UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION
3:18-cv-00197-RJC-DSC

BRUCE RHYNE and JANICE RHYNE, Plaintiffs, v. UNITED STATES STEEL CORPORATION, SAFETY-KLEEN SYSTEMS, INC., and THE SAVOGRAN COMPANY, Defendants.	)	ORDER

THIS MATTER comes before the Court on the parties' motions under Daubert and Federal Rule of Evidence 702 to exclude expert testimony and Plaintiffs' motions in limine to exclude certain evidence.

I. BACKGROUND

This is a toxic tort action brought by Bruce Rhyne and his wife, Janice Rhyne, arising out of Mr. Rhyne's diagnosis with acute myeloid leukemia ("AML"). Plaintiffs allege that Mr. Rhyne was diagnosed with AML as a result of his exposure to benzene in various products manufactured by Defendants. Nine of the twelve original Defendants have been dismissed pursuant to settlement or court order. As for the three remaining Defendants, Plaintiffs allege that Mr. Rhyne was exposed to benzene from using (a) Liquid Wrench containing raffinate supplied by Defendant United States Steel Corporation ("USS"), (b) 105 Solvent manufactured by Defendant Safety-Kleen Systems, Inc., and (c) Kutzit manufactured by Defendant The Savogran

Company. Mr. Rhyne's alleged exposure to Defendants' benzene-containing products occurred performing non-occupational work at home from approximately 1970 to 1975, during his high school internship at an auto mechanic shop from approximately 1974 to 1975, and during his employment with Duke Energy as a pipefitter and maintenance mechanic from 1976 to 1998.[1]

Before the Court are Defendants' motions to exclude the testimony of Plaintiffs' causation and exposure experts, Plaintiffs' motion to exclude the testimony of one defense expert, and Plaintiffs' motions in limine to exclude evidence of radiation exposure and a genetic defect as alternative causes of Mr. Rhyne's AML. The motions have been fully briefed and are ripe for adjudication.[2]

II. LEGAL FRAMEWORK

Rule 702 of the Federal Rules of Evidence governs the admissibility of expert testimony. Rule 702 states:

> A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if:
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> (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue;

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[1] Although Mr. Rhyne's employment with Duke Energy continued after 1998 to May 2015, he was employed as a maintenance supervisor during that time and had limited, if any, exposure to benzene. (See Doc. No. 148-3, at 4–16.)

[2] During the summary judgment hearing, the Court sought to schedule a several day hearing on the anticipated motions under Daubert and Rule 702. (Doc. No. 179, at 80:17–25, 81:15–83:23.) Counsel for Plaintiffs then suggested that the motions be decided on the papers, and counsel for Defendants did not make any objection thereto. (Doc. No. 179, at 84:4–86:9.) Accordingly, the Court resolves the motions without conducting a Daubert hearing.

(b) the testimony is based on sufficient facts or data;

(c) the testimony is the product of reliable principles and methods; and

(d) the expert has reliably applied the principles and methods to the facts of the case.

Fed. R. Evid. 702. "Courts have distilled the requirements of Rule 702 into two crucial inquiries: 1) whether the proposed expert's testimony is relevant; and 2) whether it is reliable." Yates v. Ford Motor Co., 113 F. Supp. 3d 841, 845 (E.D.N.C. 2015). "The Supreme Court has made clear that it is the trial court's duty to play a gatekeeping function in deciding whether to admit expert testimony: 'The trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable.'" United States v. Crisp, 324 F.3d 261, 265 (4th Cir. 2003) (quoting Daubert v. Merrell Dow Pharm., Inc., 509 U.S. 579, 589 (1993)).

In Daubert, the Supreme Court announced five factors that district courts may consider in assessing the relevance and reliability of expert testimony. 509 U.S. at 593–94. Those factors are:

> (1) whether the particular scientific theory "can be (and has been) tested"; (2) whether the theory "has been subjected to peer review and publication"; (3) the "known or potential rate of error"; (4) the "existence and maintenance of standards controlling the technique's operation"; and (5) whether the technique has achieved "general acceptance" in the relevant scientific or expert community.

Crisp, 324 F.3d at 266 (quoting Daubert, 509 U.S. at 593–94). The Daubert factors, however, are neither definitive nor exhaustive. Kumho Tire Co. v. Carmichael, 526 U.S. 137, 150–51 (1999). "In determining whether proffered expert testimony is reliable, the district court has broad discretion to consider whatever factors bearing

on validity that the court finds to be useful; the particular factors will depend upon the unique circumstances of the expert testimony involved." United States v. Hammoud, 381 F.3d 316, 337 (4th Cir. 2004); see also Kumho Tire, 526 U.S. at 142 ("[T]he law grants a district court the same broad latitude when it decides how to determine reliability as it enjoys in respect to its ultimate reliability determination."). "The inquiry to be undertaken by the district court is 'a flexible one' focusing on the 'principles and methodology' employed by the expert, not on the conclusions reached." Westberry v. Gislaved Gummi AB, 178 F.3d 257, 261 (4th Cir. 1999) (quoting Daubert, 509 U.S. at 594–95). At the same time, "conclusions and methodology are not entirely distinct from one another," and "nothing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." GE v. Joiner, 522 U.S. 136, 146 (1997). In determining the admissibility of expert testimony, district courts "should be conscious of two guiding, and sometimes competing, principles: (1) that Rule 702 was intended to liberalize the introduction of relevant expert evidence; and (2) that due to the difficulty of evaluating their testimony, expert witnesses have the potential to be both powerful and quite misleading." Hammoud, 381 F.3d at 337 (quotation marks omitted).

To succeed on their claims, Plaintiffs must prove both general causation and specific causation. Dunn v. Sandoz Pharm. Corp., 275 F. Supp. 2d 672, 676 (M.D.N.C. 2003). General causation exists when exposure to an agent can cause the disease at issue, and specific causation exists when exposure to the agent in fact caused the

disease in a particular individual. Doe v. Ortho-Clinical Diagnostics, Inc., 440 F. Supp. 2d 465, 471 (M.D.N.C. 2006). The Fourth Circuit has held that "[i]n order to carry the burden of proving a plaintiff's injury was caused by exposure to a specified substance, the plaintiff must demonstrate the levels of exposure that are hazardous to human beings generally as well as the plaintiff's actual level of exposure." Westberry, 178 F.3d at 263 (quotation marks omitted). Typically, expert testimony is necessary to prove general and specific causation. Zellars v. NexTech Northeast, LLC, 895 F. Supp. 2d 734, 739 (E.D. Va. 2012), aff'd, 533 F. App'x 192 (4th Cir. July 17, 2013).

It is well recognized that epidemiology usually provides the best evidence of general causation in toxic tort actions. Norris v. Baxter Healthcare Corp., 397 F.3d 878, 882 (10th Cir. 2005); Rider v. Sandoz Pharm. Corp., 295 F.3d 1194, 1198 (11th Cir. 2002); In re Lipitor (Atorvastatin Calcium) Mktg., Sales Practices & Prods. Liab. Litig., 174 F. Supp. 3d 911, 914 (D.S.C. 2016). "Epidemiology is the field of public health and medicine that studies the incidence, distribution, and etiology of disease in human populations." Michael D. Green et al., Reference Guide on Epidemiology, in Fed. Judicial Ctr., Reference Manual on Scientific Evidence 551 (3d ed. 2011) [hereinafter Reference Guide on Epidemiology]. "Epidemiologic evidence identifies agents that are associated with an increased risk of disease in groups of individuals, quantifies the amount of excess disease that is associated with an agent, and provides a profile of the type of individual who is likely to contract a disease after being exposed to an agent." Id. at 552.

The ultimate question with which epidemiologists are concerned is whether a causal relationship exists between an agent and a disease. Id. at 566. To establish causation, epidemiological studies must first show an association between exposure to an agent and the disease. Id.; accord In re Lipitor, 174 F. Supp. 3d at 914. An association, however, is not equivalent to causation. Reference Guide on Epidemiology, at 552. "An association between exposure to an agent and disease exists when they occur together more frequently than one would expect by chance." Id. at 566. Epidemiological studies commonly express the existence and strength of an observed association between exposure and disease as "relative risk." Id. A relative risk equal to 1.0 indicates that there is no association between exposure to the agent and the disease—the risk of disease in exposed individuals is the same as the risk of disease in unexposed individuals. Id. at 567. A relative risk greater than 1.0 indicates a positive association between exposure to the agent and the disease—the risk of disease in exposed individuals is greater than the risk of disease in unexposed individuals. Id. And a relative risk less than 1.0 indicates a negative association between exposure to the agent and the disease—the risk of disease in exposed individuals is less than the risk of disease in unexposed individuals. Id.; accord In re Lipitor, 174 F. Supp. 3d at 915.

An observed association in a study, however, may result from random error. Reference Guide on Epidemiology, at 572. The two main techniques for assessing random error are statistical significance and confidence intervals. Id. at 573. To measure the statistical significance of a study, epidemiologists calculate a *p*-value.

Id. at 576. "A *p*-value represents the probability that an observed positive association could result from random error even if no association were in fact present." Id. If the observed *p*-value for a study falls below the preselected level, most commonly .05, then the study is statistically significant—that is, the results are unlikely to be due to random error. Id. at 573, 576–77. "A confidence interval provides both the relative risk (or other risk measure) found in the study and a range (interval) within which the risk likely would fall if the study were repeated numerous times." Id. at 573. Put differently, "[a] confidence interval is essentially a margin of error for the estimated relative risk." In re Lipitor, 174 F. Supp. 3d at 915 (quotation marks omitted). "If a 95% confidence interval is specified, the range encompasses the results we would expect 95% of the time if samples for new studies were repeatedly drawn from the population." Reference Guide on Epidemiology, at 580. If the range of possible results includes a relative risk of 1.0, the study is not statistically significant because it includes a result which does not indicate an association. Id. at 581; accord In re Lipitor, 174 F. Supp. 3d at 915.

"Once an association has been found between exposure to an agent and development of a disease, researchers consider whether the association reflects a true cause-effect relationship." Reference Guide on Epidemiology, at 597. "Assessing whether an association is causal requires an understanding of the strengths and weaknesses of the study's design and implementation, as well as a judgment about how the study findings fit with other scientific knowledge." Id. at 553. To determine whether an association reflects a causal relationship, epidemiologists apply the

factors set out by Sir Austin Bradford Hill in his 1965 article on providing epidemiological evidence of causation: (1) temporal relationship, (2) strength of the association, (3) dose-response relationship, (4) replication of the findings, (5) biological plausibility, (6) consideration of alternative explanations, (7) cessation of exposure, (8) specificity of the association, and (9) consistency with other knowledge. Id. at 600; accord In re Lipitor, 174 F. Supp. 3d at 916. "Whether an established association is causal is a matter of scientific judgment, and scientists appropriately employing this method 'may come to different judgments' about whether a causal inference is appropriate." In re Lipitor, 174 F. Supp. 3d at 916 (quoting Milward v. Acuity Specialty Prods. Grp., Inc., 639 F.3d 11, 18 (1st Cir. 2011)).

