UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF WASHINGTON

UNITED STATES OF AMERICA, Plaintiff, v. COW PALACE, LLC, *et al.,* Defendants.	Civil No. 24-cv-03092-TOR DECLARATION OF DR. CHRISTOPHER M. TEAF IN SUPPORT OF PLAINTIFF UNITED STATES' MOTION FOR PRELIMINARY INJUNCTION

I. Professional Qualifications & Experience

1. My name is Christopher M. Teaf. I am over 18 years of age and competent to testify. This Declaration presents opinions reflecting my personal knowledge and conclusions based on my education, training, experience, and information that I have reviewed in his matter.

2. I earned a Bachelor's degree in Biology (*with Honors*) from Pennsylvania State University (PSU, 1975), a Master's degree in Biological Science from Florida State University (FSU, 1980), and a doctorate in Toxicology from the University of Arkansas College of Medicine (UAMS, 1985). I conducted my PhD research at the USEPA/USFDA National Center for Toxicological Research (NCTR) in Jefferson, Arkansas. I have served on the FSU faculty for more than 40 years, including as the Director and the Associate Director of the Center for Biomedical

& Toxicological Research & Waste Management (CBTR) at FSU from 1983 to 2020. I have held adjunct teaching and research appointments at several research universities including FSU, University of Florida, Florida A&M University, and Georgia Tech. I have served as the Director of Toxicology for Hazardous Substance & Waste Management Research, a health and environmental research firm, for 38 years. My Curriculum Vitae, including a list of scientific publications, is included as Attachment A to this Declaration. A listing of deposition and trial testimony within the past 4 years is presented in Attachment C to this Declaration.

3. I am Board-certified by the Academy of Toxicological Sciences and an active member of the Society of Toxicology, Society for Risk Analysis, and Society for Environmental Toxicology & Chemistry, all recognized international professional organizations addressing evaluation of health effects. My research, regulatory, and scientific interests are in toxicology and human health risk assessment for potential exposure to environmental and occupational hazards, including those of a chemical, physical, and biological nature, for human or nonhuman receptors. I regularly perform toxicological and health risk assessments within regulatory frameworks of various state and federal programs, such as the Safe Drinking Water Act (SDWA), Resource Conservation & Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, & Liability Act (CERCLA), Superfund Amendments & Reauthorization Act (SARA),

Occupational Safety & Health Act (OSHA), Toxic Substances Control Act (TSCA), Clean Water Act (CWA), and analogous state programs. These health and/or environmental impact evaluations of chemicals have included: **inorganic substances** (*e.g., metals, nitrates/nitrites, chlorides, perchlorate*); **organic substances** such as petroleum products (*e.g., benzene, polycyclic aromatic hydrocarbons (PAHs)),* volatile organic compounds *(VOCs)* and pesticides; **physical agents** (*e.g., particles, radionuclides*); and **microbiota** (*e.g., molds, bacteria*) in air, soil, groundwater, surface water, and sediments.

4. For more than 40 years, I have served as a scientific reviewer for many professional journals in the fields of toxicology, public health, and environmental chemistry, including: *Human & Ecological Risk Assessment, Regulatory Toxicology & Pharmacology, Risk Analysis, Journal of Toxicology & Environmental Health, Environmental Forensics, European Journal of Public Health, Environmental Toxicology & Chemistry,* and *Environmental Research*. I am Editor-in-Chief for *Soil & Sediment Contamination*, an international journal, and I serve on editorial boards for several other journals. I was the Senior Editor for Human Risk Assessment with *Human & Ecological Risk Assessment* for many years.

5. Since the late-1970s, I have directed and conducted environmental health research and educational activities for U.S. Environmental Protection Agency

(USEPA), World Health Organization (WHO), U.S. Department of Energy (USDOE), U.S. Department of Agriculture (USDA), Agency for Toxic Substances & Disease Registry (ATSDR), Centers for Disease Control and Prevention (CDC), Florida Department of Environmental Protection (FDEP), Florida Department of Health (FDOH), and analogous agencies in other states. Since 1985, I have provided technical support to Attorneys General for Florida, Washington, and Oklahoma on the subjects of toxicology and environmental health risk.

6. Since 1985, I have been qualified by courts, and I have provided deposition and/or trial testimony on behalf of plaintiffs and defendants, in state and/or federal venues, administrative hearings, and to regulatory or legislative groups of more than 20 states in subject areas of toxicology, human health risk assessment, and environmental chemistry.

II. Professional Assignment and Materials Reviewed

7. I have been retained by the United States Department of Justice (USDOJ) in this matter to review case-specific and general information, and to assess the health significance of nitrate and related contamination in groundwater and residential drinking water wells sourced from groundwater in the downgradient vicinity of three dairy operations in the Lower Yakima Valley (LYV) in central Washington state (*Cow Palace Dairy, George DeRuyter & Son/D&A Dairies, and Liberty/H&S Bosma Dairies;* collectively referred to as "Dairies." Figure 1 attached hereto (this

is also Schnaar Ex. 1) depicts the Dairies' location in the Lower Yakima Valley. To fulfill my assignment, I have taken the opportunity to review case documents, technical reports, correspondence, analytical sampling data, chemical and toxicological literature, agency health-based guidance documents, and other relevant materials cited herein including the following categories of information:

- 2013 Administrative Order on Consent SDWA-10-2013-0080, along with quarterly and annual sampling reports developed pursuant to that Consent Order (2013 until third quarter 2023);
- Expert reports prepared by Dr. Robert Lawrence in *Cmty. Ass'n for Restoration of the Env't, et al., v. Cow Palace, et al.,* E.D. Wash. No. CV-13-3016-TOR (2013), and by Dr. Keeve Nachman in *Cmty. Ass'n for Restoration of the Env't, et al., v. Decoster, et al.,* E.D. Wash. No. 1:19-CV-3110-TOR (2019);
- Numerous Lower Yakima Valley-related environmental data and sampling reports; and,
- Relevant chemical, and toxicological literature, government reports, agency protective guidelines, and other information concerning nitrate and related substances.

8. I also have relied upon the Declaration of Dr. Gregory Schnaar, offered by the United States in support of its Motion for Preliminary Injunction in this action

and I adopt, for purposes of this Declaration, Dr. Schnaar's characterization of the "Affected Area" and the "Potentially Affected Area" as described at paragraph 41 of Dr. Schnaar's Declaration and depicted on his Exhibit 18 (Figure 2 attached hereto (Areas A, B, and D, the "Affected Area," in purple, red, and grey, respectively, and Area C, the "Potentially Affected Area," in green)). Attachment B to this Declaration presents a complete list of the documents, scientific literature, and other technical materials that I have relied upon in preparing my professional opinions and this Declaration.

III. Occurrence, Chemistry, and Toxicology for Nitrate and Nitrite

9. Nitrogen-containing substances collectively known as nitrate (NO_3^-) are identified as the substances of principal interest in this matter, particularly as it relates to groundwater contamination (USEPA, 2013a; USGS, 2017; WDOE, 2021; WDOE, 2022; WDOH, 2023a; WDOH, 2023b). The Washington Department of Ecology (WDOE) reported that the natural background level of nitrate in LYV groundwater is less than 0.3 mg/L (WDOE, 2010). The amount of nitrogen in the environment, including nitrate, as a result of anthropogenic activities has increased substantially since the 1900s, primarily from animal manure and nitrogen related to agricultural fertilizers, which in turn has led to increases in nitrate reported from drinking water sources as related to percolation from the surface into local or regional aquifers (WDOH, 1996; CalOEHHA, 2018;

Singh et al., 2022). Nitrogen is essential to maintenance of human health as a component of amino acids and proteins in foods that we consume (WDOH, 1996; Gruber and Galloway, 2008; Canfield et al., 2010; Erisman et al., 2013). It also can create health concerns at sufficient exposure levels. Inorganic and organic sources of environmental nitrogen can be transformed into nitrate by mineralization, hydrolysis, and bacterial nitrification (Ward et al., 2018; WDOH, 2010).

10. Nitrate is a relatively stable form of nitrogen, and nitrate compounds can be found under natural conditions in the environment as part of the global nitrogen cycle and plant growth (Fields, 2004; CalOEHHA, 2018; Egbueri, 2023). Nitrate can be found in many commercial fertilizer products, in animal manure, and in liquid discharge from septic tanks (WDOH, 2010; ATSDR, 2017). Nitrate is a widespread and significant groundwater contaminant, with higher concentrations reported from areas exhibiting intensive agricultural activities and surface contamination (De Roos et al., 2003; Ward et al., 2005; CalOEHHA, 2018; Singh et al., 2022). Related nitrite (NO_2^-) compounds may be formed from environmental nitrate under reducing/anoxic conditions (low or no oxygen), including those related to microbial processes (ATSDR, 2017; CalOEHHA, 2018).

11. Nitrate and nitrite typically are found in the environment in highly water-soluble ionic forms associated with other ionic species (ATSDR, 2017). The

specific nitrate or nitrite form plays a role in the pharmacokinetic and pharmacodynamic properties of each (ATSDR, 2015). The potential for nitrate- or nitrite-contaminated groundwater is a function of geographic location, nitrogen application rates, soil chemistry, water chemistry, and aquifer vulnerability (De Roos et al., 2003). Presence and concentrations of nitrate/nitrite in soil and groundwater are related to chemical or microbial degradation of nitrogenous materials (e.g., wastes) to ammonia, which can be oxidized to nitrite, which in turn can be oxidized to environmental nitrate. Nitrate is typically the predominant nitrogen form detected in groundwater and surface water (ATSDR, 2015).

12. Nitrate and nitrite are known to have the ability to interact with organic material (e.g., amino acids) commonly found in contaminated surface water or groundwater to produce N-nitroso compounds (NOC) such as nitrosamines (Song et al., 2015; ATSDR, 2015; ATSDR, 2017). In addition, it has been reported that high levels of nitrate intake can be used as a surrogate measure for the exposure of target tissues to NOC (De Roos et al., 2003; van Breda et al., 2019; Seyyedsalehi et al., 2023), and that these NOCs have been implicated in the induction of human gastrointestinal carcinogenesis, as detailed below.

13. Human exposure to nitrate occurs principally through contaminated drinking water and some food products (Hill, 1991; ATSDR, 2017; CalOEHHA, 2018). Nitrate and nitrite occur naturally in fruits, vegetables, and some food additives

that are present in processed meats to prevent microbial contamination and to maintain favorable appearance and flavor (Song et al., 2015). Because NOC formation is inhibited by ascorbic acid, polyphenols, and other compounds present at high levels in many vegetables, dietary nitrate intake may not result in substantial endogenous NOC formation to the same extent as that occurring via nitrate/nitrite in drinking water (Ward et al., 2018).

