 19, 2023: Hearing via video conference in Salem, Oregon. Attorney: Barnes, Stephen. Case: Allen, J v Palmer. Case # 29-2021-CA-003412. In the Circuit Court of the 13th Judicial Circuit, in and for Hillsborough County, Florida, Civil Law Division.

April 19, 2023: Deposition via video conference in Salem, Oregon. Attorney: O'Donohoe, Judith. Case: State of Iowa v Tagge. Case # AGCR019873. In the Iowa District Court for Howard County.

April 20, 2023: Deposition preserved for trial via video conference in Salem, Oregon. Attorney: Panagakis, Nick. Case: Roldan, S v Katzen. Case # 2019-CA-003289-O. In the Circuit Court of the Ninth Judicial Circuit, in and for Orange County, Florida.

April 24, 2023: Deposition via video conference in Salem, Oregon. Attorney: Leatham, Steve. Case: Coyne, S. Case # 20-2-00874-08. In the Superior Court of the State of Washington, in and for the county of Cowlitz.

April 25, 2023: Deposition in Salem, Oregon. Attorney: Morgan-White, Annette. Case: Wells v Memorial Hospital. Case # 15-CI-00076. Commonwealth of Kentucky, Clay Circuit Court.

April 26, 2023: Deposition via video conference in Salem, Oregon. Attorney: Jones, Daniel. Case: Wiedemeier, J v White. Case # 37-2021-00047058. In the Superior Court of the State of California, for the County of San Diego.

April 27. 2023: Deposition via video conference in Salem, Oregon. Attorney: Wise, Jared. Case: Weyer, D v State Farm. Case # 2020 10839 CIDL. In the Circuit Court of the Seventh Judicial Circuit, in and for Volusia County, Florida.

April 27, 2023: Deposition via video conference in Salem, Oregon. Attorney: Bates, William. Case: Cruzado, A v Keystone. Case # 2019-CA-012188-O. In the Circuit Court of the Ninth Judicial Circuit, in and for Orange County, Florida.

May 01, 2023: Deposition via video conference in Salem, Oregon. Attorney: Ginsberg, Marc. Case: Richardson, MJHS. Case # 2022-005573-CA-01. In the Circuit Court of the 11th Judicial Circuit, in and for Miami-Dade County, Florida.

May 01, 2023: Preserved deposition for trial via video conference in Salem, Oregon. Attorney: Deem, Michael. Case: Fischer, R v Morgan Properties. Case # OCN-L-1109-20. Superior Court of New Jersey, Law Division, Ocean County.

May 02, 2023: Deposition via video conference in Salem, Oregon. Attorney: Ingram, Todd. Case: Covelli, C v Toyota. Case # 2021CV78. Weld County District Court, State of Colorado.

May 03, 2023: Deposition via video conference in Salem, Oregon. Attorney: Maida, Sam. Case: Santos, A v Estes Express Lines. Case # 2021-53505. In the District Court of Harris County, Texas, 129th Judicial District.

May 04, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Sahadeo, Ravin. Case: Sweezea, A v Drotar. Case # 2020-CA-001733-AX. In the Circuit Court of the Fifth Judicial Circuit, in and for Lake County, Florida.

May 04, 2023: Deposition via video conference in Salem, Oregon. Attorney: Paolino, Eric, Case: Duque, G v Buchner. Case # 2021-CA-000790. In the Circuit Court of the Sixth Judicial Circuit, in and for Pinellas County, Florida, Civil Division.

May 08, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Leatham, Steve. Case: Coyne, S. Case # 20-2-00874-08. In the Superior Court of the State of Washington, in and for the county of Cowlitz.

May 08, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Jones, Daniel. Case: Wiedemeier, J v White. Case # 37-2021-00047058. In the Superior Court of the State of California, for the County of San Diego.

May 09, 2023: Hearing via video conference in Salem, Oregon. Attorney: Matthews, Marc. Case: Dennis, T v State Farm Insurance. Case # 2020CA003039AX. In the Circuit Court of the Twelfth Judicial Circuit, in and for Manatee County, Florida, Civil Division.

May 09, 2023: Deposition via video conference in Salem, Oregon. Attorney: Ladah, Ramzy. Case: Maldonado- Camacho, E v Bangayan. Case # A-21-839256-C. In the District Court, Clark County, Nevada.

May 23, 2023: Deposition via video conference in Salem, Oregon. Attorney: Cox, Allyson. Case: Davis, R v Milton. Case # 2022 L 000406. In the Circuit Court of Cook County, Illinois County Department, Law Division.

May 23, 2023: Deposition via video conference in Salem, Oregon. Attorney: Singha, Chafica Case: Warren v PPEC. Case # 21-CA-6018. In the 13th Judicial Circuit, in and for Hillsborough County, Florida.

May 25, 2023: Deposition via video conference in Salem, Oregon. Attorney: Pepperman, Eric. Case: Gallagher, O v Real Water. Case # A-21-834485-B. District Court, Clark County, Nevada.

May 26, 2023: Deposition via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Teran, H v Piloto. Case # 2019-013322-CA-01. In the Circuit Court of the 11th Judicial District Circuit, in and for Miami- Dade County, Florida.

May 30, 2023: Deposition via video conference in Salem, Oregon. Attorney: Velez, Harold. Case: Payne, L v Pandolfi. Case # 2020 10772 CIDL. In the Circuit Court of the Seventh Judicial Circuit, in and for Volusia County, Florida, Civil Division.