III. DEFENDANTS' MOTIONS[3]

As to general causation, Plaintiffs offer the expert testimony of Peter F. Infante, an epidemiologist, and Robert Harrison, a medical doctor. As to specific causation, Plaintiffs offer the expert testimony of Infante, Harrison, and Steven D. Gore, a medical doctor. And as to Mr. Rhyne's level of exposure to benzene, Plaintiffs offer the expert testimony of Robert F. Herrick, an industrial hygienist. Defendants have moved to exclude the testimony of all Plaintiffs' experts.

A. Safety Kleen's Mineral Spirits Product

Before turning to the reliability and relevance of each expert's opinion, it is

[3] USS and Safety Kleen filed most of the Daubert motions presently before the Court. As Savogran filed a notice stating it joined in all the motions filed by USS and Safety Kleen, (Doc. Nos. 205, 235, 242), the Court refers to the motions as though they were filed by all Defendants and addresses defendant-specific arguments where necessary.

necessary to address an argument raised by Safety Kleen that is specific to its product. Safety Kleen's 105 Solvent ("parts washer solvent" or "mineral spirits solvent") is mineral spirits based. Mineral spirits are petroleum-derived distillate mixtures that contain benzene and other chemicals. (Doc. No. 196-9, ¶ 32.) In this case, Plaintiffs' general causation experts opine that exposure to benzene can cause AML, and Plaintiffs' specific causation experts opine that Mr. Rhyne's exposure to benzene in Defendants' products—including Safety Kleen's parts washer solvent—caused his AML. Safety Kleen argues that, with respect to Plaintiffs' claims as to Safety Kleen, the causation question in this case is not whether exposure to benzene can and did cause Mr. Rhyne's AML, but whether exposure to mineral spirits can and did cause Mr. Rhyne's AML. According to Safety Kleen, the opinions of Plaintiffs' causation experts are unreliable and irrelevant because they focus on benzene instead of mineral spirits. In making this argument, Safety Kleen relies on a declaration of its expert David Pyatt, a toxicologist, and two cases: Henricksen v. Conoco Phillips Co., 605 F. Supp. 2d 1142 (E.D. Wash. 2009) and Burst v. Shell Oil Co., No. 14-109, 2015 U.S. Dist. LEXIS 77751 (E.D. La. June 16, 2015).

Henricksen was a former gasoline tanker truck driver who was diagnosed with AML. 605 F. Supp. 2d at 1148. Henricksen and his wife alleged that his AML was caused by his exposure to benzene in defendant's gasoline. Id. The parties agreed that defendant's gasoline contained benzene and that the scientific literature provided clear evidence of a causal relationship between certain levels of exposure to benzene and benzene-containing solvents, on the one hand, and the development of

AML, on the other. Id. at 1150. Plaintiffs' theory was that low dose exposure to benzene in gasoline can cause AML. Id. at 1170. Defendant argued that plaintiffs could not establish that there was a sufficient level of benzene as an ingredient of gasoline for exposure to gasoline to result in an increased risk of AML. Id. at 1148, 1151. Defendant's experts opined that competitive inhibition between benzene and the other compounds found in gasoline mitigate the potential carcinogenic properties of the small amounts of benzene in gasoline.[4] Id. at 1151.

The court identified the general causation question as whether exposure to the benzene component of gasoline can cause AML. Id. at 1156. The court recognized that, in addition to the numerous studies on the hazardous effects of benzene, there were numerous studies on the hazardous effects of gasoline. Id. at 1170. The court engaged in an in-depth review of the scientific literature on benzene and gasoline. The court first concluded that the studies on which plaintiffs' experts relied to support their opinions that low dose exposure to benzene in gasoline can cause AML did not reliably support such opinions. Id. at 1170–72 (discussing the reports and studies that investigated the Tranguch gasoline spill and the Australian Institute of Petroleum's Health Watch reports). The court noted that the most relevant studies cited by plaintiffs' experts were those addressing occupational gasoline exposure and the risk of AML. Id. at 1172. One case-control study[5] found a statistically significant

[4] In Henricksen, plaintiffs offered Infante as a general causation expert, and defendant offered Pyatt as a causation expert. In this case, Plaintiffs and Defendants also offer Infante and Pyatt, respectively, as causation experts.

[5] A case-control study compares the rates of exposure in the group of individuals with the disease to the rates of exposure in the group of individuals without the disease.

association between the risk of AML and employment in automobile manufacturing, as a gas station attendant, and in petroleum manufacturing. Id. at 1173. The study did not find a statistically significant association between the risk of AML and employment in automobile mechanics or employment as a truck, bus, or taxi driver. Id. The study authors concluded that the associations between certain occupational exposures to gasoline and the risk of AML remain unclear. Id.

The other study cited by plaintiffs' experts that addressed occupational gasoline exposure and AML studied the risk of AML within different occupations. The only occupation that resulted in an increased risk of AML was "male petrol station attendants and demonstrators." Id. The authors hypothesized that exposure to benzene from petrol had contributed to the excess risk of AML, but the court noted that the study had been criticized by other scientists for various reasons—including for the discovery that three of the ten reported AML cases observed among petrol station attendants never worked as a petrol station attendant and three others only did so for a short time. Id. Plaintiffs' and defendant's experts recognized that the studies on gasoline station attendants yielded inconsistent results, and the largest study on service station workers found no statistically significant increased risk of AML among 19,000 gasoline attendants. Id.

The experts agreed that the most relevant studies were those on tanker truck drivers or gasoline distribution workers. Id. Three major epidemiological studies involving large cohorts of such workers had been conducted, and each showed no

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Reference Guide on Epidemiology, at 557.

statistically significant increased risk of AML among tanker truck drivers or gasoline distribution workers. Id. at 1173–74.

The court excluded the testimony of plaintiffs' general causation experts because the studies on which they relied did not support their causation conclusions "in the face of the overwhelming body of contradictory and inconsistent epidemiological evidence." Id. at 1175. The court explained that the studies relied on by plaintiffs' experts "make clear that the connection between gasoline or the benzene component of gasoline and AML is at this point in time only a hypothesis in need of further investigation" and, as a result, plaintiffs' "experts can only reliably attest to gasoline exposure as a theoretical or possible cause, not a probable cause of Henricksen's AML." Id. at 1176.

In Burst,[6] plaintiff alleged that her late husband's regular exposure to benzene in defendants' gasoline during the years he worked as a gas station attendant and mechanic caused his AML. 2015 U.S. Dist. LEXIS 77751, at *3. As in Henricksen, plaintiff's expert opined that low dose exposure to benzene in gasoline can cause AML and that plaintiff's late husband's exposure to benzene in gasoline caused his AML. Id. The parties agreed that gasoline contains benzene and, at certain levels of exposure, benzene can cause AML. Id. at *23–24. Defendants argued, however, that there is no scientific basis for concluding that exposure to gasoline containing benzene causes AML. Id. at *9. The court noted that "the data related to gasoline exposure

[6] Plaintiff and defendants also offered Infante and Pyatt, respectively, as causation experts in Burst.

is far from consistent with the data related to benzene exposure." Id. at *23. And like defendant in Henricksen, defendants argued that the observed carcinogenic effects of gasoline are different from those of benzene because of the small concentration of benzene in gasoline and because of the competitive inhibition between the components of gasoline. Id. at *25–26. The court thus concluded that although the scientific literature on benzene was relevant to plaintiff's expert's general causation opinion, it alone could not provide a reliable basis for such opinion. Id. at *27.

The court then turned to the gasoline literature on which plaintiff's expert relied. The court concluded that the expert's methodology was not reliable because he relied on a number of studies that did not isolate exposure to gasoline or did not provide exposure metrics; he relied on studies that did not exhibit statistically significant results or did not indicate a positive association between gasoline exposure and AML; he relied on studies that did not specifically examine AML; and he cherry-picked data from studies that did not otherwise support his conclusion, failed to explain contrary results, reached conclusions that the authors of the study did not make, and manipulated data without providing any evidence of his work. Id.

There are critical differences between Henricksen and Burst, on the one hand, and this case, on the other. A significant basis for the courts' decisions in both Henricksen and Burst was that there was a body of scientific literature that specifically investigated the association between exposure to gasoline and the risk of AML that was inconsistent and failed to support a causal relationship between

exposure to gasoline and the risk of AML. And in both cases, the defense experts provided a scientific explanation as to why exposure to benzene in gasoline does not cause an increased risk of AML despite the known causal relationship between exposure to benzene and the risk of AML.

Here, there is no evidence of a contrary body of literature on mineral spirits that is inconsistent with the literature on benzene generally. Safety Kleen relies on a declaration of its expert, Pyatt, who states that "there have been over a dozen studies where investigators have specifically evaluated mineral spirits (or similar distillates) related to AML or leukemia risk" and "[t]hese studies are uniformly negative regarding increased risk of leukemia, AML or related diseases." (Doc. No. 196-9, ¶ 33.) Pyatt cites eighteen different studies to support this statement, seventeen of which are included in the record.[7] (Doc. No. 196-10.)

The Court has extensively reviewed the seventeen studies and, contrary to Pyatt's declaration, they are not uniformly negative regarding exposure to mineral spirits and an increased risk of AML. For example, Bouchardy et al. (2016) was a case-referent study that presented an overview of cancer risk patterns by socioeconomic status and occupation in Switzerland. Christine Bouchardy et al., Cancer Risk by Occupation and Socioeconomic Group Among Men—A Study by the Association of Swiss Cancer Registries, 28 Scandinavian J. of Work, Env't & Health 1 (2002).[8] The authors found an excess of acute leukemia cases among foundry

[7] Only the abstract of Poynter et al. (2016), the study cited at reference 168 of Pyatt's declaration, is included in the record. (See Doc. No. 196-10, at Ex. 10-J.)
[8] See Doc. No. 196-10, at Ex. 10-d.

workers, electricians, and science professionals. Id. at 32. The study did not investigate or make any conclusions regarding associations between exposure to mineral spirits and the risk of AML. As another example, Pyatt cites Siemiatycki et al. (1987), a case-referent study that examined the associations between exposure to twelve different petroleum-derived liquids—including mineral spirits—and fourteen different cancers. Jack Siemiatycki et al., Associations Between Several Sites of Cancer and Twelve Petroleum-Derived Liquids, 13 Scandinavian J. of Work, Env't & Health 493 (1987).[9] Neither AML nor even leukemia generally, however, were among the cancers investigated, and Pyatt fails to connect or extrapolate the study's findings on associations between exposure to mineral spirits and the risk of other cancers to the risk of AML. See Burst, 2015 U.S. Dist. LEXIS 77751, at *17 ("[S]tudies that do not examine the precise disease at issue may not provide good grounds for an expert's opinion."); Reference Guide on Epidemiology, at 605 n.169 ("When a party claims that evidence of a causal relationship between an agent and one disease is relevant to whether the agent caused another disease, courts have required the party to show that the mechanisms involved in development of the disease are similar."). The other studies cited by Pyatt are likewise not relevant to the state of the literature regarding the association between exposure to mineral spirits and the risk of AML because they either do not assess exposure to mineral spirits or do not assess the risk of AML.