IV. Federal Maximum Contaminant Level Goal (MCLG) and Maximum Contaminant Level (MCL) for Nitrates/Nitrites and the Threat to Human Health

14. In developing federal drinking water criteria, after reviewing health effects information, USEPA initially sets a "maximum contaminant level goal", or MCLG (USEPA, 2023e). According to the agency definition, the MCLG is "the maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, allowing an adequate margin of safety." MCLGs are non-enforceable public health goals which are intended to consider only public health, and do not incorporate considerations such as analytical limits of detection and effectiveness of available treatment technologies. However, the health basis for MCLGs supports a conclusion that they can be used to evaluate private wells (*https://www.epa.gov/sdwa/how-epa-regulates-drinking-water-contaminants*). When determining an MCLG, EPA typically considers the adverse health risk to

sensitive subpopulations (e.g., infants, children, elderly populations, and individuals with existing chronic conditions and/or compromised immune systems). However, it is worth noting in this instance that the MCLG for nitrates/nitrites does not presently include an explicit component of the calculation that addresses potentially sensitive populations. In the case of nitrates and nitrites, these sensitive groups include infants, women in the latter stages of pregnancy, those with certain gastrointestinal conditions (e.g., gastroenteritis, achlorhydria), and individuals with specific enzyme deficiencies (e.g., glucose-6-phosphate (G-6-P) dehydrogenase, methemoglobin reductase), and dialysis patients, where nitrate/nitrite homeostasis may be affected (ATSDR, 2023; Martinez et al., 2024). For reference, G-6-P dehydrogenase deficiency is the most common human enzyme deficiency, affecting about 400 million people worldwide, including at least 10% of African American males in the United States (NIH, 2022; Johns Hopkins, 2024). The "maximum contaminant level," or "MCL," is an enforceable drinking water standard, and presently represents the maximum level allowed of a contaminant in water which is delivered to any user of a public water system. Because the MCL and MCLG for nitrate are identical (10 mg/L), and the MCL and MCLG for nitrite are identical (1 mg/L), I refer to the health-based regulatory standard for drinking water, the MCL, throughout this Declaration.

15. Nitrate officially was identified as a contaminant of significant health concern in U.S. drinking water supplies beginning in the mid-1900s, primarily based upon human cyanosis cases caused by low blood oxygen levels linked to high nitrate concentrations in drinking well water (Donahoe, 1949; Downs, 1950; NAS, 1977). In 1991, USEPA established the drinking water MCLG and MCL for nitrate at 10 mg/L (10 ppm) as nitrate-nitrogen ("nitrate-N") (USEPA, 1991a).

16. The MCLG and the MCL for nitrite are set at 1 mg/L (as nitrite-N) (USEPA, 1991a). The MCLs for both nitrite and nitrate were set at levels to protect against methemoglobinemia, also known as "Blue Baby Syndrome," primarily in infants that are bottle fed and are consuming dietary formula prepared with contaminated water supplies, but do not explicitly consider other potentially sensitive populations (USEPA, 1991b). The observed formation of methemoglobinemia, a phenomenon described nearly 50 years ago by the U.S. National Academy of Sciences (NAS, 1977) and recognized since the 1940's, is the result of enhanced binding affinity of nitrite to hemoglobin that dramatically decreases the oxygen carrying capacity of the blood (WDOH, 2010; Ludlow et al., 2023). Infant methemoglobinemia can be caused acutely by very short duration exposures and low nitrate intake (USEPA, 2002), potentially within a few days (Bailey, 1966). ATSDR (2017), citing USEPA, stressed the seriousness of methemoglobinemia regarding nitrate in drinking water, concluding that "Infants below the age of 6

months who drink water containing nitrate and/or nitrite in excess of the MCL could become seriously ill and, if untreated, may die." Such exposure includes infant formula prepared with nitrate contaminated water. In Yakima County, where the Census Bureau reported 3,449 births in 2022, groundwater nitrate concentrations exceeding the MCL potentially endanger hundreds of infants each year. Agencies differ regarding recommendations for infant consumption of breast milk in areas where groundwater is contaminated by nitrate. Some have concluded that breast milk does not appear to be adversely affected by maternal ingestion of nitrate-contaminated drinking water (Dusdieker et al., 1996; WDOH, 2024), while others have advised caution for nursing mothers in such circumstances (FDOH, undated). Chronic exposure to nitrate from drinking water at sufficient concentrations (e.g., greater than the MCL over a period of weeks to months for adults and children), or from eating foods cooked in nitrate-contaminated water, can yield significant concentrations of gastrointestinal nitrite. Subsequent binding of that nitrite to hemoglobin ("methemoglobin") dramatically decreases the ability of the blood to deliver oxygen to the tissues (ATSDR, 2017), which can result in local anoxia in those tissues leading to compromised function or cell death.

17. The federal drinking water MCL criteria of 10 mg/L and 1 mg/L for nitrate and nitrite, respectively, have remained in place and have been reiterated for over three decades (USEPA, 1991a; USEPA, 2023d). Those MCLs are described in a

Consumer Factsheet developed by the agency as follows: "The MCL for nitrates has been set at 10 ppm, and for nitrites at 1 ppm, because EPA believes, given present technology and resources, this is the lowest level to which water systems can reasonably be required to remove this contaminant should it occur in drinking water." (USEPA, 2006). EPA's statement supports a conclusion that the current MCL is in part technology-limited, rather than solely health-based. As discussed below, EPA is in the process of revisiting the present MCLG and MCL (USEPA, 2023c).

18. Toxicological knowledge regarding nitrate and nitrite, and their chemical relationship, has evolved and expanded in more than 30 years since initial development and promulgation of the MCL/MCLG. Since 1987, the scientific literature supports likely associations between nitrate/nitrite exposure and adverse health effects in addition to methemoglobinemia in some sensitive populations (e.g., infants, or those with gastroenteritis), though levels of exposure were not always quantified. Epidemiologic studies support, among other effects, an increased risk of reproductive problems (e.g., spontaneous abortion, intrauterine growth restriction, selected birth defects), and cancers (e.g., colorectal, gastric, Non-Hodgkins lymphoma), associated with increasing nitrate/nitrite intake (Weisenburger, 1990; Espejo-Herrera et al., 2016; ATSDR, 2017; Stayner et al., 2022; Chambers et al., 2022; Picetti et al., 2022; Donat-Vargas et al., 2023; NCI,

2023; NCI, 2024). Relative cancer risks greater than unity were reported for nitrite at ~1 mg/day ingestion, which represents about 0.5 mg/L at an assumed standard water consumption of 2 liters per day (Risch et al., 1985; Engel et al., 2003)

19. The oral exposure route (e.g., drinking water consumption) is the route of dominant health interest, and neither dermal exposure nor inhalation exposure contribute in a meaningful way to aggregate residential exposures under typical circumstances (ATSDR, 2017).

20. As detailed in subsequent sections, a substantial percentage of groundwater wells and residential water supply wells within and hydrologically downgradient of the Dairies' property boundaries show nitrate concentrations near to or greater than the MCL. Thus, I conclude that groundwater nitrate concentrations across a wide area hydrologically downgradient of the Dairies (i.e., the "Affected Area") continue to pose an imminent and substantial endangerment to the health of all persons drawing their drinking water from the contaminated aquifers.

21. While some researchers have suggested that the 10 mg/L nitrate criterion may be overly conservative or uncertain (Powlson et al., 2008), many others have noted that adverse cancer and noncancer health outcomes have been observed at exposures to drinking water nitrate concentrations less than the MCL (e.g., <1 mg/L to <10 mg/L for nitrite and nitrate, respectively; Bruning-Fann and Kaneene, 1993; Ward et al., 2005; VanDerslice, 2009). It also has been pointed out that

fecal contamination of human or animal origin frequently occurs coincident with nitrate contamination, particularly in agricultural and CAFO situations, and that such microbial contamination may result in enteric infections, which in turn may exacerbate the endogenous production of nitrite from ingested nitrate (VanDerslice, 2009; WDOE, 2010; Gibson and Schwab, 2011). That situation can be particularly hazardous to human health in circumstances where it relates to the *in vivo* formation of N-nitrosamines, a group of N-nitroso compounds with the potential to cause carcinogenic consequences (Song et al., 2015; Ruddell et al., 1976).

22. A review of the subject by Ward et al. (2018) specifically addressed the issue of hazards to human health posed by nitrate in drinking water. Those authors correctly noted that "Nitrate levels in our water resources have increased in many areas of the world largely due to applications of inorganic fertilizer and animal manure in agricultural areas. The regulatory limit for nitrate in public drinking water supplies was set to protect against infant methemoglobinemia, but other health effects were not considered." Those authors also reported that specific types of cancers (e.g., colorectal), developmental defects in infants, and other health concerns may be exacerbated when nitrate is ingested under conditions which increase the formation of N-nitroso compounds, concluding that "[C]onsidering all studies to date, the strongest evidence for a relationship between drinking water

nitrate ingestion and adverse health outcomes (besides methemoglobinemia) is for colorectal cancer, thyroid disease, and [fetal] neural tube defects. Many studies observed increased risk with ingestion of water *nitrate levels that were below regulatory limits*." (Emphasis added; Ward et al., 2018).

23. The recent toxicological information strongly supports reexamination of the scientific basis for the nitrate and nitrite MCL values and making the standard more restrictive to acknowledge potential health risks that go beyond the original foundation concerning methemoglobinemia in infants, including for carcinogenicity concerns (USEPA, 2007; ATSDR, 2017). USEPA has recognized this need to revisit the MCL for nitrate since at least 2015, when the agency identified nitrate and nitrite as "high priority" substances, and 2017, when the agency announced that it was undertaking a reassessment of the health effects of nitrate and nitrite (USEPA, 2017). In that 2017 document, USEPA also stated: "*Since 1987 a growing body of literature indicates potential associations between nitrate/nitrite exposure and other noncancer health effects. Some epidemiological studies also suggest an increased risk of cancer especially gastric cancer associated with dietary nitrite exposure.*" (Emphasis added). The agency presently is in the process of reconsidering the toxicology and potential acceptable exposure guidelines for nitrate and nitrite, as demonstrated in the draft document entitled

"Protocol for the Nitrate and Nitrite Assessment (Oral)" that was released for review in November 2023 (USEPA, 2023c).

V. Concentrated Animal Feeding Operations (CAFOs)

24. The Dairies have reported that they maintained a total of approximately 31,230 cattle on their facilities in 2023 and it was noted that "Each Dairy was and is a large Concentrated Animal Feeding Operation" (CAFO) (Anchor QEA, 2023a).

25. Raising large numbers of animals in confined circumstances necessarily results in the production of large and concentrated quantities of urine and feces, both of which contain significant amounts of nitrogen in the form of nitrogen-containing compounds (e.g., nitrates, ammonia). Those industrial-scale animal husbandry operations contribute chemicals and potential bacterial pathogens to environmental media, including soil, water, and air, some or all of which have the capacity to increase waterborne or foodborne illness risks, infectious disease, and environmental contamination (USEPA, 2004; Burkholder et al., 2007; Raff and Meyer, 2021; Guo et al., 2022; USEPA, 2023b). To store and manage CAFO solid and liquid excrement, millions of gallons of solid, semisolid, and liquid waste commonly are retained in piles and/or open lagoons and spread on the land (USEPA, 2004; Pew Commission, 2008; Hribar, 2010). In contrast with pasture-raised animals whose waste is naturally spread over large areas of vegetated

ground and is incorporated with the natural soil organic matter, CAFOs frequently create and/or accumulate wastes far beyond what can be absorbed and used by cultivated crops or natural vegetation.