June 01, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Ginsberg, Marc. Case: Richardson, MJHS. Case # 2022-005573-CA-01. In the Circuit Court of the 11th Judicial Circuit, in and for Miami-Dade County, Florida.

June 01, 2023: Deposition via video conference in Salem, Oregon. Attorney: Dunn, Joseph. Case: George, A v Aspire Health Partners. Case # 2020-CA-1818-O. In the Circuit Court of the Ninth Judicial Circuit, in and for Orange County, Florida.

June 02, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: King, Ryan Case: Aguilar, F v Regal Cinemas. Case # 5:20-cv-1029-JKP-HJB. In the United States District Court for the Western District of Texas, San Antonio Division.

June 26, 2023: Trial testimony in Troy, Missouri. Attorney: Wood, Branson. Case: Morgan, M v Gosney Pharmacy. Case # 19L6-CC00070. In the Circuit Court of Lincoln County, State of Missouri.

June 28, 2023: Deposition via video conference in Salem, Oregon. Attorney: Izquierdo, Ivan. Case: Millar, C v Exxel Medical Transportation, Inc. Case # 2021-021855-CA-01. In the Circuit Court of the 11th Judicial Circuit, in and for Miami-Dade County, Florida.

July 03, 2023: Deposition via video conference in Salem, Oregon. Attorney: McKenna, Kenneth. Case: Figueroa, C v Adventist Health. Case # 2020-CA-5016-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

July 06, 2023: Deposition preserved for trial via video conference in Salem, Oregon. Attorney: Mireles, Ruy. Case: Pagan, R v Cannon. Case # 2018-CCL-00224. In the County Court, At Law Number 1, Camron County, Texas.

July 06, 2023: Deposition via video conference in Salem, Oregon: Attorney: Galliher, Keith. Case: Stallworth, V. Case # A-21-841908-C. In the District Court, Clark County, Nevada.

July 11, 2023: Deposition via video conference in Salem, Oregon. Attorney: Collins, Robert. Case: Martinez, J v CenterPoint Energy. Case # 2019-58870. In the District Court of Harris County, Texas, 125th Judicial District.

July 12, 2023: Trial testimony in Las Vegas, NV. Attorney: Do, Elizabeth. Case: Wilson v USA. Case # 2:18-cv-01241-JMC-NJK. In the United States District Court, District of Nevada.

July 14, 2023: Trial testimony via video conference. Attorney: Stern, Bruce. Case: Rinaldo, R v TKV Union Station. Case # MID-L-3288-18. Superior Court of New Jersey, Law Division, Middlesex County.

July 18, 2023: Deposition via video conference in Salem, Oregon. Attorney: Garcia, Megan. Case: Dennis, D v McLary. Case # 22EV000179. In the State Court of Fulton County, State of Georgia.

July 20, 2023: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Guerra, N v EMV Transportation. Case # 2021-CVA-001687-D1. In the District Court, 49th Judicial District, Webb County, Texas.

July 21, 2023: Deposition via video conference in Salem, Oregon. Attorney: Dunn, Joseph. Case: Grzegorzweski, J. Case # 2020-CA-002508. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

July 25, 2023: Deposition via video conference in Salem, Oregon. Attorney: Morris, Anissa. Case: Lavery, M v Auto Club South. Case # 22-CA-001212. In the Circuit Court of the Sixth Judicial Circuit, In and For Pasco County, Florida.

July 25, 2023: Deposition via video conference in in Salem, Oregon. Attorney: Chavez, Ruben. Case: Garcia, A v Cabrera. Case # 2022-005720-CA-01. In the Circuit Court in the Eleventh Judicial Circuit, In and For Miami- Dade County, Florida.

July 26, 2023: Deposition via video conference in Salem, Oregon. Attorney: Sanchez, Bryan. Case: McGee, J v Morris. Case # 2021-CP-46-03615. In the Court of Common Pleas, For the Sixteenth Judicial Circuit.

August 01, 2023: Trial testimony in Brownsville, Texas. Attorney: Leibowitz, Jacob. Case: Ruiz, J v Space Exploration Tech. Case # 2020-DCL-03939. In the District Court of Cameron County, Texas, 197th District Court.

August 04, 2023: Deposition via video conference in Salem, Oregon. Attorney: Cullen, Kim. Case: Bass, L v Saint Lucie County. Case # 562017CA1108. In the Circuit Court of the Nineteenth Judicial Circuit, In and For St. Lucie County, Florida.

August 07, 2023: Deposition via video conference in Salem, Oregon. Attorney: Murrill, Rashon. Case: Thompson v Walmart. Case # 21-03982. In the United States District Court, Southern District of Texas, Houston Division.

August 08, 2023: Deposition via video conference in Salem, Oregon. Attorney: Chiapperini, Matthew. Case: Castro v Urdininea. Case # 2022-CA-001299-O. in the Circuit Court of the 9th Judicial Circuit, In and For Orange County, Florida.

August 15, 2023: Deposition via video conference in Salem, Oregon. Attorney: Henness, Mark. Case: Sabido, J v Hampton. Case # A-21-844197-C. In the District Court of Clark County, Nevada.

August 16, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Panagakis, Nicholas. Case: Roldan, S v Katzen. Case # 2019-CA-003289-O. In the Circuit Court, of the Ninth Judicial Circuit, In and For Orange County, Florida.