Further, the defense experts in Henricksen and Burst opined that exposure to benzene in gasoline does not cause an increased risk of AML due to competitive

[9] See Doc. No. 196-10, at Ex. 10-m.

inhibition between the various components of gasoline that mitigates the carcinogenic properties of benzene. Here, other than Pyatt's conclusion regarding the studies on mineral spirits, Safety Kleen has not provided any explanation for why exposure to benzene in mineral spirits should be evaluated differently than exposure to benzene in other solvents. Safety Kleen makes much about the fact that the World Health Organization's International Agency for Research on Cancer ("IARC") classifies benzene as a carcinogen but does not classify mineral spirits as a carcinogen. Safety Kleen's argument is not convincing.

IARC establishes working groups of independent scientists to evaluate the carcinogenic risk of certain agents to humans and publishes in the form of monographs reviews of the carcinogenicity data on those agents. In each monograph, IARC categorizes the carcinogenicity of the agent into one of five categories. Group 1 includes agents that are carcinogenic to humans, and this category is used when there is sufficient evidence of carcinogenicity in humans. Group 2A includes agents that are probably carcinogenic to humans, and this category is used when there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. Group 2B includes agents that are possibly carcinogenic to humans, and this category is generally used for agents for which there is limited evidence in humans in the absence of sufficient evidence in experimental animals. Group 3 includes agents that are not classifiable as to their carcinogenicity in humans, and this category is used when the agent does not fall into any other category. And Group 4 includes agents that are probably not carcinogenic to humans,

and this category is used for agents for which there is evidence suggesting lack of carcinogenicity in humans together with evidence suggesting lack of carcinogenicity in experimental animals. IARC, Some Organic Solvents, Resin Monomers and Related Compounds, Pigments and Occupational Exposures in Paint Manufacture and Painting, 47 Monographs on the Evaluation of Carcinogenic Risks to Humans 29–30 (1989).

IARC's monograph on mineral spirits is from 1989 and it concluded that there was inadequate evidence of the carcinogenicity of mineral spirits in humans and no available data on the carcinogenicity of mineral spirits in experimental animals. Id. at 72. IARC thus classified mineral spirits as a Group 3 agent that was not classifiable as to its carcinogenicity in humans. Id. IARC expressly states, however, that benzene is excluded from its monograph on mineral spirits. Id. at 35. Moreover, IARC's 2018 monograph on benzene expressly recognizes the use of mineral spirits as a potential source of benzene exposure. IARC, Benzene, 120 Monographs on the Evaluation of Carcinogenic Risks to Humans 68 (2018).

In short, unlike Henricksen and Burst, there are not compelling reasons for evaluating exposure to benzene in mineral spirits differently than exposure to benzene in other solvents. The evidence shows that 99% of all occupational exposures to benzene are not from technical grade benzene, but from solvents containing benzene. (Doc. No. 196-5, at 173:4–8.) As a result, the scientific literature on benzene primarily examines exposure to benzene as a component of other products rather than exposure to technical grade benzene. (Doc. No. 196-5, at 153:2–18.) Herrick

calculated Mr. Rhyne's benzene exposure from his use of Safety Kleen's mineral spirits solvent (as well as the other Defendants' products), and Plaintiffs' experts' causation opinions are based on Mr. Rhyne's benzene exposure as calculated by Herrick. (Doc. No. 194-3, at 131:9–15; Doc. No. 191-3, at 62:9–63:14.) Consistent with Henricksen and Burst, the Court concludes that the general causation question in this case is whether exposure to benzene in Defendants' various products—including Safety Kleen's mineral spirits solvent—can cause AML. Unlike Henricksen and Burst, the Court concludes that the scientific literature on the association between exposure to benzene as a component of other solvents and the risk of AML provides a reliable basis for Plaintiffs' experts' causation opinions. See Milward v. Acuity Specialty Prods. Grp., Inc., 639 F.3d 11, 14–15 (1st Cir. 2011) (concluding that plaintiffs' general causation expert's opinion that exposure to benzene causes acute promyelocytic leukemia was reliable and relevant to plaintiffs' claims that exposure to benzene in defendants' products caused Milward's acute promyelocytic leukemia); Campos v. Safety-Kleen Sys., Inc., 98 F. Supp. 3d 372, 378–79 (D.P.R. 2015) (concluding that plaintiffs' causation experts' opinions that exposure to benzene causes chronic myelogenous leukemia was admissible and rejecting Safety Kleen's argument that the experts considered the wrong substance because Safety Kleen's mineral spirits solvent is not benzene and the fact that it contains benzene does not support the conclusion that it can cause chronic myelogenous leukemia); Wagoner v. Exxon Mobil Corp., 813 F. Supp. 2d 771, 799 (E.D. La. 2011) (identifying the general causation question as whether exposure to benzene can cause multiple myeloma

where plaintiff alleged that exposure to benzene in defendants' products, including a mineral spirits product, caused the decedent's development of multiple myeloma).

B. Infante

Plaintiffs offer Infante to provide expert testimony on both general causation and specific causation. Defendants argue that Infante's opinion must be excluded because it is unreliable. Defendants further argue that Infante is not qualified to render an opinion on specific causation.

Infante's expert report, dated October 2, 2017, states: "The historical literature clearly demonstrates by 1971 . . . that exposure to benzene caused severe bone marrow depression and most likely all forms of leukemia as well." (Doc. No. 148-4, at 24.) In October 2018, Infante gave a PowerPoint presentation to representatives of the Norwegian government and numerous petrochemical companies. (Doc. No. 196-5, at 60:9–15, 61:6–13.) One of Infante's PowerPoint slides stated that "only after the Infante et al. 1977 study was benzene generally accepted as a cause of AML." (Doc. No. 186-3.) Defendants argue that the statement in Infante's expert report is inconsistent with the statement in his PowerPoint presentation and, as a result, Infante's opinion is unreliable.

Defendants' argument is meritless. That a fact is clearly demonstrated by the historical literature does not mean that the fact is generally accepted by the relevant scientific community. During Infante's deposition, defense counsel had Infante read the statement in his report regarding the state of the historical literature in 1971. (Doc. No. 196-5, at 57:16–58:2.) Defense counsel then asked if it was Infante's

testimony that it was generally accepted by 1971 that benzene causes AML, to which Infante replied: "No, it doesn't say that." (Doc. No. 196-5, at 58:4–7.) Infante explained that in 1971, there were many people who thought exposure to benzene caused all forms of leukemia. (Doc. No. 196-5, at 59:11–13.) But Infante repeatedly stated that general acceptance means acceptance by everyone, and exposure to benzene as a cause of AML was not generally accepted until after publication of Infante et al. (1977). (Doc. No. 196-5, at 66:5–14, 67:12–68:4.) There is no inconsistency between the statement in Infante's report regarding the state of the historical literature in 1971 and the statement in Infante's PowerPoint presentation that exposure to benzene was not generally accepted as a cause of AML until after Infante et al. (1977).

Defendants also argue that Infante is not qualified to render an opinion on specific causation. Infante is an epidemiologist; he is not a hematologist, oncologist, toxicologist, or medical doctor. (Doc. No. 196-5, at 14:8–22.) As discussed above, epidemiology focuses on the issue of general causation, not specific causation. In opposition to Defendants' argument, Plaintiffs restate Infante's qualifications that undoubtedly qualify him to render an opinion on general causation. For example, Plaintiffs state that Infante has over forty-five years of experience researching the toxicity and carcinogenicity of benzene and determining the cancer risk from exposure to chemicals as a director with OSHA, has published over twenty-five scientific articles related specifically to benzene exposure and the risk of leukemia and other benzene-related diseases, and has served as an expert epidemiologist on an

IARC working group. Plaintiffs make no effort, however, to tie those qualifications to Infante's offered opinion on specific causation. As the proponents of Infante's testimony, Plaintiffs bear the burden of proving that Infante is qualified to give the offered opinions by a preponderance of proof. Cooper v. Smith & Nephew, Inc., 259 F.3d 194, 199 (4th Cir. 2001). Plaintiffs have not met their burden with respect to Infante's offered opinion on specific causation. See In re Viagra Prods. Liab. Litig., 658 F. Supp. 2d 950, 960 (D. Minn. 2009) (concluding that an epidemiologist was not qualified to give an opinion on specific causation). Therefore, the Court grants Defendants' motions as to Infante's specific causation opinion and excludes the same. The Court denies Defendants' motions as to Infante's general causation opinion.

C. Harrison

Defendants move to exclude Harrison's expert testimony on both general causation and specific causation.

1. General Causation

With respect to general causation, Defendants argue that to support Harrison's opinion that exposure to low doses of benzene can cause AML, Harrison relies on two studies that do not support his opinion: Kirkeleit et al. (2008) and Stenehjem et al. (2015).

Kirkeleit et al. (2008) was a historical cohort study[10] of Norway upstream petroleum workers engaged in drilling and production of crude oil, natural gas, and

[10] In general, a cohort study measures and compares the incidence of disease in the group of individuals who were exposed to the agent and the group of individuals who were not exposed to the agent. Reference Guide on Epidemiology, at 557.

natural gas liquids. Kirkeleit et al., Increased Risk of Acute Myelogenous Leukemia and Multiple Myeloma in a Historical Cohort of Upstream Petroleum Workers Exposed to Crude Oil, 19 Cancer Causes Control 13 (2008).[11] Benzene is a natural component of crude oil and natural gas. Id. The study categorized petroleum workers into five categories: (1) upstream operator offshore, (2) drilling and well maintenance offshore, (3) catering offshore, (4) others offshore, and (5) petroleum workers onshore. Id. at 14. Upstream operator offshore workers had the most extensive contact with products containing benzene, and the study found a statistically significant increased risk of AML among those workers. Id. at 17. The authors concluded that "[g]iven the established association between benzene exposure and hematologic neoplasms, benzene exposure probably caused the observed risk of [AML.]" Id. Safety Kleen criticizes Harrison's reliance on the study because the authors recognized the lack of good exposure estimates as a major limitation and acknowledged "it is unclear at which level of exposure benzene poses an increased risk of developing hematologic neoplasms." Id. Still, the authors concluded that the benzene exposure levels reported in crude oil assays and the low benzene content of crude oil

> indicate that the atmospheric exposure from the crude or condensate has been well below the exposure levels that most studies have reported to be necessary for inducing hematologic neoplasms. This increased risk thus implies that the exposure levels have been higher than published for this industry, *or that the increased risk for these neoplasms can be found at lower levels of exposure than previously assumed. In support of the latter interpretation a few studies have reported an association between a mean benzene exposure around, and even below, 1 ppm and increased risk of [AML]* . . . .