26. Groundwater contamination by manure increasingly is well-recognized as a human health and ecosystem problem related to CAFO facilities (CDC, 2022; USEPA, 2023b). As animal waste, including that from livestock, decomposes, it releases nitrogen to the environment as ammonia, nitrate, and nitrite, which can be hazardous to human health. Surface runoff and vertical migration of nitrogen through the soil can cause nitrate contamination of the underlying groundwater (Harter et al., 2002).

VI. Nitrate Contamination in Lower Yakima Valley Groundwater

27. The Lower Yakima Valley is a section of the Yakima Basin and includes portions of Yakima and Benton counties in the State of Washington. The LYV aquifer is the primary drinking water source for over 56,000 residents, and approximately one-third of those residents rely on private domestic wells for their potable water supplies (WDOE, 2021). Dairy and other livestock activities in the LYV, as related to potential nitrate contamination, have been conducted and are likely to have contributed to groundwater nitrate contamination for more than 40 years (USEPA, 2013a). Moreover, in Washington State, nitrate historically has

been identified as the most common drinking water contaminant in both private and public water supplies (VanDerslice, 2009; WDOH, 2018).

28. In 2001, the Valley Institute for Research and Education (VIRE) sampled 249 private wells throughout the LYV and reported many exceedances of the nitrate MCL (VIRE, 2002). Following many media reports, multiple agencies coordinated to conduct a preliminary groundwater assessment of the area (WDOE, 2010). The Department of Ecology reported that approximately 12% of domestic well users were being exposed to nitrate levels in their drinking water exceeding the MCL of 10 mg/L (WDOE, 2010). Yakima County requested that the Washington Department of Ecology form the Lower Yakima Valley Groundwater Management Area (GWMA) along with a Groundwater Advisory Committee (GWAC) to assess the conditions within the aquifer over time, with the goal of reducing the nitrate concentrations in groundwater (Pacific Groundwater Group, 2011; WDOE, 2021). A monitoring plan to measure baseline conditions and to track the progress of water quality was certified by the WDOE in 2019 (WDOE, 2023).

29. In March of 2013, USEPA issued an Administrative Order on Consent (AOC) (USEPA, 2013a) to the Dairies under the Safe Drinking Water Act (SDWA), specifically to address the Dairies' contribution to nitrate contamination of the drinking water in the LYV. Among other things, the AOC required the

Dairies to conduct quarterly sampling of 26 monitor wells (3 deep and 23 at the water table) and to provide an annual summary report of monitoring data for each of the 8 years of sampling required by the AOC.

30. In 2015, three settlement agreements between the Dairies and the Community Association for Restoration of the Environment, Inc. (CARE) and the Center for Food Safety were entered by the federal court in Washington. In that litigation, the Court concluded that one of the Dairies (Cow Palace) had contaminated the drinking water aquifer with nitrate and that "there can be no dispute that the Dairy's operations may present an imminent and substantial endangerment to the public who is consuming the contaminated water" (*Community Association for Restoration of the Environment (CARE) v. Cow Palace, LLP*, *et al.*, 80 F. Supp. 1180, 1228 (E.D. Wash. 2015). The three Dairies were held liable for "contributing to" the disposal of solid waste under the federal Resource Conservation and Recovery Act (RCRA).

VII. Residential Well Sampling

31. Beginning with the previously identified VIRE (2002) study, multiple sets of residential well sampling data have been collected in the greater LYV area, including within and immediately downgradient of the Dairies' properties. USEPA began its three-phase investigation of the area in 2010, which included sampling drinking water wells at 331 homes in the LYV. The agency found that

over 20% of the sampled wells (67/331) contained nitrate concentrations in excess of the nitrate drinking water MCL (USEPA, 2013b). The combined USEPA Phase 2 and Phase 3 sampling in the immediate vicinity of the Dairies identified ten residential wells where groundwater nitrate concentrations exceeded the MCL, ranging from 10.8 mg/L to 45.0 mg/L nitrate (WW-15 on Dairy property, WW-11, WW-12, WW-13, WW-14, WW-16, WW-17, and WW-11008 within 1-mile downgradient of the Dairies, and WW-22063 and WW-21041 further downgradient). All of those wells are within the Affected Area identified by Dr. Schnaar. The USEPA Phase 2 and Phase 3 sampling also identified many residential wells in the Affected Area with nitrate concentrations between 5 mg/L and 10 mg/L, which is well above the estimated ≤0.3 mg/L reported as the naturally occurring nitrate level for groundwater in the LYV (WDOE, 2010).

32. As required by the 2013 AOC, representatives of the Dairies sampled residential wells on, and just downgradient of, the Dairies' properties in May and June 2013. The Dairies identified 224 private residences within the area addressed by the AOC and assessed 191 of those. Of the 191 residences assessed, 50[1]

[1] Page vi of the 2013 Residential Well Sampling Report states that 50 residences already had reverse osmosis units installed, whereas Table 2 of the same report lists 51 residences; however, it appears that one residence (241 Liberty Road) was mistakenly listed twice.

already had reverse osmosis treatment systems installed, and the Dairies conducted no sampling at those residences. One hundred and forty-one residences were sampled for nitrate (using either field test strips or laboratory analysis) and, of those, 66[2] exceeded the MCL (Arcadis, 2014).

33. The United States Geological Survey (USGS), in cooperation with the GWMA group, completed another round of residential sampling within the greater LYV in 2017. In that investigation, 892 samples were taken from 156 domestic drinking water wells in a series of six sampling events during the year (USGS, 2017). One or more exceedances of the 10 mg/L nitrate drinking water standard were observed in 26% of the wells. Eight of the wells in that USGS study were located on or within one-mile downgradient of the Dairies' properties, with two of those eight wells being located in the Affected Area, and both of those wells consistently reported nitrate concentrations in excess of 10 mg/L, with a maximum of 43.1 mg/L (well ID 10N/21E-01G01 in April 2017; USGS, 2017). There also are several wells in the Potentially Affected Area with >10 mg/L or 5-10 mg/L (10N/21E-03D02; 10N/21E-12R01; 10N/22E-07N01; and,10N/22E-06A01.

34. Nitrate was investigated as a separate component of a broader evaluation initiated by the Washington Department of Ecology (WDOE) in 2019 and directed

[2] The Residential Well Sampling Report Executive Summary states that 67 wells exceeded the MCL, while Table 7 of the same report says that 66 wells exceeded.

principally at dioxins and furans in groundwater in the LYV. That study concluded that "[E]levated nitrate in groundwater above the drinking water standard, is an issue in the Lower Yakima Valley," as well as that "[T]he nitrate results found in this study are consistent with other studies previously conducted to determine the extent of nitrate in groundwater in the Lower Yakima Valley." (WDOE, 2022).

35. Over the years, the WDOE has established the Ambient Groundwater Monitoring Network (AGMN), a network of 170 wells designed to monitor and evaluate the effectiveness of nitrate reduction efforts in the greater LYV. The AGMN consists of 136 private domestic wells that supply individual residences throughout the LYV, and 34 groundwater monitor wells that are not used for residential supply (WDOH, 2023b). That network contains some of the most recent available information regarding residential well nitrate concentrations. In the most recently reviewed data summaries (Fall 2022 and/or Summer 2023 depending on the well), three AGMN wells that are within one-mile downgradient of the Dairies' Properties and are within the Affected Area, exhibited drinking water nitrate concentrations in excess of the 10 mg/L MCL (GG-071 at 11.4 mg/L, GG-165 at 10.4 mg/L, and GG-166 at 12 mg/L). Two additional residential wells from this network, further downgradient of the Dairies but within the Affected Area, also exceeded the nitrate MCL during the 2023 sampling events (GG-074 at

45.9 mg/L and GG-179 at 14 mg/L in June 2023), as did one well on the western edge of the Potentially Affected Area (GG-068 at 13.8 mg/L). Several additional AGMN residential supply wells in the Affected Area reported nitrate levels between 5 and 10 mg/L.

36. Although many of the residential wells that were sampled early in the evaluation process (2013 and prior) have not been resampled, I am not aware of any data suggesting that the nitrate contamination profile in the area has improved significantly since. In fact, the AGMN residential well results from 2022 and 2023, together with the non-residential monitoring well results discussed below, demonstrate that nitrate concentrations are consistently elevated and are posing a continuing significant risk to the health of many residents across the Affected and Potentially Affected Areas (i.e., all residents whose well water contains nitrate concentrations at or above the MCL), as well as some public health risk to all residents of those areas (i.e., all residents whose well water is contaminated with nitrate).

VIII. Monitoring Well Sampling

37. The Dairies have performed quarterly groundwater monitoring since 2013 for a network of 26 monitoring wells that are within or at the boundary of the Dairies' properties, within the Affected Area. Those wells are screened in the surficial aquifer, which is the aquifer also used as a local drinking water source

(Inland Earth Sciences, 2016). This monitoring well network provides the most current look at the groundwater nitrate levels generally within and immediately downgradient of the Dairies' properties. A review of the historical data that were collected from those wells shows that the nitrate levels have remained fairly consistent and generally in excess of the 10 mg/L drinking water MCL over the years, with minor temporal fluctuations (Anchor QEA, 2023a). Nitrate concentrations upgradient of the Dairies generally have been less than the MCL (Anchor QEA, 2023b).

38. A review of the Anchor QEA quarterly sampling events for the first three quarters of 2023 reveals that nitrate in nearly all of the surficial (water table) wells sampled in the Dairies' network consistently exceed the 10 mg/L drinking water MCL. A different subset of wells is sampled and analyzed depending on the quarter. Thirteen of the 14-well subset sampled in the first and third quarters of 2023 exceeded the MCL, and 13 of the 19-well subset sampled in the second quarter of 2023 exceeded the MCL. Other data from 2023 show that the nitrate concentrations in those 19 wells have ranged from 0.62 mg/L to 140 mg/L, with an overall average of approximately 47 mg/L (Anchor QEA, 2023a; Anchor QEA, 2023b).

39. An additional 14 groundwater monitor wells (YVD-19 though YVD-32) were added to the groundwater monitoring network as a component of the 2015

Consent Decrees between the Dairies and the Community Association for Restoration of the Environment, Inc. (CARE) and the Center for Food Safety. Those wells (the "Consent Decree monitoring wells") were distributed to the south/southwest of the Dairies, consistent with the reported northeast to southwest direction of surficial groundwater flow. All of these wells are within the area where Dr. Schnaar has determined that the Dairies are contributing nitrate to the drinking water resource at a concentration greater than 1 mg/L (i.e., the "Affected Area") (see Figure 2 to this Declaration (Schnaar Ex. 18)). The Consent Decree monitoring wells were sampled initially in the first quarter of 2017. The analytical results from sampling of those wells are summarized in Anchor QEA (2023c).