August 17, 2023: Deposition via video conference in Salem, Oregon. Attorney: Russo, Nicholas. Case: Quijano, G v Haase. Case # 2021-CA-008557-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

August 22, 2023: Deposition via video conference in Salem, Oregon. Attorney: White, Marlon. Case: Grant, J v Mariana. Case # 2020-CA-006994-O. In the Circuit Court of the 9th Judicial Circuit, In and For Orange County, Florida.

August 22, 2023: Deposition via video conference in Salem, Oregon. Attorney: McBride, Paul. Case: Tavarez-Rodriguez v Cool Team. Case # 502021CA012484XXXMBAI. In the Circuit Court of the 15th Judicial Circuit, In and For Palm Beach County, Florida.

August 25, 2023: Deposition via video conference in Salem, Oregon. Attorney: Maida, Sam. Case: Flores, R, v DS Services of America. Case # 2021-54429. In the District Court of Harris County, Texas, 270th Judicial District.

August 28, 2023: Deposition via video conference in Salem, Oregon. Attorney: Ladah, Ramzy. Case: Carpenter, J v Denny. Case # 2:23-cv-00208-RFB-NJK. United States District Court, District of Nevada.

August 29, 2023: Deposition via video conference in Salem, Oregon. Attorney: Boigris, Dylan. Case: Williams v BP. Case # 1:22-cv-00278-LG-BWR. United States District Court, Southern District of Mississippi, Southern Division.

August 30, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Boigris, Dylan. Case: Williams v BP. Case # 1:22-cv-00278-LG-BWR. United States District Court, Southern District of Mississippi, Southern Division.

September 06, 2023: Deposition via video conference in Salem, Oregon. Attorney: Benson, Joshua. Case: Alter, B v Klagues. Case # A-21-843401-C. District Court, Clark County, Nevada.

September 07, 2023: Deposition via video conference in Salem, Oregon. Attorney: Johnson, Jordan. Case: Daigle, S v Cook. Case # 20CV369832. Superior Court of California, County of Santa Clara.

September 08, 2023: Deposition via video conference in Salem, Oregon. Attorney: Lopez, Fermin. Case: Lindblad, L v Adventist Health Systems. Case # 2020-CA-72-MP. In the Circuit Court of the Ninth Judicial Circuit, In and For Osceola County, Florida.

September 12, 2023: Deposition via video conference in Salem, Oregon. Attorney: Leeder, Thomas. Case: Wiles, L v Tallahassee Memorial Healthcare. Case # 2019-CA-53. In the Circuit Court of the Second Judicial Circuit, In and For Leon County, Florida.

September 19, 2023: Deposition via video conference in Salem, Oregon. Attorney: Chavez, Ruben. Case: Garcia, A v Cabrera. Case # 2022-005720-CA-01. In the Circuit Court in the Eleventh Judicial Circuit, In and For Miami- Dade County, Florida.

September 20, 2023: Deposition via video conference in Salem, Oregon. Attorney: Sherwin, Julia. Case: Gonzalez v City of Alameda. Case # 4:21-cv-09733-DMR. United States District Court, Northern District of California.

September 25, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Johnson, Jordan. Case: Daigle, S. Case # 20CV369832. Superior Court of California, County of Santa Clara.

September 25, 2023: Deposition preserved for trial via video conference in Salem, Oregon. Attorney: Williams, Burgess. Case: Morales, J. Case # 2021-54717. In the District Court, 55th Judicial District, Harris County, Texas.

October 13, 2023: Deposition via video conference in Salem, Oregon. Attorney: Rousso, Darren. Case: Rodriguez, N v Publix. Case # 2021-019569. In the Circuit Court of the 11th Judicial Circuit, In and For Miami-Dade County, Florida.

October 16, 2023: Deposition via video conference in Salem, Oregon. Attorney: Patterson, Mark. Case: Harlowe, M v FCA. Case # 2017-CA-011231-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

October 18, 2023: Deposition via video conference in Salem, Oregon. Attorney: King, Ryan. Case: Diaz, T v CR England. Case # 2021CVA001304D2. In the Judicial District, 111th District Court, Webb County, Texas.

October 18, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: White, Case: Grant, J v Mariana. Case # 2020-CA-006994-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

October 20, 2023: Deposition in Salem, Oregon. Attorney: Kobylinski, Tyler. Case: Dooley, J v Adventist Health System. Case # 2019-CA-12405-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

October 23, 2023: Deposition via video conference in Salem, Oregon. Attorney: Shapiro, Richard. Case: Sabugo, M v Florida Health Sciences Center. Case # 19-CA-000231. In the Circuit Court of the Thirteenth Judicial Circuit of the State of Florida, In and For Hillsborough, Florida.

October 24, 2023: Deposition via video conference in Salem, Oregon. Attorney: Paolino, Eric. Case: Duque, Gerado v Buchner. Case # 2021-CA-000790. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, Florida Civil Division.

November 01, 2023: Trial testimony via video conference in Salem, Oregon. Attorney: Paolino, Eric. Case: Duque, Gerado v Buchner. Case # 2021-CA-000790. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, Florida Civil Division.

November 06, 2023: Deposition via video conference in Salem, Oregon. Attorney: Boigris, Dylan. Case: Deepwater Horizon Belo Cases. Case # 3:19-cv-00963. In the United States District Court for the Northern District of Florida, Pensacola Division.

November 07, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Boigris, Dylan. Case: Deepwater Horizon Belo Cases. Case # 3:19-cv-00963. In the United States District Court for the Northern District of Florida, Pensacola Division.