[11] See Doc. No. 194-6.

Id. at 19 (emphasis added). The study thus lends support for Harrison's opinion that benzene exposure at lower doses can cause AML, notwithstanding that the study did not definitively conclude that an increased risk of AML can be found at lower levels of exposure. See Knight v. Kirby Inland Marine Inc., 482 F.3d 347, 354 (5th Cir. 2007) ("We also understand that in epidemiology hardly any study is ever conclusive, and we do not suggest that an expert must back his or her opinion with published studies that unequivocally support his or her conclusion."); Yates, 113 F. Supp. 3d at 851 ("[T]he general level of hazardous exposure need not be expressly established by a particular scientific study, so long as the expert is able to establish that he uses a scientifically reliable method to extrapolate the results from scientific literature.").

Stenehjem et al. (2015) was another historical cohort study of Norwegian upstream petroleum workers. J.S. Stenehjem et al., Benzene Exposure and Risk of Lymphohaematopoietic Cancers in 25,000 Offshore Oil Industry Workers, 112 British J. of Cancer 1603 (2015).[12] The study found an association between cumulative low-level benzene exposure and the risk of AML; however, the result was not statistically significant. Id. at 1607–08. Safety Kleen contends that because the result was not statistically significant, the study does not provide a reliable basis for Harrison's opinion, citing cases from other jurisdictions. But the Fourth Circuit has expressly "decline[d] to establish a bright-line rule requiring experts to rely only on evidence that is statistically significant or else have their opinions excluded." In re Lipitor (Atorvastatin Calcium) Mktg., Sales Practices & Prods. Liab. Litig., 892 F.3d 624, 642

[12] See Doc. No. 194-9.

(4th Cir. 2018).

Therefore, the Court concludes that Kirkeleit et al. (2008) and Stenehjem et al. (2015) provide a reliable basis for Harrison's opinion that exposure to lower doses of benzene can cause AML.

2. Specific Causation

Defendants argue that Harrison's specific causation opinion must be excluded because he failed to perform a reliable differential diagnosis.

"[D]ifferential diagnosis is a standard scientific technique of identifying the cause of a medical problem . . . by determining the possible causes for the patient's symptoms and then eliminating each of these potential causes until reaching one that cannot be ruled out or determining which of those that cannot be excluded is the most likely." Cooper, 259 F.3d at 200 (quotation marks omitted) (omission in original). "This technique has widespread acceptance in the medical community, has been subject to peer review, and does not frequently lead to incorrect results." Westberry, 178 F.3d at 262 (quotation marks omitted). Thus, the Fourth Circuit has held that "a reliable differential diagnosis provides a valid foundation for an expert opinion." Id. at 263.

Defendants argue that Harrison's differential diagnosis is unreliable because he failed to rule out radiation exposure, a genetic defect, and obesity as alternative causes of Mr. Rhyne's AML. "A differential diagnosis that fails to take serious account of other potential causes may be so lacking that it cannot provide a reliable basis for an opinion on causation." Id. at 265. "Thus, if an expert utterly fails to

consider alternative causes or fails to offer an explanation for why the proffered alternative cause was not the sole cause, a district court is justified in excluding the expert's testimony." Cooper, 259 F.3d at 202. "However, [a] medical expert's causation conclusion should not be excluded because he or she has failed to rule out every possible alternative cause of a plaintiff's illness." Westberry, 178 F.3d at 265 (quotation marks omitted) (alteration in original). "In such cases, the alternative causes suggested by a defendant normally affect the weight that the jury should give the expert's testimony and not the admissibility of that testimony." Cooper, 259 F.3d at 202.

The parties do not dispute that Mr. Rhyne was exposed to radiation during his employment with Duke Energy, and the experts agree that radiation exposure at certain levels is a risk factor for AML. Defense experts Pyatt and Debra Kaden, a toxicologist, testified that Mr. Rhyne's radiation exposure was insufficient to cause his AML. (Doc. No. 199-9, at 115:2–22; Doc. No. 199-10, at 88:1–17.) And Defendants expressly concede that they do not posit that radiation caused Mr. Rhyne's AML. (Doc. No. 207, at 5.) Accordingly, radiation exposure is not a plausible alternative cause of Mr. Rhyne's AML. See Kannankeril v. Terminix Int'l, 128 F.3d 802, 808 (3d Cir. 1997) (stating that defendant may attack plaintiff's expert's differential diagnosis by pointing to "a plausible cause of the plaintiff's illness other than the defendant's actions").

Nevertheless, Harrison adequately ruled out radiation exposure as an alternative cause of Mr. Rhyne's AML. Harrison understood that Mr. Rhyne's

dosimetry measurements indicate that Mr. Rhyne's cumulative radiation exposure over his lifetime was 0.5 REM,[13] and Harrison testified that 0.5 REM is insufficient to cause AML. (Doc. No. 194-3, at 44:3–7.) Defendants take issue with Harrison's assumption that Mr. Rhyne's radiation exposure was 0.5 REM, but Defendants do not contend that Mr. Rhyne's radiation exposure was greater than 0.5 REM. Moreover, Harrison testified that radiation exposure is only significant to AML at 5 REMs or above. (Doc. No. 194-3, at 146:8–22.) Therefore, Harrison adequately ruled out radiation exposure as the sole cause of Mr. Rhyne's AML. Cooper, 259 F.3d at 202 (stating that "if an expert utterly fails to consider alternative causes or fails to offer an explanation for why the proffered alternative cause was not the sole cause, a district court is justified in excluding the expert's testimony").

Defendants also argue that Harrison failed to rule out that Mr. Rhyne's AML was familial. Mr. Rhyne's sister was diagnosed with AML, and the experts agree that AML can have a familial or genetic link. There are a number of genetic or heritable mutations that are commonly found in familial AML, and the presence of these mutations can be determined by genetic analysis. (Doc. No. 194-3, at 36:7–11.) Harrison testified that in order to determine whether Mr. Rhyne's AML is familial, Harrison would need to see genetic testing confirming the presence of one or more of the genetic defects commonly found in familial AML. (Doc. No. 194-3, at 39:4–12.) Mr. Rhyne did not have these tests done because of the critical condition he was in when he first presented with AML. (Doc. No. 191-3, at 41:9–19.) As a result, Harrison

[13] REM stands for roentgen equivalent man and is a unit of radiation dosage.

could not conclusively rule out familial AML. Harrison explained, however, that familial AML is rare, accounting for only about 4% of all AML cases. (Doc. No. 194-3, at 36:5–6.) In addition, the average age of persons who present with familial AML is in the thirties, and it is unusual for familial AML to present in someone in their fifties or sixties. (Doc. No. 194-3, at 37:1–5.) Mr. Rhyne was diagnosed with AML at age 59. Therefore, the Court concludes that Harrison considered the possibility that Mr. Rhyne's AML is familial, and his inability to conclusively rule out familial AML does not render his causation opinion unreliable, but instead goes to the weight that the jury should give the opinion. Cooper, 259 F.3d at 202 (stating that "the alternative causes suggested by a defendant normally affect the weight that the jury should give the expert's testimony and not the admissibility of that testimony").

Last, Defendants argue that Harrison failed to rule out obesity as an alternative cause of Mr. Rhyne's AML. There is scientific literature suggesting that obesity is a risk factor for AML, and Mr. Rhyne was obese at the time of diagnosis. Harrison's expert report incorrectly states that Mr. Rhyne was not obese. (Doc. No. 148-6, at 12.) But during his deposition, Harrison testified that if Mr. Rhyne were obese, then obesity is a possible contributing factor to his AML. (Doc. No. 194-3, at 145:3–9.) Harrison also explained that even if Mr. Rhyne were obese, cancer can be multifactorial and exposure to benzene was still a substantial contributing factor to the development of Mr. Rhyne's AML. (Doc. No. 194-3, at 196:15–25.) Thus, Harrison's mistaken belief that Mr. Rhyne was not obese does not render his differential diagnosis unreliable and can be attacked on cross-examination. See

Bresler v. Wilmington Tr. Co., 855 F.3d 178, 195 (4th Cir. 2017) (stating that "questions regarding the factual underpinnings of the [expert's] opinion affect the weight and credibility of the [witness's] assessment, not its admissibility" (quotation marks omitted)); United States v. Moreland, 437 F.3d 424, 431 (4th Cir. 2006) ("The court need not determine that the proffered expert testimony is irrefutable or certainly correct. As with all other admissible evidence, expert testimony is subject to testing by 'vigorous cross-examination, presentation of contrary evidence, and careful instruction on the burden of proof.'" (citation omitted) (quoting Daubert, 509 U.S. at 596)).

* * *

Therefore, the Court concludes that Harrison's causation opinions are both reliable and relevant. The Court denies Defendants' motions to exclude Harrison's expert testimony.

D. Gore

Plaintiffs offer Gore to provide expert testimony on specific causation. Defendants make three arguments as to why Gore's testimony should be excluded: (1) he failed to perform a reliable differential diagnosis, (2) he should not be permitted to rely on Herrick's exposure calculations, and (3) his opinion that a damaged hematopoietic, or blood-forming, stem cell may stay quiescent for many years or even decades before it proliferates and causes leukemia is not based on a reliable method.

1. Differential Diagnosis

Defendants contend that Gore's differential diagnosis is unreliable because he

failed to rule out radiation exposure, a genetic defect, and obesity as alternative causes of Mr. Rhyne's AML.

As discussed above, defense experts Pyatt and Kaden testified that Mr. Rhyne's radiation exposure was insufficient to cause his AML, (Doc. No. 199-9, at 115:2–22; Doc. No. 199-10, at 88:1–17), and Defendants concede that they do not posit that radiation caused Mr. Rhyne's AML. Thus, radiation exposure is not a plausible alternative cause of Mr. Rhyne's AML. See Kannankeril, 128 F.3d at 808 (stating that defendant may attack plaintiff's expert's differential diagnosis by pointing to "a plausible cause of the plaintiff's illness other than the defendant's actions"). Nevertheless, Gore testified that Mr. Rhyne's position at Duke Energy was not a high-risk radiation occupation, and it would be very unlikely that radiation exposure caused Mr. Rhyne's AML. (Doc. No. 191-3, at 17:25–18:12.) The Court thus concludes that Gore considered radiation exposure as an alternative cause of Mr. Rhyne's AML and offered an adequate explanation as to why it was not the sole cause. See Cooper, 259 F.3d at 202 (stating that "if an expert utterly fails to consider alternative causes or fails to offer an explanation for why the proffered alternative cause was not the sole cause, a district court is justified in excluding the expert's testimony").