40. Eight of the 14 (57%) second quarter 2023 results from the Consent Decree monitoring wells exceeded the nitrate MCL of 10 mg/L, with a maximum of 40.8 mg/L in well YVD-19, and a mean of 15 mg/L for the 14 wells (range of 0.075 mg/L to 40.8 mg/L for 14 wells). Similar, but generally higher nitrate concentrations were noted during the most recent available third quarter 2023 sampling event with 8 of 14 wells at or above the MCL, with a maximum of 64.1 mg/L in well YVD-19, and a mean of 16.6 mg/L for the 14 wells (range of 0.21 mg/L to 64.1 mg/L) (Anchor QEA, 2023c).

IX. Conclusions and Opinions

41. It is my professional opinion that available evidence confirms that CAFOs can and do release toxicologically significant quantities of nitrate and nitrite or their precursor nitrogen compounds to soil, surface water, groundwater, and potable water supplies.

42. It is my professional opinion that nitrate and nitrite, when present in an underground source of drinking water at concentrations near to or exceeding the applicable federal drinking water standard (i.e., the MCL), pose an imminent and substantial endangerment to the human population that is reliant on that underground source of drinking water. This is especially so for sensitive individuals, including infants, children, elderly populations, and individuals with existing chronic diseases and/or compromised immune systems.

43. Based on Dr. Schnaar's modeling (Figure 2 attached hereto; Exhibit 18 to Schnaar Declaration) and the available data from residential well sampling and groundwater well monitoring, I conclude that many of the residences within Dr. Schnaar's "Affected Area" - Areas "A" (depicted in purple), "B" (depicted in red), and "D" (depicted in grey) - may have concentrations of nitrate in drinking water that exceed the MCL. Indeed, within the Affected Area and the Potentially Affected Area, it is already known that some wells exceed the MCL. Thus, it is my professional opinion that all residential drinking water wells in the Affected Area

and the Potentially Affected Area should be sampled as soon as possible to determine current nitrate concentrations in the drinking water.

44. Further, it is my professional opinion that within the Affected and Potentially Affected Areas, where well water sampling reveals that the nitrate concentration in a residential well exceeds 10 mg/L (the MCL), residents dependent on that well for drinking water are facing an imminent and substantial endangerment and should be provided with a reverse osmosis filter or other alternative water supply.

45. It is also my professional opinion that the persistence and seasonal variability of nitrate contamination in the underground source of drinking water, even at concentrations less than the MCL, warrants periodic sampling of the underground source of drinking water. Accordingly, where well water sampling within the Affected and Potentially Affected Areas reveals that the nitrate concentration in a residential well is between 5 and 10 mg/L, that well should be sampled for nitrate quarterly for at least three years to monitor the ongoing health risk posed by the nitrate-contaminated drinking water.

X. Supplemental Information

46. I reserve the opportunity to modify and/or to supplement the opinions presented in this Declaration, to the extent that I become aware of new information, if reinterpretation of existing information becomes appropriate, or if it is appropriate to provide supplemental response and/or rebuttal to technical opinions put forth in writing or verbally by other experts in this matter.

47. My professional billing rate for standard activities in this matter is $325 per hour, and $490 per hour for deposition or trial testimony, exclusive of direct expenses which are billed at cost.

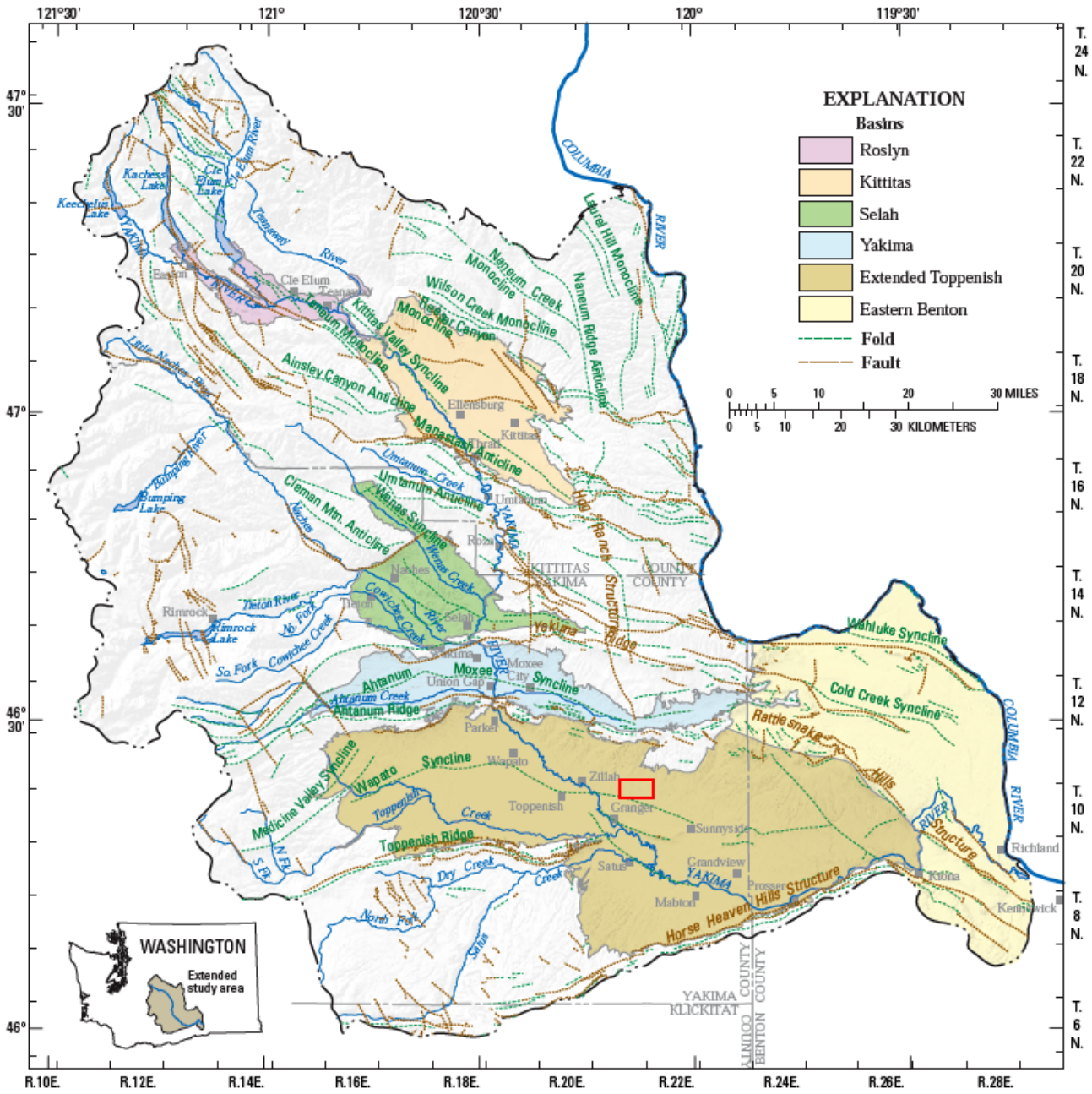
I declare under penalty of perjury that the foregoing is true and correct.

Date: 17 June 2024

Christopher M. Teaf, PhD

Figure 1

Schnaar Exhibit 1



Note: Approximate Dairies location shown at red box

Source: Vacarro et al., 2009

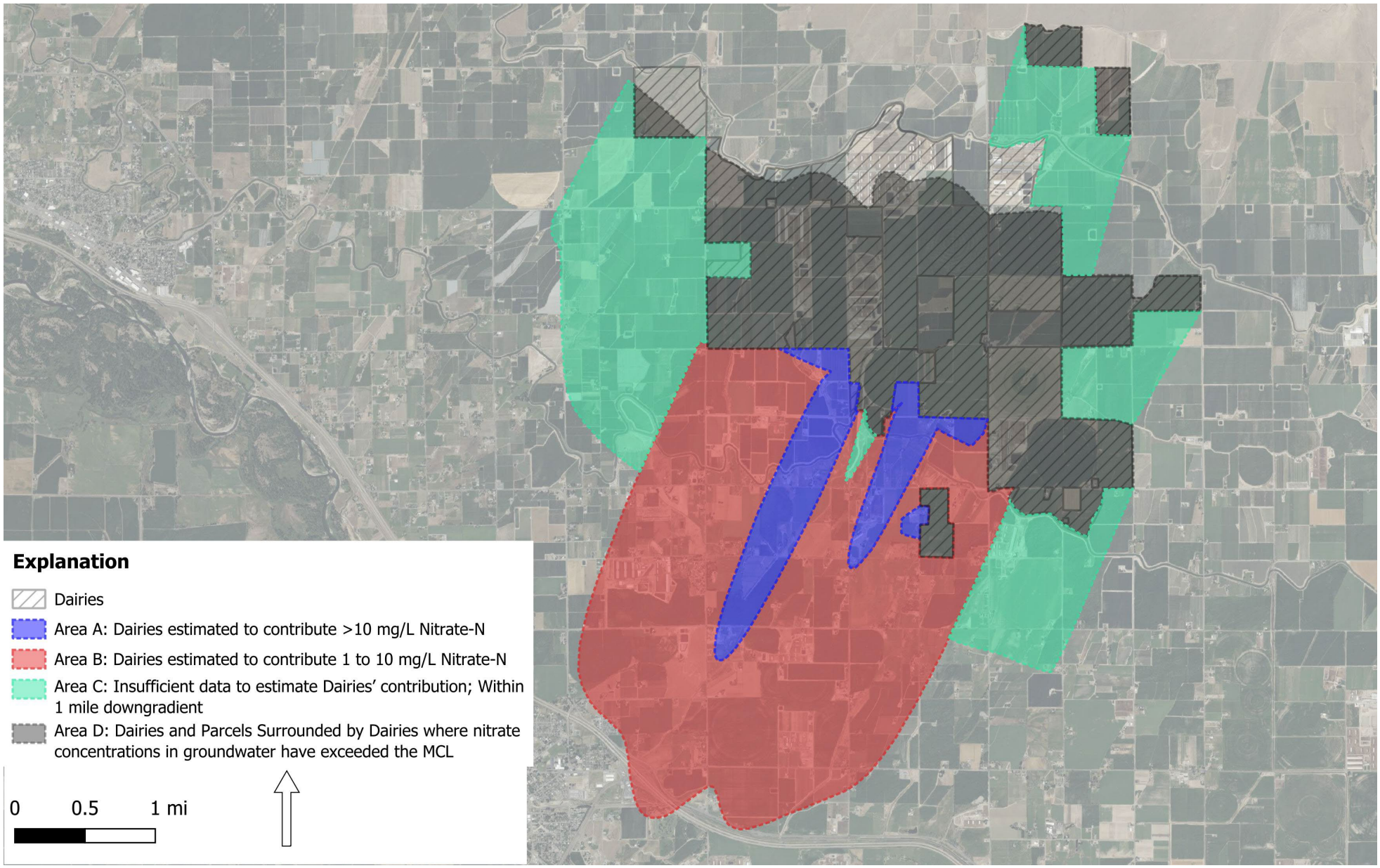
YAKIMA VALLEY DAIRIES

Dairies Location and Yakima River Basin Aquifer System

Q:\Projects\DB23.1324_Yakima_Valley_Dairies\Final Documents\Schnaar Declaration

Figure 2

Schnaar Exhibit 18



YAKIMA VALLEY DAIRIES

Affected Areas in Groundwater

Q:\Projects\DB23.1324_Yakima_Valley_Dairies\Final Documents\Schnaar Declaration

5/3/2024 DB23.1324

Exhibit 18

Attachment A

Curriculum Vitae

CURRICULUM VITAE

NAME: Dr. Christopher M. Teaf

PLACE OF BIRTH: Philadelphia, PA

PROFESSIONAL POSITIONS:

President & Director of Toxicology
Hazardous Substance & Waste Management Research, Inc.
2976 Wellington Circle West
Tallahassee, FL 32309
(850) 681-6894 *phone*
(850) 933-0963 *mobile*)
(850) 906-9777 *FAX*
cteaf@hswmr.com *email*

Director Emeritus
Center for Biomedical & Toxicological Research and Waste Management
Florida State University
2035 East Paul Dirac Drive, Suite 226 HMB
Tallahassee, FL 32310
cteaf@fsu.edu *email*

EDUCATION:

Ph.D.	Toxicology *College of Medicine, University of Arkansas for Medical Sciences*	1985	
M.S.	Biological Science *Florida State University*	1980	
B.S.	Biology *Pennsylvania State University*	1975	(*with Honors*)

PROFESSIONAL MEMBERSHIPS:

Academy of Toxicological Sciences
Society of Toxicology
Society for Environmental Toxicology and Chemistry
Society for Risk Analysis
Florida Bar, Environmental and Land Use Law Section
International Society for Technical & Environmental Professionals
National Association of Environmental Professionals
National Association of Underwater Instructors

CERTIFICATIONS:

Board Certified Fellow, Academy of Toxicological Sciences (ATS)
Radon Measurement Specialist (1989 to present; *Florida DOH R1032)*

ACTIVITIES & HONORS:

Board Certified Fellow, Academy of Toxicological Sciences. 2009 to present.

Research Scholar, Institute for Science & Public Affairs, Florida State University, Tallahassee, FL, 2020 to present. Adjunct Faculty.

Florida Bar Association, Second Judicial Circuit Grievance Committee "A", Non-Attorney Public Member, term 2022-2025.

Radon/Radiation Measurement & Evaluation Team, Florida State University, 2021 to present.

Interstate Technology and Regulatory Council (ITRC), 1,4-Dioxane Technical Team. 2019 to 2022.

Per- and Polyfluoralkyl Substances (PFAS) Forum, Program Steering Committee, 2019 to present.

Active Member – Society of Toxicology, Academy of Toxicological Sciences, Society for Risk Analysis, Society of Environmental Toxicology & Chemistry

Editor-in-Chief, *Soil & Sediment Contamination*, Taylor & Francis. 2021 to 2024 (*Co-Editor-in-Chief 2015-2021*)

Associate Editor, *Human & Ecological Risk Assessment*, published by Taylor & Francis. 2000 to present (*Senior Human Health Editor, 2004 to 2015*).

Editorial Board, international journal *Environmental Forensics*, Taylor & Francis Publishers, 2006 to present.

Science Advisory Board, 15th to 40th International Conference on Contaminated Soils, Sediments & Water. Amherst, MA. 1999 to present. (*also served on Risk Assessment Subcommittee, chaired Student Presentation Committee, and chaired symposium technical sessions on Risk Assessment, Remediation, Site Investigation).*

Scientific Peer Reviewer: European Journal of Public Health (*2013 to present*); Chemico-Biological Interactions (*2018 to present*); Journal of Radiation and Cancer Research (*2020 to present*); Environmental Research (*2019-present*); Pharmacological Research (*2019 to present*); Regulatory Toxicology & Pharmacology (*2018 to present*); Dose Response (*2021 to present*); Aging Research Reviews (*2021 to present*); Mechanisms of Aging and Development (*2021 to present*); Antioxidants & Redox Signaling (*2021 to present*); Human & Ecological Risk Assessment (*1999-present*); Food & Chemical Toxicology (*2019 to present*); Nonlinearity in Biology, Toxicology and Medicine (*2005-present*); Soil & Sediment Contamination (*2002-present*); Environmental Forensics (*2006-present*); Chemosphere (*2010 to present*); Wound Repair and Regeneration (2022 to present); Ohio Journal of Science (*1988-1992*); Bulletin of Marine Science (*1994-1998*); Environmental Toxicology & Chemistry (*1997-present*); Environmental Biology of Fishes (*1987-1990*).

Symposium Steering Committee, International Symposium & Exhibition on the Redevelopment of Manufactured Gas Plant Sites. 2018 to 2022.

Radon Measurement Specialist (*FL HRS Certification R1032*), 1989 to present.

Board of Directors, Dog Island Conservation District. 2002 to present (*Board Member, 2002 to present; Chair, 2004 to 2015; Treasurer 2015 to 2020*).

Board Member, Coastal Conservation Association (CCA), Big Bend Florida Chapter. 2014 to 2017.

District 2 Local Emergency Planning Committee, Florida State Emergency Response Commission, 1987 to present (*Vice Chair, 1991*).

Co-Editor, Joint Proceedings of the 26th West Coast and 32nd East Coast Annual International Conferences on Soil, Sediments, Water & Energy. Association for Environmental Heath & Sciences (AEHS). March, 2016 (San Diego, CA) and October 2016 (Amherst, MA).

Co-Editor, Joint Proceedings of the 25th West Coast and 31st East Coast Annual International Conferences on Soil, Sediments, Water & Energy. Association for Environmental Heath & Sciences (AEHS). March, 2015 (San Diego, CA) and October 2015 (Amherst, MA).

Human Health Peer Review Committee for Chapter 62-302, FAC. FL Department of Environmental Protection. 2012 to 2016.

Co-Editor, Proceedings of the 30th Annual International Conference on Soil, Sediments, Water & Energy. Association for Environmental Heath & Sciences (AEHS). October 2014. Amherst, MA.

Co-Editor, Proceedings of the 30th Annual International West Coast Conference on Soil, Water, Energy & Air. March 2014. San Diego, CA.

Peer Reviewer, Doctoral Dissertation Committee, Office of the Dean, University of British Columbia, Vancouver, BC. 2014. (*Dr. Maryam Khoshnoodi*).

Co-Editor, Proceedings of the 29th Annual International Conference on Soil, Sediments, Water & Energy. Association for Environmental Heath & Sciences (AEHS). October 2013. Amherst, MA.

Co-Editor, Proceedings of the 23rd Annual International West Coast Conference on Soil, Water, Energy & Air. March 2013. San Diego, CA.

Co-Chair, Human Health Session, Fourth Annual International Symposium & Exhibition on the Redevelopment of Manufactured Gas Plant Sites (MGP 2012). Chicago IL. March 28-30, 2012.

Co-Editor, Proceedings of the 28th International Conference on Contaminated Soils, Sediments & Water, October 2012. Amherst, MA.

Senior Fellow, Environmental Health & Safety. Center for Risk Communication. New York, NY and Stevens Point, MD. 2011 to present.

Professional Masters Program Development Advisory Comm., FSU Department of Oceanography. 2010 to 2022.

Co-Editor, Proceedings of the 27th International Conference on Contaminated Soils, Sediments & Water, October 2011. Amherst, MA.

Certificate of Appreciation. Cascades Park Former MGP Site. U.S. EPA Region 4. Atlanta, GA. 2008.

Advisory Board, Center for Strategic Health Preparedness, Florida State University College of Medicine. 2001 to present. (*formerly Center for Terrorism & Public Health*)

Editorial Board, international journal *Soil & Sediment Contamination*, CRC Press, LLC. 2002 to 2006.

Courtesy Professor, Department of Geology, Florida State University. 1999 to 2022.

Science Advisory Board, 18th International Conference on Contaminated Soils, Sediments & Water. 2002. Amherst, MA.

Co-Director, NATO Advanced Research Workshop on Risk Assessment and Water Issues in Central Asia. 2000 to 2003. Almaty, Kazakhstan. 2000 to 2003.

Advisory Bd., Int'l Congress on Petroleum Contaminated Soils, Sediment & Water. London. 2000-2001.

Assistant Scoutmaster (*Troop 44, Boy Scouts of America*). Tallahassee, FL. 1998 to 2004.

Editorial Board, *Environmental Toxicology & Chemistry*, published by CRC Press, LLC. 2003-2005.

Petroleum Underground Storage Tanks Technical Committee, Florida DEP. 1996 - 2015.

Advisory Board, 15th Int'l Conf. on Contaminated Soils, Sediments & Water. Amherst, MA. 1998-1999.

Toxic Substances Advisory Council, Florida Department of Labor. 1990-2000 (*Chair, 1991-1996*).

Florida Bar, Environmental and Land Use Law Section Faculty and Steering Committee, 1996 - 1997.

Safety Committee, Florida Department of Environmental Protection, 1995 – 1997 (*advisor 1995-2020*).

Florida Bar, Environmental and Land Use Law Section Faculty and Steering Committee, 1993 - 1994.

Technical Committee, MGP '95 – International Symposium on Cleanup of Manufactured Gas Plant (MGP) Sites. Prague, Czech Republic, 1994-1995.

Florida Comparison of Environmental Risks Project, 1994-1995 (*Human Health Co-chair*).

Landfill Technical Advisory Group, Florida Department of Environmental Protection, 1993-1994.

Benlate Health Effects Committee, Pesticide Review Council, Florida Dept of Agriculture, 1993-1995.

Technical Advisory Committees for Budapest '92, Budapest '94, Warsaw '96, Warsaw '98, Prague 2000, Prague, 2003; Int'l Symposia on Environmental Contamination in Central & Eastern Europe. 1991-2004.

Financial & Tech. Advisory Committee, Florida Department of Environmental Protection. 1986-1992.

Director, Tallahassee Marathon/Half Marathon, 1989, 1990, 1991, 1992, 1995.

Outstanding Research Award, University of Arkansas Medical School, 1984.

Who's Who Among American College Students, 1983.

Graduation With Honors, Pennsylvania State University, 1975.

National Merit Scholar Program, 1971.