November 14, 2023: Deposition via video conference in Salem, Oregon. Attorney: Collins, Robert. Case: Scott v Evans Delivery. Case # 22EV005672. In the State Court of Fulton County, State of Georgia.

November 14, 2023: Deposition via video conference in Salem, Oregon. Attorney: Vasquez, James. Case: Lembert, V v Kang. Case # BER-L-120-21. In the Superior Court of New Jersey Law Division, Bergen Co.

November 21, 2023: Deposition via video conference in Salem, Oregon. Attorney: Sullivan, Don. Case: Hiser, S v Jones. Case # CV-35620. In the District Court of Albany County, Wyoming, Second Judicial District.

November 28, 2023: Deposition via video conference in Salem, Oregon. Attorney: Soong, Danny. Case: DR v Mizel. Case # C19-07152 NMC. In the United States District Court, Northern District of California.

November 30, 2023: Deposition via video conference in Salem, Oregon. Attorney: Maxwell, Mike. Case: Kamaka, M v Coram Specialty Infusion. Case # 21-2-11760-7 SEA. Superior Court of Washington, King County.

December 04, 2023: Deposition via video conference in Salem, Oregon. Attorney: Mathena, Chris. Case: Krhalic, E v Tebbe. Case # 21-CA-5329 DIV D. In the Circuit Court of the 13th Judicial Circuit, In and For Hillsborough County, Florida.

December 11, 2023: Deposition via video conference in Salem, Oregon. Attorney: Karimi, Adrian. Case: Sanchez, R v Dominguez. Case # A-22-858902-C. In the District Court, Clark County, Nevada.

December 13, 2023: Deposition via video conference in Salem, Oregon. Attorney: Rariden, Andy. Case: Price, C v Coles. Case # 2020 CA 010331. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

December 14, 2023: Deposition via video conference in Salem, Oregon. Attorney: O'Brien, John. Case: Arteaga v Pentair. Case # 30-2021-01227987-CU-PO-CJC. In the Superior Court of the State of California, In and For the County of Orange.

December 18, 2023: Deposition via video conference in Salem, Oregon. Attorney: Panagakis, Nick. Case: Hammer, L v Travelers. Case # 21CA5999 DIV T. In the Circuit Court of the Thirteenth Judicial Circuit, in and For Hillsborough County, Florida, Civil Division.

December 19, 2023: Deposition via video conference in Salem, Oregon. Attorney: Lee, Edward. Case: Hernandez, Z McClaskey. Case # 19STCV36192. In the Superior Court of the State of California, County of Los Angeles, Central District.

December 20, 2023: Deposition via video conference in Salem, Oregon. Attorney: Crockett, Brian. Case: Vinklarek, W v Harper. Case # 110869-CV. In the District court of Brazoria County, Texas, 412th Judicial District.

December 21, 2023: Deposition via video conference in Salem, Oregon. Attorney: Low, Joseph. Case: Molina v FedEx. Case # 34-2022-00315405. In the Superior Court of the State of California, County of Sacramento.

December 22, 2023: Continued deposition via video conference in Salem, Oregon. Attorney: Maxwell, Mike. Case: Kamaka, M v Coram Specialty Infusion. Case # 21-2-11760-7 SEA. Superior Court of Washington, King County.

December 27, 2023: Deposition via video conference in Salem, Oregon. Attorney: Pajcic, Seth. Case: Cellino/ Kuntz v Best Tech. Case # 16-2021-CA-006467-XXXX-MA. In the Circuit Court of the Fourth Judicial Circuit, In and For Duval County, Florida.

December 28, 2023: Deposition preserved for trial via video conference in Salem, Oregon. Attorney: Hosseinzadeh, Kristin. Case: Bean, S v Meritus Medical Center. Case # C-21-CV-21-000050. In the Circuit Court for Washington County.

2024

January 04, 2024: Deposition via video conference in Salem, Oregon. Attorney: Carr, Patrick. Case: Catterton, R v Ramos. Case #2020-CP-27-00538. In the Court of Common Pleas, Fourteenth Judicial Circuit, State of South Carolina, County of Jasper.

January 04, 2024: Deposition via video conference in Salem, Oregon. Attorney: Mathena, Christopher. Case: Krhalic v Tebbe. Case #21-CA-005329. In the Circuit Court of the Thirteenth Judicial Circuit of the State of Florida, In and For Hillsborough County, Civil Division.

January 05, 2024: Deposition via video conference in Salem, Oregon. Attorney: Sahadeo, Ravin. Case: Alderman, M v Progressive American Insurance Company. Case # 2022-CA-000069-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

January 08, 2024: Deposition via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Teran, H v Piloto. Case # 2019-01322-CA-01. In the Circuit Court of the 11th Judicial Circuit, In and For Miami-Dade County, Florida Circuit Civil Division.

January 08, 2024: Deposition via video conference in Salem, Oregon. Attorney: Hendler, Scott. Case: Koen, S v Monsanto. Case # 1:22-cv-00209-RP. In the United States District Court for the Western District of Texas, Austin Division.

January 24, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Teran, H v Piloto. Case # 2019-01322-CA-01. In the Circuit Court of the 11th Judicial Circuit, In and For Miami-Dade County, Florida Circuit Civil Division.

January 25, 2024: Preserved deposition via video conference in Salem, Oregon. Attorney: Boigris, Dylan. Case: Deepwater Horizon Belo Cases. Case #3:19-cv-00963. In the United States District Court for the Northern District of Florida, Pensacola Division.