As discussed with respect to Harrison's differential diagnosis, the genetic tests necessary to determine the presence of genetic defects commonly found in familial AML were not done for Mr. Rhyne due to his critical condition. This does not render Gore's opinion unreliable, but instead affects its weight. Smith v. Wyeth-Ayerst Labs. Co., 278 F. Supp. 2d 684, 692 (W.D.N.C. 2003) (stating that "differential diagnosis

doesn't require plaintiff to rule out every other cause, only to offer an explanation and take account of the other potential causes").

With respect to Mr. Rhyne's obesity, Gore considered it as an alternative cause of Mr. Rhyne's AML. Gore recognized that "[t]he aggregate data suggests that obesity may increase the risk of AML by a factor of approximately 1.5" and that Mr. Rhyne's "obesity may be considered a contributing factor." (Doc. No. 148-8, at 11.) But that obesity may have been a contributing factor to Mr. Rhyne's AML does not render exposure to benzene a non-substantial contributing factor to Mr. Rhyne's AML. (Doc. No. 148-8, at 19.) Therefore, the Court concludes that Gore performed a reliable differential diagnosis.

2. Reliance on Herrick's Exposure Calculations

Defendants also contend that Gore should not be permitted to rely on Herrick's exposure calculations because Gore's report relied on exposure calculations performed by a different expert whom Plaintiffs have since withdrawn, and Gore did not amend his report to indicate that he intended to rely on Herrick's exposure calculations. Defendants argue that without Herrick's exposure calculations, Gore cannot reliably "rule in" exposure to benzene as a cause of Mr. Rhyne's AML.

Federal Rule of Civil Procedure 26(a)(2) requires the parties to disclose the identity of any expert witness whom may be used at trial. Such disclosure must be accompanied by a written report prepared by the witness that contains "a complete statement of all opinions the witness will express and the basis and reasons for them," "the facts or data considered by the witness in forming them," "any exhibits that will

be used to summarize or support them," "the witness's qualifications," "a list of all other cases in which, during the previous 4 years, the witness testified as an expert at trial or by deposition," and "a statement of the compensation to be paid for the study and testimony in the case." Fed. R. Civ. P. 26(a)(2)(B). "Rule 26(e)(1) requires a party to supplement its experts' reports and deposition testimony when the party learns of new information." S. States Rack & Fixture, Inc. v. Sherwin-Williams Co., 318 F.3d 592, 595–96 (4th Cir. 2003).

"If a party fails to provide information or identify a witness as required by Rule 26(a) or (e), the party is not allowed to use that information or witness to supply evidence on a motion, at a hearing, or at a trial, unless the failure was substantially justified or is harmless." Fed. R. Civ. P. 37(c)(1). "District courts are accorded broad discretion in determining whether a nondisclosure or untimely disclosure of evidence is substantially justified or harmless." Bresler, 855 F.3d at 190 (quotation marks omitted). In making this determination, district courts consider the following factors: "(1) the surprise to the party against whom the evidence would be offered; (2) the ability of that party to cure the surprise; (3) the extent to which allowing the evidence would disrupt the trial; (4) the importance of the evidence; and (5) the nondisclosing party's explanation for its failure to disclose the evidence." S. States, 318 F.3d at 597. "The first four factors listed above relate primarily to the harmlessness exception, while the last factor, addressing the party's explanation for its nondisclosure, relates mainly to the substantial justification exception." Bresler, 855 F.3d at 190.

The Court concludes that Plaintiffs' failure to supplement Gore's report to

indicate that he was relying on Herrick's exposure calculations was harmless. With respect to the first factor, any surprise from Plaintiffs' failure to supplement Gore's report was minimal. This case was originally filed in Pennsylvania state court. While the case was proceeding in Pennsylvania, Plaintiffs provided the expert reports of Infante, Harrison, Gore, and Stephen Petty, an industrial hygienist who calculated Mr. Rhyne's level of exposure to benzene. After the Pennsylvania court dismissed the case based on *forum non conveniens*, Plaintiffs refiled it in this Court. Plaintiffs' deadline to provide reports from their expert witnesses in this case was August 29, 2019. (Doc. No. 110.) Plaintiffs re-served the reports of Infante, Harrison, and Gore, but did not re-serve Petty's report. Instead, Plaintiffs provided the report of Herrick and designated him as their exposure expert. Thus, Defendants were aware at least as of September 2019 that Plaintiffs were relying on Herrick, rather than Petty, to establish Mr. Rhyne's level of exposure to benzene. Moreover, during his November 4, 2019 deposition, Gore testified that he was relying on Herrick's exposure calculations. (Doc. No. 191-3, at 46:1–5.)

Turning to the second factor, Defendants were able to cure any purported surprise. Defendants were put on notice that Plaintiffs were relying on Herrick as their exposure expert at least two months before Gore's deposition and approximately one year before the trial is scheduled to begin in September 2020. See Bresler, 855 F.3d at 194 (concluding that plaintiff's untimely disclosure did not affect defendant's ability to conduct its defense in any material respect where defendant had access to the untimely disclosed information two months before trial). And importantly,

Herrick's calculation of Mr. Rhyne's exposure level was significantly less than Petty's calculation, thereby minimizing the prejudicial effect of any purported surprise. Further, there is nothing in the record to suggest that allowing Gore's testimony in reliance on Herrick's calculations would disrupt the trial in any way. Thus, the second and third factors also strongly weigh in favor of finding that the nondisclosure was harmless.

The fourth and fifth factors weigh in favor of Defendants. The evidence is important to Plaintiffs' ability to prove specific causation, and Plaintiffs have not offered any justification for the nondisclosure. Nevertheless, given the minimal surprise caused by the nondisclosure, Defendants' ample ability to cure any surprise, and that allowing the evidence would not disrupt the trial, the Court concludes that Plaintiffs' failure to supplement Gore's report to indicate he was relying on Herrick's exposure calculations was harmless, and Gore may rely on Herrick's calculations at trial. See id. (concluding that the district court did not abuse its discretion in admitting plaintiff's untimely expert evidence where the first three factors supported a finding that the untimely disclosure was harmless even though the last two factors weighed in favor of exclusion).

3. Quiescent Stem Cell Opinion

Defendants also move to exclude Gore's opinion that a damaged hematopoietic, or blood-forming, stem cell may stay quiescent for many years or even decades before it proliferates and causes leukemia. Defendants argue that Gore's quiescent stem cell opinion is not based on a reliable method. Relying on a declaration of Pyatt,

Defendants argue that numerous epidemiological studies establish that only those benzene exposures that occurred within ten to fifteen years of diagnosis cause or contribute to AML. (Doc. No. 182-9, ¶¶ 7–15.) Gore, however, failed to cite any scientific literature in support of his opinion that a damaged hematopoietic stem cell may stay quiescent for many years or even decades before it proliferates and causes leukemia. And according to Pyatt's declaration, the studies that have addressed the length of time that stem cells remain quiescent do not support Gore's opinion.[14] (Doc. No. 182-9, ¶¶ 25–34.)

In their opposition to Defendants' motion to exclude Gore's testimony, Plaintiffs do not address Gore's quiescent stem cell opinion or Defendants' arguments for the exclusion thereof. Although Gore's opinion may very well be correct, "nothing in either Daubert or the Federal Rules of Evidence requires a district court to admit opinion evidence that is connected to existing data only by the *ipse dixit* of the expert." GE, 522 U.S. at 146. That is essentially what Plaintiffs ask this Court to do. Gore does not cite any scientific literature or data to support his quiescent stem cell opinion, and Plaintiffs make no effort to show or argue that the opinion is the product of a reliable methodology. While Gore testified during his deposition approximately eight months ago that there are a "gazillion" articles that support his quiescent stem cell opinion, (Doc. No. 191-3, at 58:9–59:2), Plaintiffs did not have Gore submit a supplemental report with citations to any supporting articles or other data.

[14] None of the studies cited by Pyatt regarding Gore's quiescent stem cell opinion are included in the record.

Plaintiffs bear the burden of proving that Gore's opinion is reliable by a preponderance of proof. In the face of literature contrary to Gore's opinion, an absence of any literature or data supporting Gore's opinion, and Plaintiffs' failure to make any effort to show or argue that Gore's opinion is reliable, the Court is constrained to conclude that Plaintiffs have not met that burden with respect to Gore's quiescent stem cell opinion. Therefore, the Court excludes Gore's opinion that a damaged hematopoietic stem cell may stay quiescent for many years or even decades before it proliferates and causes leukemia.

E. Herrick[15]

Herrick first calculated Mr. Rhyne's daily average benzene exposure from each product. Herrick then used Mr. Rhyne's daily average benzene exposures to calculate Mr. Rhyne's cumulative benzene exposure from each product. Herrick opines that the medium range of Mr. Rhyne's cumulative benzene exposure was 12.96 to 26.57 parts per million-years ("ppm-years")[16] with a midrange value of 17.53 ppm-years. (Doc. No. 132-8.) In support of their motions to exclude Herrick's testimony, Defendants raise arguments that are specific to Herrick's exposure calculations for their respective products, as well as an argument that is not specific to any product or calculation. The Court addresses Defendants' product-specific arguments first and

[15] In response to Defendants' motions to exclude Herrick's expert testimony, Plaintiffs filed a declaration of Herrick. (Doc. No. 226-1.) Defendants argue that Herrick's declaration is an improper and untimely supplemental expert report. The Court need not decide the propriety of Herrick's declaration because the Court concludes that Herrick's testimony is admissible without considering Herrick's declaration.

[16] Cumulative exposure is expressed in ppm-years and is the product of Mr. Rhyne's average daily exposure to benzene and the number of years of exposure to benzene.

then turns to the general argument.

1. Safety Kleen's Product-Specific Arguments

i. Herrick's Use of ART

To calculate Mr. Rhyne's exposure to benzene from Safety Kleen's parts washer solvent, Herrick used the Advanced REACH Tool ("ART"). Safety Kleen argues that ART is not a reliable tool for conducting an individual retrospective exposure assessment. The Court disagrees.