Eagle Scout, l969 (*Troop 1, Boy Scouts of America; Paoli, PA; Assistant Scoutmaster 1971 to 1975*)

SUMMARY OF ACTIVITIES

Dr. Teaf received a BS (Biology) from Penn State with Honors, an MS (Biological Science) from Florida State (FSU), and a Ph.D. (Toxicology) from the University of Arkansas College of Medicine. He conducted his research at the National Center for Toxicological Research. His experience includes Director (and Associate Director) of the FSU Center for Biomedical & Toxicological Research (1983-present), and Director of Toxicology for HSWMR, Inc. since 1985 (President since 1989). From 1980 to 1982 he served as Research Staff for the Florida Governor's Hazardous Waste Policy Advisory Council.

Dr. Teaf is Board Certified as a Fellow by the Academy of Toxicological Sciences and certified as a Radon Measurement Specialist by the Florida Department of Health (since 1989).

Research and professional activities include: toxicology and risk assessment for exposure to occupational or environmental agents (e.g., radionuclides, PFAs, PCBs, 1,4-dioxane, nitrogen compounds, solvents, petroleum, PAHs, metals (e.g., As, Hg, Pb, silica, pesticides, particulates, microbiota), drugs and alcohol; male reproductive toxicity, aquatic toxicology, waste management, and Prop 65. He has been peer reviewer for many technical journals (e.g., *Journal of Radiation and Cancer Research; Risk Analysis; Soil & Sediment Contamination; Environmental Forensics; Nonlinearity in Biology, Toxicology & Medicine; Environmental Toxicology & Chemistry; Regulatory Toxicology and Pharmacology; Food & Chemical Toxicology, Integrated Environmental Assessment & Mgmt; Chemico-Biological Interactions; Bulletin of Marine Science; European Journal of Public Health; Chemosphere; Environmental Biology of Fishes*), research submitted to ATSDR, and books. He is Co-Editor-in-Chief for *Soil & Sediment Contamination*, Associate Editor for *Human & Ecological Risk Assessment,* and on the *Environmental Forensics* Editorial Board.

Chris has directed or conducted research for the U.S. Environmental Protection Agency (USEPA), Centers for Disease Control (CDC) and Agency for Toxic Substances and Disease Control (ATSDR), U.S. Department of Agriculture (USDA), and several Florida agencies: Department of Labor, Department of Environmental Protection (FDEP), Department of Health (FDOH), Department of Community Affairs. And was toxicologist to the Governor's Financial & Technical Advisory Committee, and the state Landfill Technical Advisory Group. He served as toxicologist for the Petroleum Underground Storage Tanks Technical Advisory Committee. He was Co-chair of the Florida Comparison of Environmental Risks Project, a cooperative study of USEPA, FDEP and other agencies. He served as Chair of the Toxic Substances Advisory Council (Florida Department of Labor), implementing the state Right-to-Know Law. He is toxicologist for and served as Vice-Chair of the District 2 Local Emergency Planning Committee (State Emergency Response Commission). From 1986-1989, he was liaison for the State University System of Florida Toxicological Research Coordinating Committee and FDEP. He has been actively involved in the U.S. and abroad on chemical terrorism. Since 1998, Chris has been active in the Florida Contaminated Soils Forum (FDEP) on soil contamination issues. He has served on graduate committees at Florida A&M University, Georgia Tech, and University of British Columbia and was an active member of the Interstate Technology & Regulatory Council (ITRC) 1,4-Dioxane Technical Team.

Chris has taught graduate and undergraduate courses at FSU, Florida A&M, University of Florida, and Georgia Tech. He has organized and presented at seminars and training courses for the World Health Organization (WHO), USEPA, NASA, USDA, ATSDR, FDOH, Florida Engineering Society, Florida Bar Association, FDEP, Florida Department of Education, Florida Chamber of Commerce, National Conference on Waste Exchange & Resource Reuse, National Hazardous Materials Training Center, and American Bar Association. Chris served on Advisory Committees for International Symposium on Manufactured Gas Plants; Prague), and for 6 International Symposia on Environmental Contamination in Central & Eastern Europe (Budapest, Warsaw, Prague). He has been involved in many risk-based initiatives for World Health Organization (WHO) and the North Atlantic Treaty Organization (NATO) in Central & Eastern Europe (*Poland, Hungary, Bulgaria*) and Central Asia (*Kazakhstan*)

Dr. Teaf has provided technical services on toxicology, environmental health risk assessment, waste management, recycling, water quality, radiation safety, consumer product safety and occupational health/safety, particularly regarding the OSHA Hazard Communication Standard, Florida Right-to-Know Law and federal requirements under RCRA, CERCLA, TSCA or related state regulations, including CERCLA cost allocations. He has provided service to the U.S. Attorney, Florida State Attorney, and Attorneys General of Florida, Washington, Oklahoma. Chris has testified on environmental toxicology, alcohol/drugs, occupational exposure, health effects, mold, consumer products, and health risk assessment to regulatory, administrative, legislative or judicial bodies (*federal and state venues*).

SUMMARY OF PROFESSIONAL POSITIONS:

Director of Toxicology
Hazardous Substance & Waste Management Research, Inc. (HSWMR)
Tallahassee, FL
1985 to present (President, 1989 to present)

Director Emeritus
Center for Biomedical & Toxicological Research and Waste Management
Florida State University (Tallahassee, FL)
2020 to present

Adjunct Research Scholar
FSU Institute for Science & Public Affairs
2020 to present

Director
Center for Biomedical & Toxicological Research and Waste Management
Florida State University (Tallahassee, FL)
2016 to 2020

Associate Director
Center for Biomedical & Toxicological Research and Waste Management
Florida State University (Tallahassee, FL)
1983 to 2016

Advisory Committee
Professional Masters Program Development
FSU Department of Oceanography
2010 to present

Advisory Board
Center for Strategic Public Health Preparedness (*formerly FSU Center for Terrorism & Public Health*)
Florida State University College of Medicine
2001 to present

Adjunct Faculty
Florida A & M College of Pharmacy & Pharmaceutical Sciences
1998 to present

Board Member
Dog Island Conservation District
Franklin County, Florida
2002 to 2020 (Chair, 2004 to 2015; Treasurer, 2015 to 2020)

Board of Directors
Southern Waste Information Exchange (Tallahassee, FL)
2000 to present (Chair, 2000 to 2004)

Toxicologist
Human Health Peer Review Committee
Florida Department of Environmental Protection (Tallahassee, FL)
2012 to 2016

Associate in Medicine
FSU Program in Medical Sciences / FSU College of Medicine
1995 to 2002

Toxicologist
Toxic Substances Advisory Council

Florida Department of Labor & Employment Security (Tallahassee, FL)
1990 - 1998 (Chairman, 1992 to 1998)

Toxicologist
Petroleum Underground Storage Tanks Advisory Committee
Florida Department of Environmental Protection (Tallahassee, FL)
1996 to present

Toxicologist
District 2 Local Emergency Planning Committee
Florida Department of Community Affairs (Tallahassee, FL)
1987 to present (Vice Chairman, 1991)

Toxicologist
Florida Landfill Technical Advisory Group
Florida Department of Environmental Protection (Tallahassee, FL)
1993 - 1994

Adjunct Faculty
Interdisciplinary Toxicology Program
University of Arkansas for Medical Sciences (Little Rock, AR)
1986 - 1989

Toxicologist
Governor's Financial and Technical Advisory Committee
Florida Department of Environmental Regulation (Tallahassee, FL)
1986 - 1992

Research Assistant
National Center for Toxicological Research and the University
of Arkansas for Medical Sciences (Little Rock, AR)
1983 - 1985

Associate Director
Southern Waste Information Exchange (Tallahassee, FL)
1981 - 1983

Research Staff
Florida Governor's Hazardous Waste Policy Advisory Council
1980 - 1982

Research Associate, Hazardous Waste Management Program
Florida State University (Tallahassee, FL)
1979 - 1983

Teaching/Research Assistant
FSU Departments of Biological Science and Oceanography
1976 - 1980

Animal Colony Technician
Wyeth Laboratories (Philadelphia, PA)
1975 - 1976

TEACHING EXPERIENCE:

Air Quality (*Indoor/Outdoor*)
Alcohol, Smoking, Medicinal & Recreational Drugs: Toxicology and Exposure
Aquatic Toxicology
Carcinogenesis, Carcinogens and Cancer
Comparative Vertebrate Morphology
Dermal Toxicology
Emergency Response and Contingency Planning
Environmental Hazards
Environmental Chemistry & Behavior of Chemicals
Exposure Assessment
General Zoology
Hazardous Waste Management
Health and Safety for Site Investigation and Response Personnel (*40 Hr and 8 Hr*)
Ichthyology
Inhalation Toxicology
Industrial and Occupational Toxicology
Industrial Health & Safety
Landfills: Chemistry, Potential Health Risk, Environmental Management & Remediation
Mammalian Toxicology & Health Effects in Animals
Metals Toxicology (*e.g., arsenic, lead, mercury, nickel, vanadium, cadmium, chromium*)
Mutagenesis
Nephrotoxicity
Airborne Particulates, Fibers, Mold
Right-to-Know and Hazard Communication Laws (*OSHA and state*)
Particulates Toxicology and Regulation
Pesticide Toxicology
Toxicology and Environmental Behavior of Polyfluoroalkyl Substances (PFAs)
Principles of Toxicology and Risk Assessment
Radionuclides and Radiation Toxicology
Reproductive Toxicology
Research Diving Techniques
Seafood Safety: Health Effects from Contaminated Products
Toxicology of Solvents and Other Organic Hydrocarbons (*e.g., PCBs, PFAs, PAHs*)
Toxicological Risk Assessment
Toxicology and Management of Mixed Wastes (*Chemical/Radiological*)
Toxicology for Physicians, Nurses, and Other Public Health Personnel
Vapor Intrusion: Evaluation and Health Significance

Single day events to full semester graduate/undergraduate courses at University of Florida, University of North Florida, Florida A & M University, University of Arkansas, Georgia Tech, Tallahassee Community College, Florida State University (Biology, Chemistry, Engineering, Geology, Oceanography, Urban & Regional Planning Depts.)

PUBLICATIONS AND SELECTED ABSTRACTS:

Teaf, C.M. 2024. Session Moderator and Facilitator. PFAS Forum IV. Orlando, Florida. May 28-30, 2024.

Missimer, T.M., J.H. MacDonald, S. Tsegaye, S. Thomas, C.M. Teaf, D.J. Covert, and Z. Kassis. 2024. Natural Background and the Anthropogenic Enrichment of Mercury in the Southern Florida Environment: A Review with a Discussion on Public Health. In press for publication in International Journ. of Environ. Research & Public Health. *January 2024*.

Teaf, C.M., M.M. Garber and D.J. Covert. 2023. Radon and Cancer in the General Population: Truth or Exaggeration. *39th Annual Conference on Soils, Sediments, Water, and Energy (AEHS East). Amherst, MA. October, 2023. (Also serving as session chair for Risk Assessment session.)*

Barcan, R., Z.R Kassis, C.M. Teaf, A. Danley-Thomson, D.J. Covert, and T.M. Missimer. 2023. Dry and Wet Atmospheric Fallout in Southwest Florida: Environmental and Health Implications. Atmosphere 14: 102 (25 pp). Available at *https://doi.org/10.3390/atmos14010102*

Teaf, C.M. Technical Session Moderator, Session IV: PFAS and Chlorinated Solvents. Florida Remediation Conference. Orlando, FL. November 15-17, 2022.