January 26, 2024: Deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Durr, C v Dolton Medical Associates, LTD. Case # 20 L 011510. In the Circuit Court of Cook County, Illinois, County Department, Law Division.

January 29, 2024: Deposition via video conference in Salem, Oregon. Attorney: Bocott, James. Case: Teets, G v Beveridge Wel Drilling, Inc. Case # CI 22-463. In the District Court of Lincoln County, Nebraska.

January 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Joyce, Robert. Case: Alsufi, H v Jackson. Case # 22-CA-006985. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

January 31, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: McNamara, Michael. Case: Novalis-Marine, C v Monash. Case # C20202716. In the Superior Court of the State of Arizona, In and For the County of Pima.

February 01, 2024: Continued deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Durr, C v Dolton Medical Associates, LTD. Case # 20 L 011510. In the Circuit Court of Cook County, Illinois, County Department, Law

February 05, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Deem, Michael. Case: Fischer, R v Morgan Properties. Case # OCN-L-1109-20. Superior Court of New Jersey Law Division- Ocean County.

February 13, 2024: Preserved deposition via video conference in Salem, Oregon. Attorney: LaRue, David. Case: Martinez, D v C.M. Joslin Co Inc. Case # 22-04-05053. In the District Court 281st Judicial District, Montgomery County, Texas.

February 15, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Lewis, Andrea. Case: Bryan v Vargas. Case # 50-2022-CA-010943-xxxx-MB AD. In the Circuit Court of the Fifteenth Judicial Circuit, In and For Palm Beach County, Florida.

February 19, 2024: Deposition via video conference in Salem, Oregon. Attorney: Spingarn, Jared. Case: May, S v Air Compressor & Motor Company. Case # CACE-22-013939.In the Circuit Court of the 17th Judicial Circuit, In and For Broward County, Florida.

February 20, 2024: Deposition preserved for trial via video conference in Salem, Oregon. Attorney: Jones, Travis. Case: Jackson, B v Lewis. Case # CC2020-0098. In the Court of Common Pleas, Muskingum County, Ohio.

February 26, 2024: Deposition via video conference in Salem, Oregon. Attorney: Booze, Raissa. Case: Helton, W v Aderholt. Case # 2020-CA-398. In the Circuit Court of the Fifth Judicial Circuit, In and For Marion County, Florida.

February 28, 2024: Deposition via video conference in Salem, Oregon. Attorney: Kelley, Devry. Case: Romano, V v Progressive American Insurance Company. Case # 2022-CA-000559. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Seminole County, Florida.

March 01, 2024: Trial testimony in Austin, Texas. Attorney: Smalley, Josh. Case: ST of TX v Camden. Case # D1-DC-20-900070. In the District Court for the 299th Judicial District, Sitting in Travis County, Texas.

March 11, 2024: Deposition via video conference in Salem, Oregon. Attorney: Anderson, Nancy. Case: Chestnut, J. Case # 17SV00052. In the State Court of Decatur County, State of Georgia.

March 13, 2024: Preserved deposition for trial via video conference in Salem, Oregon. Attorney: Denmon, Christian, Case: Hale, T v Ware. Case # 22-000592-CI. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, Florida.

March 13, 2024: Continued deposition via video conference in Salem, Oregon. Attorney: Booze, Raisa. Case: Helton v Aderholt. Case # 20-CA-000398. In the Circuit court of Fifth Judicial Circuit, In and For Marion County, Florida, General Civil Division.

March 15, 2024: Deposition via video conference in Salem, Oregon. Attorney: Denmon, Christian. Case: Ecklund, R v Ferron. Case # 22-002911-CI. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas Countyu, State of Florida, Civil Division.

March 19. 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Bocott, James. Case: Teets, G v Beverage Well Drilling. Case # CI 22-463. In the District Court of Lincoln County, Nebraska.

March 26. 2024: Deposition via video conference in Salem, Oregon. Attorney: Kopacz, Joe. Case: Lauzon, T v Golden Corral. Case # 2020CA001614000000. In the Tenth Judicial Circuit, In and For Polk County, Florida, Civil Division.

March 27, 2024: Deposition via video conference in Salem, Oregon. Attorney: Rariden, Andy. Case: Gustavsen, M v Harris. Case # 2020-CA-011362-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

March 28, 2024: Deposition via video conference in Salem, Oregon. Attorney: Kim, Ethan. Case: Roller, R v Bogle. Case # 2022-CA-019365. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Brevard County, Florida.

April 02, 2024: Deposition via video conference in Salem, Oregon. Attorney: Stephens, Joe. Case: Martin, S v O'Reilly. Case # 110548-CV. In the District Court of Brazoria County, Texas, 412th Judicial District.

April 03, 2024: Deposition via video conference in Salem, Oregon. Attorney: Smith, Alicia. Case: Jorza v Home Depot. Case # 2021-CA-002383. In the Circuit Court of the Eighteenth Circuit Judicial Circuit, In and For Seminole County, Florida.

April 11, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Collins, Robert. Case: Martinez, J v CenterPoint Energy Resources. Case # 2019-58870. In the District Court of Harris County, Texas, 125th Judicial District.

April 16, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Kopacz, Joe. Case: Lauzon, T v Golden Corral. Case # 2020CA001614000000. In the Tenth Judicial Circuit, In and For Polk County, Florida, Civil Division.

April 18, 2024: Deposition via video conference in Salem, Oregon. Attorney: Mitchell, Ryan. Case: Buckelew, D. Case # 22-CA-001427. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, State of Florida.