A European regulation titled Registration, Evaluation, Authorization and Restriction of Chemicals ("REACH") requires manufacturers and importers of chemical substances to conduct quantitative occupational exposure studies for identified and selected exposure scenarios. ART was developed to assist companies in complying with REACH. (Doc. No. 148-3, at 18.) It simulates exposure to various substances from different activities that users create through exposure scenarios by selecting predetermined options regarding the product being used and circumstances of use. (Doc. No. 201-3, at 86:11–17.) ART has two components: (1) a mechanistic model based on physicochemical properties such as the product, vapor pressure, size of the room, and type of use, and (2) calibration data of 2,500 to 3,000 real-world measurements of exposure that are characteristic of the scenario being modeled. (Doc. No. 201-3, at 87:10–16, 101:17–21, 102:22–103:12.)

In LeBlanc et al. (2018), cited in Herrick's report, the authors compared ART's benzene exposure predictions from using a mineral spirits parts washer solvent to real-world measurements and found that ART's exposure estimates were closer to the

real-world measurements than other modeling approaches. (Doc. No. 204-8; Doc. No. 201-3, at 162:13–21, 165:1–13.) In addition, Herrick brought three recently published articles to his deposition that compared different models' predictions against real-world exposure measurements that further support the superiority of ART over other models. (Doc. No. 201-3, at 89:18–91:17.) While ART may have been developed to assess exposures under REACH, that does not mean ART is an unreliable tool for modeling individual retrospective exposure assessments. There is scientific literature supporting the reliability of ART's individual exposure estimates and, therefore, the Court concludes that Herrick's methodology of using ART to calculate Mr. Rhyne's benzene exposure from use of Safety Kleen's parts washer solvent was reliable. See Milward v. Acuity Specialty Prods. Grp., Inc., 969 F. Supp. 2d 101, 108 (D. Mass. 2013) (concluding that expert's exposure assessment was admissible where expert used ART to calculate plaintiff's benzene exposure from using paint that contained mineral spirits), aff'd, 2016 U.S. App. LEXIS 7470 (1st Cir. Apr. 25, 2016).

ii. Herrick's Estimate of the Benzene Concentration in the Parts Washer Solvent

In modeling Mr. Rhyne's exposure to benzene from using Safety Kleen's parts washer solvent, Herrick estimated that the concentration of benzene in the solvent was 58 ppm. Safety Kleen argues that in estimating the benzene concentration was 58 ppm, Herrick ignored relevant and reliable real-world data on the benzene concentration of mineral spirits, thus rendering his calculations unreliable.

Safety Kleen operated a recycling center in Lexington, South Carolina, which collected samples of its parts washer solvent for testing. Composite testing data

indicates that from May 1992 through June 1993, the average concentration of benzene in samples of parts washer solvent from the Lexington facility was 32.1 ppm with a maximum of 64.3 ppm and a minimum of 11.6 ppm. (Doc. No. 206.) Additional composite testing data indicates that the average concentration of benzene in samples of parts washer solvent from the Lexington facility was 22.5 ppm in the first quarter of 1994, 19.5 ppm in the second quarter of 1994, and 15.6 ppm in the fourth quarter of 1994.[17] (Doc. No. 201-6.) Safety Kleen argues that Herrick's use of 58 ppm benzene in the face of that data was unreliable.

The evidence tends to show that Mr. Rhyne used the parts washer solvent from the mid-1970s through 1998. The benzene concentration in mineral spirits has decreased over the years as the hazardous effects of benzene became known and accepted and governmental agencies started regulating the benzene content of products. (See Doc. No. 201-3, at 329:11–21.) The benzene concentration in mineral spirits was thus higher in the 1970s and 1980s than it was in the 1990s. (Doc. No. 148-3, at 24–25.) Accordingly, the concentration of benzene in Safety Kleen's mineral spirits solvent in the early 1990s is not representative of the solvent's benzene concentration in the 1970s and 1980s. Moreover, the benzene in the parts washer solvent decays over time, (Doc. No. 201-3, at 218:9–15), thus suggesting that the benzene concentration in the samples at the time they were tested was less than the concentration to which users were exposed.

Further, Herrick's use of 58 ppm was not based on mere speculation, as Safety

[17] There is no data for the third quarter of 1994.

Kleen contends. The purpose of the parts washer is to recirculate the solvent so that it is used repeatedly. (Doc. No. 201-3, at 218:20–24.) As a result, based on information from Safety Kleen on how often the parts washer solvent was replaced with fresh solvent, Herrick estimated that the parts washer only contained fresh solvent about every two weeks. (Doc. No. 201-3, at 323:16–22.) As the benzene in the solvent decays over time, the benzene concentration in the solvent on any given day was somewhere between the original benzene concentration when the solvent was first replaced and the benzene concentration as time passed. (Doc. No. 201-3, at 323:23–324:2.) Herrick did not have specific information or data on the original benzene concentration in the parts washer solvent. (Doc. No. 201-3, at 324:14–19, 325:5–8.) Herrick cited to scientific literature suggesting that until at least 2000, the benzene content of fresh mineral spirits ranged from 100 ppm to 1,000 ppm, and other literature reported ranges from 1,000 ppm to 10,000 ppm. (Doc. No. 148-3, at 24–25; Doc. No. 201-3, at 325:9–14, 326:9–13.) Herrick thus recognized that there was not a consensus as to the starting concentration of benzene in mineral spirits and estimated that the average benzene concentration of the solvent used by Mr. Rhyne was 58 ppm. (Doc. No. 201-3, at 325:9–18.) He explained that 58 ppm was a reasonable value based on the historical literature and the rate at which Safety Kleen changed out the solvent, and that 58 ppm was a conservative value that was likely on the low end. (Doc. No. 201-3, at 217:5–10, 218:8–24, 323:16–324:23, 325:4–18, 326:9–22.) In addition, by using a concentration of 58 ppm, Herrick was able to validate ART's predictions using the results of Fedoruk et al. (2003), which took real-

world exposure measurements from use of a mineral spirits solvent containing 58 ppm benzene. (Doc. No. 201-3, at 323:9–15.)

Therefore, the Court concludes that Herrick's estimate that the parts washer solvent contained 58 ppm benzene was not based on mere speculation, and Safety Kleen's challenges to the accuracy of that factual underpinning go to the weight that the jury should give Herrick's opinion. See Bresler, 855 F.3d at 195 (stating that "questions regarding the factual underpinnings of the [expert's] opinion affect the weight and credibility of the [witness's] assessment, not its admissibility" (quotation marks omitted)); Manpower, Inc. v. Ins. Co. of Pa., 732 F.3d 796, 808 (7th Cir. 2013) ("The reliability of data and assumptions used in applying a methodology is tested by the adversarial process and determined by the jury; the court's role is generally limited to assessing the reliability of the methodology—the framework—of the expert's analysis.").

iii. Herrick's Inclusion of Far Field Exposures

Safety Kleen also argues that Herrick's exposure assessment is unreliable because his calculation of Mr. Rhyne's exposure from using Safety Kleen's parts washer solvent includes exposures from other products being used around Mr. Rhyne.

ART allows one to measure exposure in the near field, which includes sources within approximately three feet of the user, and the far field, which are secondary sources of exposure outside the near field. (Doc. No. 201-3, at 133:11–134:4, 228:9–12.) In modeling Mr. Rhyne's exposure from his use of Safety Kleen's parts washer solvent, Herrick included near field and far field sources of exposure. (Doc. No. 201-

3, at 342:8–13.) The far field sources of exposure were other sources of benzene exposure in general, and one cannot tell from ART's results how much exposure is from the near field and how much is from the far field. (Doc. No. 201-3, at 238:22–25, 343:3–8.) As a result, Herrick's assessment of Mr. Rhyne's benzene exposure from using Safety Kleen's parts washer solvent includes exposure from other sources for which Safety Kleen is not responsible. Safety Kleen contends that this renders Herrick's exposure assessment unreliable.

The Court disagrees. The inclusion of secondary sources of exposure is a question as to the factual underpinnings of Herrick's opinion, and it is for the jury to determine the soundness of those factual underpinnings and the weight to be given to his resulting conclusions. See Milward, 969 F. Supp. 2d at 108 (stating that "questions about the proper [ART] input parameters are questions about the factual underpinnings of the opinion, which are matters going to weight rather than admissibility").

2. USS's Product-Specific Arguments

Plaintiffs contend that Mr. Rhyne was exposed to benzene from raffinate, a chemical byproduct of USS's coking operations that was captured and sold. USS's raffinate contained a minimum of 5% benzene. USS sold raffinate to non-party Radiator Specialty Company ("Radiator") from 1960 through 1978 in bulk sales. In turn, Radiator designed, manufactured, labeled, and sold a product called Liquid Wrench that contained raffinate. USS last sold raffinate to Radiator in April 1978. USS argues that as a result, Herrick's estimate that Mr. Rhyne used the raffinate

formula of Liquid Wrench until January 1979 is mere speculation.

USS's argument is without merit. Although USS last sold raffinate to Radiator in April 1978, it does not follow that the raffinate formula of Liquid Wrench ceased to exist in the marketplace at that time. Herrick explained that he estimated that Mr. Rhyne used Liquid Wrench that contained raffinate until January 1979 because he was trying to account for the fact that there was a certain amount of the raffinate-containing Liquid Wrench in the marketplace that continued to be used after USS last sold raffinate to Radiator in April 1978. (Doc. No. 201-3, at 166:15–167:6.) Herrick's estimate was not based on mere speculation, and USS's challenges to the correctness of that estimate and Herrick's conclusions based thereon are for the jury. See United States v. Cavely, 318 F.3d 987, 997–98 (10th Cir. 2003) (stating that questions as to the validity of the assumptions underlying the expert's opinion go to weight and not admissibility); Acosta v. Vinoskey, 310 F. Supp. 3d 662, 673 (W.D. Va. 2018) (stating that "arguments about the factual basis of an expert's opinion normally go to its weight and not its admissibility").

3. Savogran's Product-Specific Arguments

Savogran argues that Herrick's exposure calculations are based on mere speculation and that Herrick failed to use a reliable methodology.

i. Exposure from Using Kutzit at Home

Herrick relied on Mr. Rhyne's deposition testimony for information about Mr. Rhyne's product use. From 1970 to 1975, Mr. Rhyne used Kutzit at home while working with his dad on the family cars. (Doc. No. 214-2, at 316:14–317:19, 328:14.)

Specifically, Mr. Rhyne used Kutzit to cut and scrape off gaskets. (Doc. No. 214-2, at 316:21–317:8, 317:16–17.) To calculate Mr. Rhyne's exposure to benzene from using Kutzit at home, Herrick estimated that Mr. Rhyne worked on the family cars one day per month for six to seven hours. (Doc. No. 148-3, at 31.) Mr. Rhyne testified that he did not use Kutzit every time he worked on cars with his dad. (Doc. No. 214-2, at 330:16–18.) Herrick thus estimated that Mr. Rhyne used Kutzit one day in every three days that he worked on cars. (Doc. No. 148-3, at 31.) Based on those estimations, Herrick used ART to determine that Mr. Rhyne's daily average exposure to benzene over each year from using Kutzit at home was 0.04 ppm. (Doc. No. 148-3, at 31.)