Teaf, C.M., M.M Garber and D.J. Covert. 2022. Radon and Cancer in the General Population: Perception vs Reality. *38th Annual Conference on Soils, Sediments, Water, and Energy (AEHS East). Amherst, MA. October, 2022*.

Agathokleous, E. and 40 others including C.M. Teaf. 2022. Rethinking subthreshold effects in regulatory chemical risk assessments. Environmental Science & Technology 56: 11095-11099 *online edition, https://doi.org/10.1021/acs.est.2c02896*

Teaf,C.M., D.J. Covert, and M.M. Garber. 2022. Pollution Liability in Florida: Emerging Issues. *35th Annual Environmental Permitting Summer School. Florida Environmental Network and Florida Chamber, Marco Island, FL. July 19-22, 2022. (Toxicology and Regulation of PFAs: Federal and Florida Synopsis).*

Teaf, C.M. and M.M. Garber. 2022. Toxicology and Properties of Organic Solvents and Solvent-like Chemicals. *In*: Roberts, S.M. R.C. James, and P.L. Williams (*eds*.), Principles of Toxicology: Industrial and Environmental Applications (*Fourth Edition*). John Wiley & Sons, Inc., Hoboken, NJ.

Teaf, C.M., M.M Garber and D.J. Covert. 2022. PFAS Toxicology, Risk and Regulation: Florida & USEPA Activity. *Presented at PFAS Forum. Tampa, FL. May 2022.*

Teaf, C.M., D.J. Covert, and M.M Garber. 2021. Updates and Approaches to Toxicological Risk Issues and Aspects of Risk Communication for MGP Sites: Perception and Practice. *9th International Symposium and Exhibition on Redevelopment of Manufactured Gas Plant Sites (MGP 2021)* and *26th Florida Remediation Conference. Orlando, FL. November, 2021. Also served as a member of the Symposium Steering Committee.*

Teaf, C.M., M.M. Garber and D.J. Covert,. 2021. Threshold vs Nonthreshold: Evaluation of Low Dose Ionizing Radiation Risks. *Annual International Conference on Soils, Sediments, Water and Energy. Amherst, MA. October, 2021.*

DeMeo, R.A., C.M. Teaf, J. Oliveros, M. Delcamp, and J Caspary. 2021. Emerging Issues in Pollution Liability in Florida (Perfluoroalkyls, Environmental Insurance, Lieupo vs Simon's Trucking, Site Characterization). 34th Annual Environmental Permitting Summer School. Florida Environmental Network and Florida Chamber, Marco Island, FL. July 20-23, 2020. (*Presentation: Toxicology and Risk Issues Regarding PFAs*).

Teaf, C.M., M.M Garber and D.J. Covert,. 2021. PFAS Toxicology, Risk and Recent Regulatory Considerations. *PFAS Forum. Tampa, FL. April 2021.*

Li, Y., A. Smyth, J. Crane, C.M. Teaf, and G. Liu. 2021. Soil Arsenic in Miami-Dade County: A Fact Sheet. Extension Data Information Source (EDIS), University of Florida Institute of Food & Agricultural Sciences (IFAS), Publication SL483. March, 2021.

Herman, J.P., L. Redfern, C.M. Teaf, D.J. Covert, and T.M. Missimer. 2020. Cumene Contamination in Groundwater: Observed Concentrations, Evaluation of Remediation by Sulfate Enhanced Bioremediation (SEB), and Public Health Issues. International Journal of Environmental Research and Public Health Volume 17(22): 8380. *doi:10.3390/ijerph17228380.*

Teaf, C.M., M.M. Garber, and D.J. Covert. 2020. State of the Science and Recent Regulatory Status of 1,4-Dioxane and Polyfluorinated Substances. *36th Annual International Conference on Soils, Sediments, Water and Energy. Amherst, MA. October, 2020. (Also served as session chair for Site Investigation & Characterization session, and Chair of Student Presentation Evaluation Committee).*

DeMeo, R.A., C.M. Teaf, J. Oliveros, M. Delcamp, M. Gerding, and P. Cornais. 2020. Emerging Issues in Pollution Liability in Florida (Perfluoroalkyls, Environmental Insurance, Lieupo vs Simon's Trucking, Site Characterization). *34th Annual Environmental Permitting Summer School. Florida Environmental Network and Florida Chamber, Marco Island, FL. July 21-24, 2020. (Presentation: Toxicology and Risk Issues for PFAs).*

Teaf, C.M., M.M Garber and D.J. Covert,. 2020. PFAS Toxicology, Risk and Recent Regulatory Considerations. *Accepted for presentation at PFAS Forum. Tampa, FL. Scheduled for April, 2020, postponed to April 2021.*

Teaf, C.M., M.M Garber and D.J. Covert,. 2019. Drive for Regulatory Action on 1,4-Dioxane in Drinking Water and Controversy Surrounding its Mode of Action. *35th Annual International Conference on Soils, Sediments, Water and Energy. Amherst, MA. October, 2019. (Also served as Risk Assessment session chair and Chair of Student Presentation Evaluation Committee).*

Teaf, C.M. 2019. Perfluoroalkyl Substances (PFAS): Human Health Considerations. Air & Waste Management Association, Florida Section. *Tallahassee, FL. October, 2019. (panel of toxicological, analytical laboratory, regulatory, geological/engineering experts).*

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NATO Pilot Study Meeting on Human Health Issues and Tools for Disease Prevention in Central Asia. Almaty, Kazakhstan. November, 2003. (*Served as Session Moderator*).

Sixth International Symposium on Environmental Contamination in Central and Eastern Europe. Prague, Czech Republic. September, 2003. (*Session Moderator and Steering Committee Member*).

OSHA Refresher Course for University Health and Safety Activities (8 hours). For Florida State University. Tallahassee, Florida. June 11, 2003.

Statewide Video Conference on Chemical Terrorism. For Florida State University College of Medicine and Florida Department of Health. June 10, 2003.

Personnel Health and Safety Refresher Course (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. May 7, 2003.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. January 8, 2003.

NATO Advanced Research Workshop: Risk Assessment as a Tool for Environmental Decision-Making in Central Asia. Almaty, Kazakhstan. September, 2002. (*Served as Co-Director and Editor of Proceedings*).

Safety Concerns: Awareness for the Field Inspector. For Florida Department of Environmental Protection. St. Petersburg, Florida. August, 2002

Vulnerability of Municipal and Private Water Systems to Chemical Attack. Presented at World Health Organization Restricted Expert Consultation on Prevention and Management of Substance Terrorism Against Water Services. Copenhagen, Denmark. November, 2001.

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Planning Seminar on Introduction of the Rapid Environmental & Health Risk Assessment for the Lower Danube River. For WHO and Italian Ministry of Environment. Sofia, Bulgaria. January, 2001.

Evaluating and Communicating Health Risks. Holland & Knight Annual Environmental Seminar Series. Orlando, Florida. October, 2000.

Fifth International Symposium on Environmental Contamination in Central and Eastern Europe. Prague, Czech Republic. September, 2000. (*Session Moderator and Steering Committee Member*).

14th Annual Environmental Permitting School. Managing sites with chemical issues: Evaluation and presentation of risk information. Florida Chamber of Commerce. Marco Island, Florida. July, 2000.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Ft. Myers, Florida. August, 1999.

Toxicology and Risk Assessment: Using the Expert Witness. 1999 Annual Meeting, National Association of Legal Assistants. Tampa, FL. July, 1999.

Risk-Based Corrective Action at Miami International Airport. 1999 Hazardous Waste Management Conference. Miami, Florida. May, 1999.

Toxicology and Risk Considerations for Chlorinated Solvents. For Florida Department of Health & Rehabilitative Services. Wakulla Springs, Florida. May, 1999.

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Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Ft. Myers, Florida. July, 1998.

Risk Assessment Principles & Practice: Application to the Polish Environment. For Institute for Ecology of Industrial Areas and U.S. Department of Energy. Katowice, Poland. January, 1997.

Control of Reportable Diseases in Florida: A Public-Private Partnership. For Florida Department of Health & Rehabilitative Services. Tallahassee, Florida. October 24, 1996.

Third International Symposium on Environmental Contamination in Central and Eastern Europe. Warsaw, Poland. September, 1996. (*Session Moderator and Steering Committee Member*).

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. June 6, 1996.

Environmental Toxicology for Physicians *and* Medical History-taking in the Evaluation of Environmental or Occupational Disease. For Florida Department of Health & Rehabilitative Services. Sebring, Florida and Vero Beach, Florida. May 10 and May 15, 1996.

Control of Reportable Diseases in Florida: A Public-Private Partnership. For Florida Department of Health & Rehabilitative Services. Tallahassee, Florida. April 17, 1996.

RCRA Compliance Technical Assistance Training Courses. For Florida Department of Environmental Protection. Tallahassee, Florida (Eleven locations in Florida during period February to August, 1996).

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. April 2, 1996.

American Bar Association Section of Litigation, 8th Annual Environmental Litigation Midyear Meeting. Vail, Colorado. February 15-16, 1996.

12th Annual Environmental Permitting Course. Florida Chamber. Orlando, FL. January 17-18, 1996.

1995 Conference on State of Practice of Risk Assessment in Human Health and Environmental Decision Making. Tallahassee, FL. December 13-14, 1995. (*Session Moderator and Steering Committee Member*).

Risk Assessments, Audits & Other Compliance Management Tools. Environmental Compliance & Risk Management Seminar, Florida Chamber of Commerce. Tampa, FL. November, 1995.

Air Contamination in Central and Eastern Europe: What We Have Seen Since the Iron Curtain was Pulled Back. For Carolinas Air Pollution Control Association. Myrtle Beach, SC. October, 1995.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. September 27, 1995.

MGP'95 International Symposium and Trade Fair on the Cleanup of Manufactured Gas Plants. Prague, Czech Republic. September, 1995. (*Session Moderator and Steering Committee Member*).

Seafood Poisoning: Biological & Nonbiological Effects of Contaminated Fish and Shellfish from the Gulf of Mexico. For U.S. EPA, Florida Department of Health & Rehabilitative Services. Tallahassee, FL; Corpus Christi, TX; Lafayette, LA; Biloxi, MI; Daytona Beach, FL and Orange Beach, AL. March 26, May 22, July 15, August 3, August 18, October 13, October 18, November 11, 1994, June 6, 1995.

Required Personnel Health and Safety Refresher Course for Hazardous Waste Activities (8 hours). For Levine•Fricke. Tallahassee, Florida. August 14, 1995.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. May 18, 1995.

Worker Health and Safety Requirements. For U.S. Environmental Protection Agency RCRA Inspector Training Institute. Orlando, Florida. January 24-26, 1995.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Ft. Myers, Florida. January 12, 1995.