April 23, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Denmon, Christian. Case: Ecklund, R v Ferron. Case # 22-002911-CI. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas Countyu, State of Florida,

April 24, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: McBride, Paul. Case: Rodriguez, J v Cool Team Services. Case # 502021CA012484. In the Circuit Court of the Fifteenth Judicial Circuit, In and For Palm Beach County, Florida.

April 25, 2024: Deposition via video conference in Salem, Oregon. Attorney: Jones, Steven. Case: Scott v Kelter. Case # CV2021-015672. In the Superior Court of the State of Arizona, In and For the County of Maricopa.

April 29, 2024: Deposition via video conference in Salem, Oregon. Attorney: Kaludi, Ike. Case: Garcia L v Gregg. Case # MSC20-00825. In the Superior Court of the State of California, For the County of Contra Costa.

April 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Thrower, Jason. Case: Carr v IF&P Holding. Case # 2:22-CV00480. In the United States District Court, Eastern District of Louisiana.

April 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Karimi, Adrian. Case: Pena v Chocolate Magic Las Vegas. Case # A-22-855163-C. In the District Court Clark County, Nevada.

May 01, 2024: Deposition via video conference in Salem, Oregon. Attorney: Boigris, Dylan. Case: Deepwater Horizon Belo Cases. Case # 3:19-cv-00963. In the United States District Court for the Northern District of Florida, Pensacola Division.

May 02, 2024: Deposition via video conference in Salem, Oregon. Attorney: Toth, Adrienn. Case: Keighler, A v East Coast Metals. Case # 2022-CA-053750. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Brevard County, Florida.

May 08, 2024: Deposition via video conference in Salem, Oregon. Attorney: Borrego, Nick. Case: Phan, V. Case # 22-CA-000892. In the Circuit Court of the Twentieth Judicial Circuit, In and For Lee County, Florida, Civil Action.

May 28, 2024: Continued deposition via video conference in Salem, Oregon. Attorney: Borrego, Nick. Case: Phan, V. Case # 22-CA-000892. In the Circuit Court of the Twentieth Judicial Circuit, In and For Lee County, Florida, Civil Action.

May 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Avera, Lance. Case: Muncaster v Lansing. Case # 2022-CA-003255. In the Circuit Court of the Eighth Judicial Circuit, In and For Alachua County, Florida.

May 31, 2024: Deposition via video conference in Salem, Oregon. Attorney: Sahadeo, Ravin. Case: Cancel, H v Friedmann. Case # 2020-CA-006479-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

June 03, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Borrego, Nick. Case: Phan, V. Case # 22-CA-000892. In the Circuit Court of the Twentieth Judicial Circuit, In and For Lee County, Florida, Civil Action.

June 03, 2024: Deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Carlton v Advocate Condell Medical Center. Case # 2024 L 2170. In the Circuit Court of Cook County, Illinois County Department, Law Division.

June 05, 2024: Deposition in Salem, Oregon. Attorney: Shragal, Otto. Case: Pochron v Metra. Case # 2022 L 005325. In the Circuit Court of Cook County, Illinois County Department, Law Division.

June 06, 2024: Deposition via video conference in Salem, Oregon. Attorney: Kopacz, Joe. Case: Hinkle v National Vision, Inc. Case # 3:22-cv-00930-BKS-ML. United States District Court, Northern District of New York.

June 07, 2024: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Bush-Radomski, N v Krisan. Case # 2019-CA-117. In the Circuit Court 5th Judicial Circuit, In and For Lake County, Florida.

June 10, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Toth, Adrienn. Case: Keighler, A v East Coast Metals. Case # 2022-CA-053750. In the Circuit Court of the Eighteenth Judicial Circuit, In and For Brevard County, Florida.

June 10, 2024: Deposition via video conference in Salem, Oregon. Attorney: Fine, Cherie. Case: Suber v Rine. Case # 2023-CA-001544. In the Circuit Court, Eighth Judicial Circuit, In and For Alachua County, Florida.

July 09,2024: Continued deposition via video conference in Salem, Oregon. Attorney: Johnson, Jordan. Case: Daigle, S v Cook. Case # 20CV369832. Superior Court of California, County of Santa Clara.

July 23, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Galluzzi, Tim. Case: Bond, R v Davis. Case # 2023CV31074. In the District Court, Jefferson County, Colorado.

July 23, 2024: Deposition via video conference in Salem, Oregon. Attorney: Shaw, Megan. Case: Brown, C v Geico. Case # 23-CA-734. In the Circuit Court of the Twentieth Judicial Circuit, In and For Lee County, Florida, Civil Circuit Division.

July 24, 2024: Deposition via video conference in Salem, Oregon. Attorney: Sparkman, Kevin. Case: Payne v Looney. Case # 19-CA-009150. In the Circuit Court of the Thirteenth Judicial Circuit, In and For Hillsborough County, Florida.

July 26, 2024: Deposition via video conference in Salem, Oregon. Attorney: Kopacz, Joe. Case: Booker v WAWA. Case # 19-CA-002239-ES. In the Circuit Court of the Sixth Judicial Court, In and For Pasco County, Florida.

July 30, 2024: Hearing via video conference in Salem, Oregon. Attorney: Vasquez, James. Case: Lembert, V. Case # BER-L-120-21. In the Superior Court of New Jersey Law Division, Bergen County.

July 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Russo, Nick. Case: Johnson, C v Geico. Case # 2020-CA-003426-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida, Civil Division.