Savogran argues that Herrick's exposure assessment is based on mere speculation because Mr. Rhyne never testified that he worked on family cars one day per month or that he used Kutzit one in every three days at home. While Mr. Rhyne did not testify to such concrete data on how frequently he used Kutzit, Herrick's estimates are not based on mere speculation. Mr. Rhyne testified that he and his dad worked on cars sometimes during the week after his dad got off from work and sometimes on the weekend. (Doc. No. 214-2, at 330:9–13.) Based on that testimony, Herrick's estimate that Mr. Rhyne worked on cars one day per month is conservative. As to how often he used Kutzit while working on cars, Mr. Rhyne testified that he did not use Kutzit every time, but that he used Kutzit when he had to cut and scrape off gaskets. (Doc. No. 214-2, at 317:16–17, 319:15–18.) Based on the type of work Mr. Rhyne used Kutzit for, Herrick conservatively estimated that Mr. Rhyne used Kutzit

one-third of the time that he worked on cars. (Doc. No. 148-3, at 19; Doc. No. 201-3, at 347:12–25, 348:23–349:16.) Thus, while Herrick's estimates are not based on exact data on how often Mr. Rhyne used Kutzit at home, Herrick's estimates are not based on mere speculation. To require expert testimony to be based on exact information as to how frequently plaintiff used a product fifty years ago, as Savogran suggests, would effectively prohibit a plaintiff from ever recovering in a latent disease case. Herrick's estimates as to how often Mr. Rhyne used Kutzit at home are not based on mere speculation, and Savogran's challenges to the accuracy of those estimates go to the weight that the jury should give to Herrick's opinion. See Bresler, 855 F.3d at 195 (stating that "questions regarding the factual underpinnings of the [expert's] opinion affect the weight and credibility of the [witness's] assessment, not its admissibility" (quotation marks omitted)).

Like Safety Kleen, Savogran also argues that ART is not a reliable tool for conducting an individual retrospective exposure assessment. As discussed above, the Court rejects that argument and concludes that Herrick's methodology of using ART to calculate Mr. Rhyne's benzene exposure from using Kutzit at home is reliable.

ii. Exposure from Using Kutzit at Setzer's

During his junior and senior years of high school (1974 and 1975), Mr. Rhyne worked at Setzer's Buick and Pontiac, an auto mechanic shop. (Doc. No. 214-2, at 584:13–16.) In his work at Setzer's, Mr. Rhyne used Kutzit to cut and scrape off gaskets. (Doc. No. 214-2, at 663:12–16.) To calculate Mr. Rhyne's exposure to benzene from using Kutzit at Setzer's in 1974, Herrick estimated that Mr. Rhyne

used a formulation of Kutzit that contained up to 56% benzene. (Doc. No. 148-3, at 17–18, 34.) But to calculate Mr. Rhyne's exposure in 1975, Herrick estimated that Mr. Rhyne used a formulation of Kutzit that contained approximately 0.025 to 0.5% benzene. (Doc. No. 148-3, at 34.) To determine exposure from Mr. Rhyne's use of Kutzit, Herrick relied on Young et al. (1978), which collected air samples for five sequential five-minute periods when a formula containing 52% benzene was used for paint stripping. (Doc. No. 148-3, at 18, 34; Doc. No. 204-5.) The concentration of benzene in the air samples ranged from 73 ppm to 225 ppm for an average of 130 ppm over the 25-minute period. (Doc. No. 148-3, at 34; Doc. No. 204-5.) Accordingly, to calculate Mr. Rhyne's benzene exposure from using the benzene formulation of Kutzit in 1974, Herrick used 130 ppm as Mr. Rhyne's benzene exposure from using Kutzit for a one-hour period. (Doc. No. 148-3, at 34.) To calculate Mr. Rhyne's benzene exposure from using the toluene formulation of Kutzit in 1975, Herrick reduced the 130 ppm value in proportion to his estimate that the toluene formulation of Kutzit contained 0.025 to 0.5% benzene, yielding an average benzene exposure of 0.65 ppm over a one-hour period. (Doc. No. 148-3, at 34.) Herrick then estimated that Mr. Rhyne used Kutzit for one hour per day, one day per week, during the 9-month school year. (Doc. No. 148-3, at 34.) Herrick's estimations yielded a daily average exposure of 2.44 ppm in 1974 and 0.01 ppm in 1975. (Doc. No. 148-3, at 34.) But because Mr. Rhyne testified that some days he would work on gaskets (and use Kutzit) and other days he would clean bolting or carburetors (and not use Kutzit), Herrick divided those estimates in half, yielding an average daily exposure of 1.22 ppm in 1974 and 0.005

ppm in 1975. (Doc. No. 148-3, at 34.)

Savogran first argues that Herrick's estimate that Mr. Rhyne used a Kutzit formulation in 1974 that contained up to 56% benzene is baseless because Herrick had no information as to which formulation of Kutzit Mr. Rhyne used in 1974.

The evidence suggests that sometime around the end of 1973 and the beginning of 1974, Savogran developed a new formulation of Kutzit in which benzene was removed as an ingredient and replaced with toluene, thereby reducing but not eliminating the benzene content of Kutzit. There is conflicting information, however, as to when benzene was removed as an ingredient of Kutzit. (Doc. No. 148-3, at 17–18.) Savogran inventory records indicate that the benzene formulation of Kutzit was used until February 28, 1974. (Doc. No. 148-3, at 17.) Herrick thus estimated that the benzene formulation of Kutzit existed in the marketplace and was used until it was depleted at the end of 1974. (Doc. No. 201-3, at 359:21–362:1.) Herrick's estimate is not based on mere speculation and the accuracy thereof is for the jury.

Next, Savogran argues that Herrick's methodology of using the exposure levels reported in Young et al. (1978) to calculate Mr. Rhyne's exposure from using Kutzit is unreliable because (1) Herrick states that the authors used a Kutzit formula but nothing in the study indicates a Kutzit product or formula was used, (2) the authors conducted the paint stripping in a two-car garage measuring approximately eight feet by twenty-one feet by twenty feet and there is no reason to believe that Mr. Rhyne's workspace at Setzer's was "anywhere close" to a two-car garage, and (3) the authors only collected air samples for five sequential five-minute periods.

Savogran's arguments are meritless. Although there is nothing in the study to indicate that a Kutzit formula was used, the study used a solvent containing 52% benzene, and Herrick estimated that the Kutzit formulation used by Mr. Rhyne contained up to 56% benzene. As a result, the reported air sample levels provide a reliable basis for Herrick's estimate as to Mr. Rhyne's exposure from using Kutzit in 1974, and Herrick's methodology of reducing that value in proportion to the lesser benzene content of the toluene formulation of Kutzit to estimate Mr. Rhyne's exposure from using Kutzit in 1975 was reliable. Turning to Savogran's second point, that there is no information as to the exact size and ventilation of Mr. Rhyne's workspace at Setzer's does not render Herrick's use of the reported exposure levels from Young unreliable. Such a challenge goes to the weight that the jury should give Herrick's opinion. The same is true of Savogran's criticism that the authors only collected five air samples.

Last, Savogran argues that Herrick's exposure assessment is based on mere speculation because Mr. Rhyne never testified that his use of Kutzit averaged out to one hour per day, one day per week. In so arguing, Savogran seeks to impose a standard of exactness and overlooks a critical step in Herrick's methodology. Herrick's starting estimate that Mr. Rhyne used Kutzit one hour per day, one day per week is based on Mr. Rhyne's testimony that he worked at Setzer's one day per week and on the days that he cleaned gaskets, he used Kutzit for one hour. (Doc. No. 214-2, at 584:17–19, 661:22–662:3.) Mr. Rhyne also testified, however, that some days he would clean gaskets and thus use Kutzit, and other days he would clean bolting or

carburetors for which he did not use Kutzit. (Doc. No. 214-2, at 661:10–21.) To account for the fact that Mr. Rhyne did not clean gaskets each day he went to Setzer's, Herrick divided his exposure calculations in half. (Doc. No. 148-3, at 34.) In so doing, Herrick effectively changed his estimate as to how often Mr. Rhyne used Kutzit from one hour per day, one day per week to one hour per day, one day every other week. Therefore, the Court concludes that Herrick's assessment of Mr. Rhyne's benzene exposure from using Kutzit at Setzer's is based on a reliable methodology.

iii. Exposure from Using Kutzit at Duke Energy

Savogran challenges Herrick's reliance on Young et al. (1978) to calculate Mr. Rhyne's benzene exposure from using Kutzit at Duke Energy. For the reasons discussed above, the Court concludes that Young et al. (1978) provides a reliable basis for Herrick's exposure calculations.

Savogran also argues that Herrick's assessment of Mr. Rhyne's exposure to benzene from using Kutzit at Duke Energy is based on speculation because there is no evidentiary support for Herrick's assumption that Mr. Rhyne used Kutzit at Duke Energy from 1985 to 1998.

Mr. Rhyne testified that his use of Kutzit during his employment with Duke Energy was limited to his time as a maintenance mechanic. (Doc. No. 214-2, at 323:2–9.) Mr. Rhyne further testified that he became a maintenance mechanic in 1985 and continued as a maintenance mechanic until 1998 when he became a maintenance supervisor. (Doc. No. 214-2, at 323:14–16, 426:9–16.) Accordingly, there is evidentiary support for Herrick's estimate that Mr. Rhyne used Kutzit at Duke

Energy from 1985 to 1998, and Herrick's assessment of Mr. Rhyne's benzene exposure from using Kutzit at Duke Energy is based on a reliable methodology.

4. Defendants' General Argument for Exclusion

All Defendants argue that Herrick's exposure assessment is unreliable because he excluded exposures from certain products for which there was sufficient evidence and included exposures from certain products for which there was insufficient evidence. Specifically, Defendants contend that Herrick excluded exposures from Mr. Rhyne's use of Tap Magic and Spotcheck even though Mr. Rhyne testified to using those products, and included exposures from Mr. Rhyne's use of CRC 3-36 even though there was insufficient evidence that the CRC Industries product used by Mr. Rhyne was CRC 3-36.

Defendants' argument is not persuasive. Herrick explained that he did not calculate Mr. Rhyne's benzene exposure from Tap Magic because although an April 1992 approved chemical list for Duke Energy's McGuire facility included a Tap Magic product, several Material Safety Data Sheets[18] for Tap Magic products report a composition of petroleum distillates ranging from 40 to 75%. (Doc. No. 148-3, at 30.) As the record does not indicate which of those Tap Magic products Mr. Rhyne used, Herrick did not estimate Mr. Rhyne's benzene exposure from his use of Tap Magic. (Doc. No. 148-3, at 30; Doc. No. 201-3, at 51:20–52:2.) The same is true of Spotcheck.