RCRA Personnel Health and Safety Training Course (40 hours). For Florida Department of Environmental Protection. Orlando, Florida. December 5-9, 1994.

Training Course in Principles of Toxicology, Risk Assessment and Risk Communication. Conducted for Florida Department of Health and Rehabilitative Services. Jacksonville, Florida. November, 1994.

Risk Assessments: Understanding Their Strengths and Weaknesses (*Session Co-Chair*). For the Florida Bar Association, Environmental and Land Use Law Committee. Tampa, Florida. October 10, 1994.

Training Course for RCRA Inspectors. For Florida Department of Environmental Protection. Tallahassee, Florida. October 4-6, 1994.

Second International Symposium on Environmental Contamination in Central and Eastern Europe. Budapest, Hungary. September 20-23, 1994. (*Session Moderator and Steering Committee Member*).

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Protection. Tallahassee, Florida. August 23, 1994.

Regulations, Environmental Considerations and Safety Aspects of Petroleum Sites under Chapter 17-770. For Florida Department of Environmental Protection. Tallahassee, Florida. June 7-8, 1994.

Toxicology & Risk Assessment Training Course. Conducted for Florida Department of Environmental Protection. Tallahassee, Florida. May 18-19, 1994.

Seminars for Physicians & Medical Personnel: Public Health Implications of Toxic Materials & Hazardous Waste Sites. For Florida Dept of Health and Rehabilitative Services, Agency for Toxic Substances and Disease Registry. Miami, Sarasota, Tallahassee, Florida. March 3, 11, 12, 25, 30, 1994.

Required Personnel Health and Safety Refresher Course for Hazardous Waste Activities (8 hours). For Levine•Fricke. Tallahassee, Florida. March 7, 1994.

Training Course in Principles of Toxicology, Risk Assessment and Risk Communication. Conducted for Florida Department of Health & Rehabilitative Services. Jacksonville, Florida. February 3-4, 1994.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. January 8, 1994.

RCRA Personnel Health and Safety Training Course (40 hours). For Florida Department of Environmental Regulation. Orlando, Florida. December 6-10, 1993.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. July 8, 1993.

Personnel Health and Safety Refresher Course for RCRA Activities (8 hours). For Florida Department of Environmental Regulation. Orlando, Florida. May 20, 1993.

Medical Seminars on Public Health Implications of Hazardous Waste Sites. For Florida Department of Health and Rehabilitative Services and Agency for Toxic Substances and Disease Registry. Pensacola, Ft. Lauderdale and Miami, Florida. March, April, May, November, 1993.

Training Course in Principles of Toxicology, Risk Assessment and Risk Communication. Conducted for Florida Department of Health and Rehabilitative Services. Ft. Myers, Florida. January 28-29, 1993.

Personnel Health and Safety Refresher Course for Hazardous Waste Activities (8 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. December 9, 1992.

RCRA Personnel Health and Safety Training Course (40 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. November 16-20, 1992.

Required Personnel Health and Safety Refresher Course for Hazardous Waste Activities (8 hours). For Levine•Fricke. Tallahassee, Florida. November 18, 1992.

First International Symposium on Environmental Contamination in Central and Eastern Europe. Budapest, Hungary. October 21-24, 1992. (*Session Moderator and Steering Committee Member*).

Training Course in Principles of Toxicology and Risk Assessment. For Florida Department of Health and Rehabilitative Services. Orlando, Florida. July 23-24, 1992.

RCRA Personnel Health and Safety Required Refresher Course (8 hours). For Florida Department of Environmental Regulation. Orlando and Tallahassee, Florida. May 29, June 23 and September 15, 1992.

Training Course in Principles of Toxicology and Risk Assessment. Conducted for Florida Department of Health and Rehabilitative Services. Tallahassee, Florida. June 18-19, 1992.

General Principles of Toxicology and Risk Assessment (3 Graduate Semester Hours). For Department of Biological Science, Florida State University. Tallahassee, Florida. January to April, 1992.

Medical Seminar on Community Public Health Implications of Hazardous Waste Sites. For Florida Department of Health and Rehabilitative Services and Agency for Toxic Substances and Disease Registry. Rockledge, Miami, and Orlando, Florida. April 10, April 24, May 28 and October 22, 1992.

Personnel Health & Safety Refresher Course for Hazardous Waste Activities (8 hours). For Florida Department of Environmental Regulation. Orlando, Tallahassee, FL. April, October, November, 1991.

RCRA Personnel Health and Safety Training Course (40 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. January 4-8 and September 16-20, 1991.

Physician Training Course on Public Health Implications of Environmental Toxicants. For Florida DOH and ATSDR. St. Petersburg and Orlando, Florida. April, September, 1991.

Supervisors Site Health and Safety Training Course for Hazardous Waste Activities (8 hours). For Levine•Fricke. Tallahassee, Florida. June 18, 1991.

Required Personnel Health and Safety Refresher Course for Hazardous Waste Activities (8 hours). For Levine•Fricke. Tallahassee, Florida. June 17, 1991.

Training Course on General Principles of Toxicology and Risk Assessment. Conducted for Florida Department of Health and Rehabilitative Services. Orlando, Florida. May 1-2 and May 21-22, 1991.

Training Course on Mixed Radioactive and Hazardous Waste. For Florida Department of Environmental Regulation. Tallahassee, Florida. October, 1990.

Physician Training Course on Public Health Implications of Environmental Toxicants. For Florida DOH and ATSDR. Tampa and Tallahassee, Florida. March 15 and July 24, 1990.

Mercury Contamination in Florida: Impacts and Solutions. Conducted by FSU Center for Biomedical & Toxicological Research, sponsored by 19 federal and state agencies. June 20-21, 1990.

Environmental Toxicology & Epidemiology: Practical Approach for Local Health Officials & Physicians. For National Assoc. of County Health Officials, ATSDR, DOH. Ft. Lauderdale. *July, 1990.*

RCRA Personnel Health and Safety Training Course (40 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. June 4-8, 1990.

RCRA Personnel Health and Safety Required Refresher Course (8 hours). For Florida Department of Environmental Regulation. Tallahassee, Florida. May 31, 1990.

RCRA Personnel Health and Safety: Basic Training Course (40 hours). For Florida Department of Environmental Regulation. Orlando, Florida and Tallahassee, FL. April 24-28 and December 4-8, 1989.

Groundwater Investigations and Application to Assessment of Risks. For Florida Department of Environmental Regulation. Tallahassee, Florida. June 6-7, 1989.

Risk Assessment & Decision-Making Training. Conducted for Florida Department of Environmental Regulation and U.S. Environmental Protection Agency. Tallahassee, Florida. August 30-31, 1988.

Training Course on General Principles of Toxicology & Risk Assessment. For Florida Department of Health & Rehabilitative Services. Tallahassee, Florida. September/October, 1987. Orlando, Florida.

Hazardous Materials Training (Risk Assessment; Hazardous Materials Contingency Plans). Conducted for National Hazardous Materials Training Center, Little Rock, Arkansas. October 28-30, 1986.

Training Course on Toxicology: Hazardous Waste Field Activities. Conducted for the Florida Department of Environmental Regulation and the Florida Department of Health and Rehabilitative Services. Tallahassee, Florida. June 25-26, 1986 and Orlando, Florida. October 8-9, 1986.

Training Course on Emergency Response and Contingency Planning. Conducted for the U.S. Environmental Protection Agency. Atlanta, Georgia. March, 1985; March, 1986.

Training Course for the Holmes Regional Medical Center: Employee Toxic Substances Right-to-Know Program. Conducted for the Holmes Regional Medical Center. Melbourne, Florida. 1986.

Training Seminar on Florida Right-to-Know Law & Management of Hospital Hazardous Waste. Conducted for the Florida Hospital Association (FHA). November, 1985; August, 1986. Orlando, FL.

Hazardous Waste Disposal and Hazardous Substances Right-to-Know Regulations. Conducted for Florida Hospital Engineers Association. Orlando, Florida. April 4, 1986.

Second National Conference on Waste Exchange & Resource Reuse. Tallahassee, Florida. March, 1985.

Training Course on the OSHA Hazard Communication Standard. Orlando, Florida. February, 1985.

Symposium: Alternative Technologies for Waste Management. Tallahassee, FL. February, 1984.

Training Course on Toxicology and Risk Assessment. Conducted for the Florida Department of Health and Rehabilitative Services. Orlando, Florida. October 3-5, 1984.

Monitoring and Management of Hazardous Waste at RCRA Subtitle D Facilities. Conducted for U.S. EPA Office of Research & Development,. Tallahassee, Florida. October, 1984.

Symposium on EDB. Conducted for FL State University System. Tallahassee, FL. February, 1984.

Workshop on Monitoring Considerations in the Siting and Operation of Hazardous Waste Disposal Facilities in Temperate Zone Wet Environments. Conducted for the Office of Research and Development, U.S. Environmental Protection Agency. Tallahassee, Florida. October 4-5, 1983.

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Hazardous Materials Contingency Planning Workshop. Conducted for Region IV, Environmental Emergencies Branch, U.S. Environmental Protection Agency. Atlanta, Georgia. March 26, 1981.

Workshop on Hazardous Waste Management for Educational Institutions. Conducted for the Florida Department of Education. Orlando, Florida. February 3-4, 1981.

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State Waste Exchange Workshop. For Florida Chamber of Commerce. Tallahassee, FL. December, 1980.

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Attachment B

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Attachment C

Deposition and Trial Testimony

Teaf Testimony

May 2020 to May 2024

CASE IDENTIFIER	CASE NUMBERS	REPRESENT PLAINTIFF OR DEFENSE	JURISDICTION	STATE	Deposition	Hearing or Trial
Burke vs Florida DEP and Amanda Gaskins	21-1294	Defense	Florida Division of Administrative Hearings	FL	July 29, 2021	None
State of Florida vs. Chait et al	21-2242CF10A; 212243CF10A; 21-2244CF10A; 212245CF10A; 21-8103CF10A	Plaintiff	Circuit Court, Broward County	FL	February 9, 2023	None
Williford vs Syngenta	21-CA-006219	Defense	Circuit Court, Hillsborough County	FL	June 14, 2023	None
Watters et al. vs. Clouse et al.	31-CV-2019-900881.00	Plaintiff	Circuit Court, Etowah County	GA	None	January 2023
Kentucky Waterways Alliance and Sierra Club vs Kentucky Utilities Company	5:17-292-DCR	Defense	U.S. District Court, Eastern District	KY	July 20, 2020	None
Tillman, Martin, Lewis, Morrell, Stokes, and Watson vs Highland Industries, Inc	4:18-CV-02563-SAL; 4:18-CV-03143-SAL; 4:19-CV-01251-SAL; 4:19-CV-01252-SAL; 4:19-CV-01253-SAL; 4:19-CV-02338-SAL	Defense	U.S. District Court	SC	November 16, 2021	None