July 31, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Vasquez, James. Case: Lembert, V. Case # BER-L-120-21. In the Superior Court of New Jersey Law Division, Bergen County.

July 31, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Johnson, Jordan. Case: Daigle, S v Cook. Case # 20CV369832. Superior Court of California, County of Santa Clara.

July 31, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Kmetic, Shannon. Case: State of Oregon v Martinez. Case # 21CR13729. In the Circuit Court of the State of Oregon, For the County of Multnomah.

August 01, 2024: Deposition via video conference in Salem, Oregon. Attorney: LaCien, Brian. Case: Lindberg, M v Northwestern Medicine. Case # 2020 L 004115. In the Circuit Court of Cook County, Illinois County Department, Law Division.

August 06, 2024: Deposition via video conference in Salem, Oregon. Attorney: Sparkman, Kevin. Case: Lewis, C v Nelson. Case # 23-CA-000005. In the Circuit Court of the Sixth Judicial Circuit, In and For Pasco County, Florida Civil Division.

August 07, 2024: Deposition via video conference in Salem, Oregon. Attorney: Coats, Elizabeth. Case: Morris, K. Case # A-22-860747-C. Eighth Judicial District Court, Clark County, Nevada.

August 08, 2024: Continued deposition via video conference in Salem, Oregon. Attorney: Kopacz, Joe. Case: Hinkle, J, v National Vision. Case # 3:22-cv-00930-BKS-ML. In the United States District Court, Northern District of New York.

August 13, 2024: Deposition via video conference in Salem, Oregon. Attorney: Rudd, Ryan. Case: Vravis, T v Deer. Case # 2020-CA-006465-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

August 23, 2024: Deposition via video conference in Salem, Oregon. Attorney: Azizi, David. Case: Sanchez, C v Santos. Case # 21STCV39793. In the Superior Court of the State of California, County of Los Angeles, Central District.

August 23, 2024: Deposition via video conference in Salem, Oregon. Attorney: Bates, Will. Case: Green, N v Mid Florida Metal Roofing. Case # 35-2022-CA-000361-AXXX. In the Circuit Court of the Fifth Judicial Circuit, In and For Lake County, Florida.

August 26, 2024: Deposition in Salem, Oregon. Attorney: Henderson, David. Case: Kiyuklook, H v USA. Case # 3:23-cv-00089-JMK. In the United States District Court for the District of Alaska.

August 27, 2024: Continued deposition in Salem, Oregon. Attorney: Henderson, David. Case: Kiyuklook, H v USA. Case # 3:23-cv-00089-JMK. In the United States District Court for the District of Alaska.

August 28, 2024: Deposition via video conference in Salem, Oregon. Attorney: Garcia, Jorge. Case: Canada, M v Mesa. Case #2023-002317-CA-01. In the Circuit Court of the 11th Judicial Circuit, In and For Miami-Dade County, Florida.

September 05, 2024: Deposition via video conference in Salem, Oregon. Attorney: Sahadeo, Ravin. Case: Cancel, H v Torres-Fiedman. Case # 2020-CA-006479-O. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

September 10, 2024: Deposition via video conference in Salem, Oregon. Attorney: Borrego, Nick. Case: Pindel, R v Amaury Sotolongo. Case # 22-24464-CA-01. In the Circuit Court In and For The Eleventh Judicial Circuit, In and For Miami-Dade County, Florida.

September 10, 2024: Deposition via video conference in Salem, Oregon. Attorney: Wise, Jared. Case: Green, S v Mendoza. Case # 2022-CA-8739. In the Circuit Court of The Ninth Judicial Circuit, In and For Orange County, Florida.

September 12, 2024: Deposition via video conference in Salem, Oregon. Attorney: Smith, Alicia. Jorza, R v Home Depot. Case # 2021-CA-002383. In the Circuit Court of the Eighteenth Judicial Circuit. In and For Seminole County, Florida.

September 16, 2024: Deposition via video conference in Salem, Oregon. Attorney: Felice, Timothy. Case: Villanueva, J v Besafe Transportation. Case # 2021-CA-2024-AN. In the Circuit Court of the Ninth Judicial Circuit, In and For Osceola County, Florida.

September 16, 2024: Deposition via video conference in Salem, Oregon. Attorney: Wasson, Karen. Case: Johnson, B v Grange. Case # 20-001935-CI. In the Circuit Court of the Sixth Judicial Circuit, In and For Pinellas County, Florida.

September 17, 2024: Deposition in Salem, Oregon. Attorney: Slater, Tom. Case: Rocha, Z v H2ECO. Case # 2019-CA-008418-0. In the Circuit Court of the Ninth Judicial Circuit, In and For Orange County, Florida.

September 18, 2024: Deposition in Salem, Oregon. Attorney: Harrell, Renee. Case: Doe, J v Durham School Services. Case # 2022-CA-94. In the Circuit Court, Fourth Judicial Circuit, In and For Duval County, Florida.

September 19, 2024: Deposition via video conference in Salem, Oregon. Attorney: Hermida, Andres. Case: Masters, P v Publix. Case # 20-CA-000172-M. In the Circuit Court of the 16th Judicial Circuit, In and For Monroe County, Florida.

September 24, 2024: Deposition via video conference in Salem, Oregon. Attorney: Phillips, Adam. Case: Perez v Moxie. Case # 22STCV28583. In the Superior Court of the State of California, County of Los Angeles.

September 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Finn, Larry. Case: O'Neill, M v Campbell. Case # CJ-2020-6162. In the District Court of Oklahoma County, State of Oklahoma.