[18] A Material Safety Data Sheet is a document produced in compliance with the hazard communication standard and is used by manufacturers and industry readers as a means of communicating information to users of the product. (Doc. No. 201-3, at 308:10–18.)

Although Spotcheck was on the April 1992 approved chemical list, Herrick was unable to obtain a Material Safety Data Sheet for Spotcheck from the relevant time period, and the record did not otherwise indicate the composition of the product. (Doc. No. 148-3, at 30–31; Doc. No. 201-3, at 52:3–22, 53:15–21.) Accordingly, Herrick did not estimate Mr. Rhyne's benzene exposure from his use of Spotcheck. (Doc. No. 148-3, at 31; Doc. No. 201-3, at 52:14–18.)

While the Court ultimately granted summary judgment in favor of former Defendant CRC Industries, Inc. because there was insufficient evidence that the CRC Industries product used by Mr. Rhyne was CRC 3-36, Herrick's inclusion of that product as a source of benzene exposure goes to the weight of Herrick's opinion, rather than its admissibility. See Bresler, 855 F.3d at 195 (stating that "questions regarding the factual underpinnings of the [expert's] opinion affect the weight and credibility of the [witness's] assessment, not its admissibility" (quotation marks omitted)).

* * *

Therefore, the Court concludes that Herrick's exposure assessment is based on sufficient data and the product of a reliable methodology. The Court denies Defendants' motions to exclude Herrick's testimony.

F. Petty

Defendants move to exclude the expert testimony of Petty, whom Plaintiffs offered as their exposure expert when the case was pending in Pennsylvania state court. Plaintiffs did not file a response to Defendants' motion, but as previously discussed, Plaintiffs did not identify Petty as an expert when they refiled this case in

this Court. Moreover, Plaintiffs concede that "Petty has been withdrawn as an expert and his calculations have no bearing on this case now." (Doc. No. 218, at 23.) Therefore, the Court grants Defendants' motion to exclude Petty's expert testimony.

IV. PLAINTIFFS' MOTIONS

Plaintiffs move to exclude certain testimony of defense expert John W. Spencer. Plaintiffs also move to exclude evidence of radiation exposure and a genetic defect as alternative causes of AML.

A. Motion to Exclude Spencer's Expert Testimony

Mr. Rhyne testified that during his employment with Duke Energy, he used Liquid Wrench to cool hot couplings and pipe. (Doc. No. 209-1, at 268:1–3.) Put differently, Mr. Rhyne testified that he used Liquid Wrench as a metal coolant. In his expert report, Spencer opines that it is unlikely that Mr. Rhyne used Liquid Wrench as he described. (Doc. No. 193-2, at 39.) Plaintiffs move to exclude that opinion, arguing it is an impermissible attack on Mr. Rhyne's credibility. The Court agrees.

"The assessment of a witness's credibility . . . is usually within the jury's exclusive purview. Thus, in the absence of unusual circumstances, Rule 702 renders inadmissible expert testimony on issues of witness credibility." United States v. Lespier, 725 F.3d 437, 449 (4th Cir. 2013) (quotation marks and citation omitted). In opining that it is unlikely Mr. Rhyne used Liquid Wrench as he testified to using it, Spencer plainly calls into question Mr. Rhyne's credibility. Exclusion of his opinion is appropriate on that basis alone.

The Court further concludes that Spencer's opinion is not the product of reliable methods. The basis for Spencer's opinion that Mr. Rhyne likely did not use Liquid Wrench as a metal coolant is (1) using Liquid Wrench in that manner may have caused a fire, and (2) there were more suitable products for such use that were available to Mr. Rhyne. (Doc. No. 193-2, at 39.) Even if Spencer's opinion concerned a matter appropriate for expert testimony, his opinion is not reliable—"there is simply too great an analytical gap between the data and the opinion proffered." Doe, 440 F. Supp. 2d at 471. That using Liquid Wrench as a metal coolant may have caused a fire and that there were more suitable products for such use that were available to Mr. Rhyne reliably support a conclusion that Mr. Rhyne should not have used Liquid Wrench as a metal coolant, but those facts do not reliably support Spencer's offered opinion that Mr. Rhyne did not in fact use Liquid Wrench as a metal coolant. Therefore, the Court grants Plaintiffs' motion and excludes Spencer's opinion that it is unlikely that Mr. Rhyne used Liquid Wrench as he described.

B. Motion to Exclude Evidence of Radiation Exposure as an Alternative Cause

Plaintiffs move to exclude evidence that radiation exposure can cause AML or that radiation exposure caused Mr. Rhyne's AML. As discussed above, Mr. Rhyne was exposed to radiation during his employment with Duke Energy, and the experts agree that, at certain levels, radiation exposure is a risk factor for AML. But Plaintiffs' specific causation experts ruled out radiation exposure as an alternative cause of Mr. Rhyne's AML, and defense experts Pyatt and Kaden testified that Mr. Rhyne's radiation exposure was insufficient to cause his AML. And while Defendants

concede that they do not offer radiation exposure as an alternative cause of Mr. Rhyne's AML, Defendants nonetheless contend that Mr. Rhyne's radiation exposure is relevant to the reliability of, and weight that should be given to, Plaintiffs' specific causation experts' opinions that exposure to benzene caused his AML. The Court disagrees.

Relevant evidence—that which has a tendency to make a fact of consequence more or less probable than it would be without the evidence—is generally admissible. Fed. R. Evid. 401–402. Courts may exclude relevant evidence, however, if its probative value is substantially outweighed by the danger of unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence. Fed. R. Evid. 403.

Plaintiffs' and Defendants' experts agree that Mr. Rhyne's radiation exposure was insufficient to have caused his AML, and Plaintiffs' specific causation experts considered and ruled out Mr. Rhyne's radiation exposure as an alternative cause. While "[t]he alternative causes suggested by a defendant affect the weight that the jury should give the expert's testimony," Westberry, 178 F.3d at 265, Defendants do not suggest that radiation exposure was an alternative cause of Mr. Rhyne's AML. For this reason, evidence of radiation exposure as an alternative cause of AML in general and Mr. Rhyne's AML is not relevant. In addition, allowing evidence of Mr. Rhyne's radiation exposure and radiation exposure generally as a cause of AML would likely confuse the issues, mislead the jury, and cause undue delay. Therefore, the Court concludes that evidence of radiation exposure as a cause of AML or that

radiation exposure caused Mr. Rhyne's AML is irrelevant. The Court alternatively concludes that the probative value of such evidence is substantially outweighed by the danger of confusing the issues, misleading the jury, and causing undue delay. The Court grants Plaintiffs' motion to exclude evidence that radiation exposure can cause AML or that radiation exposure caused Mr. Rhyne's AML.

C. Motion to Exclude Evidence of a Genetic Defect as an Alternative Cause

Plaintiffs move to exclude evidence of Mr. Rhyne's sister's AML and evidence that a genetic defect can cause AML or that a genetic defect caused Mr. Rhyne's AML. The basis for Plaintiffs' motion is essentially the same as that for their motion to exclude evidence of radiation exposure as an alternative cause—that no defense expert has opined that Mr. Rhyne's AML was familial.

While the experts agree that Mr. Rhyne's radiation exposure was insufficient to cause his AML, the genetic tests necessary to confirm the presence of genetic defects commonly found in familial AML were not done. As a result, although the Court has concluded that Plaintiffs' specific causation experts adequately considered the possibility that Mr. Rhyne's AML was familial such that their differential diagnoses were reliable, no expert could definitively rule out that Mr. Rhyne's AML was familial. And as discussed above, the inability of Plaintiffs' specific causation experts to conclusively rule out familial AML goes to the weight that the jury should give those opinions. Cooper, 259 F.3d at 202 (stating that "the alternative causes suggested by a defendant normally affect the weight that the jury should give the expert's testimony and not the admissibility of that testimony").

Evidence of Mr. Rhyne's sister's AML and the lack of genetic tests confirming or refuting the existence of genetic defects commonly found in familial AML is thus relevant to whether Mr. Rhyne's AML was familial—a fact that, unlike Mr. Rhyne's radiation exposure, is still of consequence to determining this action. Of course, Plaintiffs will be permitted to rebut this evidence with evidence that familial AML is rare and normally presents in patients much younger than Mr. Rhyne. It will then be left to the jury to consider and weigh this evidence as to the cause of Mr. Rhyne's AML. Therefore, the Court denies Plaintiffs' motion to exclude evidence of Mr. Rhyne's sister's AML and evidence of a genetic defect as a cause of AML generally or Mr. Rhyne's AML.

V. CONCLUSION

IT IS THEREFORE ORDERED that:

1. Defendants' motions to exclude the testimony of Plaintiffs' experts are **GRANTED in part** and **DENIED in part**.

    a. USS's and Safety Kleen's motions to exclude Infante's expert testimony, (Doc. Nos. 186, 195), are **GRANTED** as to Infante's offered opinion on specific causation, and such opinion is excluded. The motions are **DENIED** in all other respects.

    b. USS's and Safety Kleen's motions to exclude Harrison's expert testimony, (Doc. Nos. 188, 192), are **DENIED**.

    c. USS's motion to exclude Gore's expert testimony, (Doc. No. 182), is **GRANTED** as to Gore's quiescent stem cell opinion, and such

opinion is excluded. The motion is **DENIED** in all other respects.

d. Safety Kleen's motion to exclude Gore's expert testimony, (Doc. No. 190), is **DENIED**.

e. USS and Safety Kleen's joint motion to exclude Herrick's expert testimony, (Doc. No. 197), and Savogran's motion to exclude Herrick's expert testimony, (Doc. No. 203), are **DENIED**.

f. USS and Safety Kleen's joint motion to exclude Petty's expert testimony, (Doc. No. 184), is **GRANTED**, and Petty will not be permitted to testify at trial.

2. Plaintiffs' evidentiary motions are **GRANTED in part** and **DENIED in part**.

a. Plaintiffs' motion to exclude Spencer's expert testimony, (Doc. No. 193), is **GRANTED**, and Spencer's opinion that it is unlikely Mr. Rhyne used Liquid Wrench as he described is excluded.

b. Plaintiffs' motion to exclude evidence of radiation exposure as an alternative cause, (Doc. No. 198), is **GRANTED**, and the Court excludes evidence that radiation exposure can cause AML or caused Mr. Rhyne's AML.

c. Plaintiffs' motion to exclude evidence of Mr. Rhyne's sister's AML and a genetic defect as an alternative cause, (Doc. No. 200), is **DENIED**.

Signed: July 23, 2020

Robert J. Conrad, Jr.
United States District Judge