October 01, 2024: Deposition via video conference in Salem, Oregon. Attorney: Collins, Robert. Case: Scott v Evan Delivery. Case # 22EV005672. In the State Court of Fulton County, State of Georgia.

October 02, 2024: Deposition via video conference in Salem, Oregon. Attorney: Vance, Blake. Case: Littlefield v Ford. Case # 2019 L 19. In the Circuit Court for the Twenty-Third Judicial Circuit, Dekalb County, Illinois.

October 03, 2024: Deposition in Salem, Oregon. Attorney: Barker, Brown. Case: Brown v Metra. Case # 2021 L 012685. In the Circuit Court of Cook County, Illinois County Department, Law Division.

October 03, 204: Trial testimony via video conference in Salem, Oregon. Attorney: Jones, Steven. Case: Finkbeiner, C. Case # CV2019-090186. In the Superior Court of The State of Arizona, In and For the County of Maricopa.

October 10, 2024: Deposition via video conference in Salem, Oregon. Attorney: Williams, Don. Case: Johnson, K v Perrillioux. Case # 721559 SECTION 32. In the 19th Judicial District Court, Parish of East Baton Rouge, State of Louisiana.

October 10, 2024: Deposition via video conference in Salem, Oregon. Attorney: Romand, Genevieve. Case: Vanderhule v The Freemont Experience. Case # A-22-856968-C. In the District Court, Clark County, Nevada.

October 30, 2024: Deposition via video conference in Salem, Oregon. Attorney: Hasty, Thomas. Case: Barboza, J v El Santo Taqueria. Case # 2023-005490-CA-01. In the Circuit Court of the Eleventh Judicial Circuit, In and For Miami-Dade County, Florida.

October 31, 2024: Trial testimony via video conference in Salem, Oregon. Attorney: Fong, Eric. Case: Chipps v State of Alaska Corrections. Case #3AN-22-04989CI. In the Superior Court for the State of Alaska, Third Judicial District at Anchorage.

DR. FREEMAN'S STATEMENT OF COMPENSATION

FORENSIC RESEARCH + ANALYSIS

Michael D. Freeman MedDr PhD MScFMS MPH FRCPath FFFLM FACE DLM

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2024 Fee Schedule

Fees:

Services: **$700.00/hr.** All non-testimony services rendered by Dr. Freeman (reports, responses, research, analysis, etc.) are billed at a rate of $700 per hour, prorated in quarter-hour increments.

Ancillary Services: **$250.00-400.00/hr.** Work such as medical record review, report assistance, statistical analysis, and other associate scientist services will be billed at a rate of $250.00-400.00 per hour. MADYMO simulations are billed at a minimum of $2000, depending on complexity.

Retainer: **$7000.00** retainer covering the first 10 hours of work is due before work begins. Half of the retainer ($3500.00 for the first 5 hours) is non-refundable. In circumstances in which analysis is needed in a short timeframe, the retainer may be changed to include the estimated work to complete the requested analysis. Please note that analyses requiring a report will typically require a *minimum* of 15 hours to complete. Our office can provide an estimate of charges prior to retention.

Testimony: **$950.00/hr.** Pertains to deposition, trial, hearings, or other video or telephonic testimony with no travel requirement. Testimony requiring travel is billed door-to-door; **$10,000.00** for full-day travel and testimony, and **$15,000.00** when overnight stay is required. Travel expenses including lodging, airfare, and ground transportation will be invoiced separately.

Payment for services and calendar reservation:

Testimony and other events held on the calendar for 3 or more months in advance require a single hour ($950) non-refundable deposit. Less than 3 months but more than 1 month requires half of the total fee, with the remaining balance due 1 month to 5 business days in advance. Please note that unless other arrangements have been made, events that are not paid in according to the above schedule will be removed from the calendar.

A minimum of one hour at $950.00 is required to hold a time on the calendar for a deposition or other testimony. Events are scheduled for the time reserved and prepaid in all cases, unless there is a prior agreement for extenuating circumstances. Any additional charges incurred for deposition overages will be billed in half-hour increments, triggered after 10 minutes into the half-hour. **Retaining counsel is responsible for ensuring timely payment of calendar requests, including by opposing counsel.**

One-half of the total testimony fee is due as a non-refundable deposit. The entire fee becomes the cancellation fee if cancellation is within 5 business days. Half of the paid fee will be carried over for postponements with more than 5 days notification.

To be placed on Dr. Freeman's calendar for any meeting, phone conference, deposition, inspection, or testimony requests, **retaining counsel must communicate directly with FR+A** (contact is Katie Smith, Executive Assistant) to determine availability and deposit requirements and to schedule their time slot. Depositions and testimony appearances cannot be calendared until deposits are received. The office staff does not typically communicate directly with opposing counsel to avoid *ex parte* issues.

If the undersigned fails to pay the full amount of the charges within 30 days of receipt of the invoice, the unpaid amounts shall accrue interest at a rate of 1.5% per month. Returned checks and chargeback payments will incur a $75 bank and administrative fee. By signing below, the undersigned agrees to pay all FR+A costs of collection, including reasonable attorney fees.

Please make checks payable to: Forensic Research + Analysis, Inc. Tax id # 68-0551731

My signature is an acknowledgment that I have read the above two-page fee schedule and agree to abide by same. I understand that work does not commence until this signed agreement is returned to FR+A.

_____

Signature Date

_____

Retaining Attorney/ Firm (printed)

_____

Case name/ style