

**ARKANSAS COURT OF APPEALS**

DIVISION II

No. CA10-591

TERRY RICHARDSON

APPELLANT

V.

UNION PACIFIC RAILROAD  
COMPANY

APPELLEE

**Opinion Delivered** September 28, 2011APPEAL FROM THE PULASKI  
COUNTY CIRCUIT COURT,  
THIRD DIVISION  
[NO. CV-07-11954]

HONORABLE JAY MOODY, JUDGE

AFFIRMED

**JOHN MAUZY PITTMAN, Judge**

This appeal involves the admissibility of expert-witness testimony. Appellant Terry Richardson was employed by appellee Union Pacific Railroad Company and its predecessor as a brakeman, conductor, and hostler from 1971 until 2006, when he was diagnosed with a type of cancer known as multiple myeloma. He brought this action against appellee under the Federal Employers' Liability Act, 45 U.S.C. §§ 51-60 (FELA), alleging that his exposure to diesel fuel, diesel exhaust, creosote, and pesticides during his employment with appellee caused his cancer. The Pulaski County Circuit Court on March 9, 2010, granted appellee's motion in limine excluding appellant's experts' testimony. Because appellant could not prove causation without the experts' testimony, the court granted summary judgment to appellee. Appellant then pursued this appeal.

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Summary judgment is to be granted by a circuit court only when it is clear that there are no genuine issues of material fact to be litigated, and the party is entitled to judgment as a matter of law. *Green v. Alpharma, Inc.*, 373 Ark. 378, 284 S.W.3d 29 (2008). Once the moving party has established a prima facie entitlement to summary judgment, the opposing party must meet proof with proof and demonstrate the existence of a material issue of fact. *Id.* On appellate review, we determine if summary judgment was appropriate based on whether the evidentiary items presented by the moving party in support of the motion leave a material fact unanswered. *Id.* We view the evidence in a light most favorable to the party against whom the motion was filed, resolving all doubts and inferences against the moving party. *Id.* When a party cannot present proof on an essential element of his claim, the moving party is entitled to summary judgment as a matter of law. *Schmoll v. Hartford Cas. Ins. Co.*, 104 Ark. App. 215, 290 S.W.3d 41 (2008).

It is not disputed that the material question of causation was left unanswered in the absence of the excluded testimony, so the question before us is whether the trial court erred in granting appellee's motion in limine. Appellant advances a plethora of arguments on this issue, but they resolve into two crucial questions: What is the standard of review in an appeal from a trial court's ruling on the scientific validity underpinning expert opinion, and to what extent must a toxic-tort plaintiff prove the degree of exposure to the allegedly toxic substance in order to establish causation? We hold that the abuse-of-discretion standard is applicable. We further hold that causation requires more than mere proof of exposure to above-ambient

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levels of the alleged toxin, and instead requires evidence of the levels of exposure that are hazardous to human beings generally, as well as the plaintiff's actual level of exposure to the defendant's toxic substance.

FELA provides for concurrent jurisdiction of the state and federal courts. *Norfolk S. Ry. Co. v. Sorrell*, 549 U.S. 158, 165 (2007); 45 U.S.C. § 56 (2011). Although state courts use state procedural rules, substantive issues, such as causation, are governed by FELA. *Norfolk S. Ry. Co. v. Sorrell*, *supra*. The test of causation under FELA is much easier to prove than in state tort cases; it is whether the railroad's negligence played "any part, even the slightest," in the injury that is the subject of the suit. *Rogers v. Missouri Pac. R.R. Co.*, 352 U.S. 500, 506 (1957); *see also Fletcher v. Union Pac. R.R. Co.*, 621 F.2d 902 (8th Cir. 1980), *cert. denied*, 449 U.S. 1110 (1981).

In a FELA context, when there is no obvious origin to an injury and it has multiple potential etiologies, expert testimony is necessary to establish causation. *Aurand v. Norfolk S. Ry. Co.*, \_\_\_ F. Supp. 2d \_\_\_, 2011 WL 2938447 (N.D. Ind. 2011). The trial court must engage in a three-step inquiry before admitting expert testimony. First, it must determine whether the witness is qualified; second, whether the expert's methodology is scientifically reliable; and third, whether the testimony will assist the trier of fact to understand the evidence or to determine a fact in issue. *Id.*

A toxic tort plaintiff must adduce evidence of both general and specific causation. *Id.* General causation addresses whether a particular agent can cause a particular illness. *Id.*

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Specific causation addresses whether that agent in fact caused the particular plaintiff's illness.

*Id.* There is a two-step process in examining the admissibility of causation evidence in toxic-tort cases. First, the trial court must determine whether there is general causation; second, if it concludes that there is admissible general-causation evidence, it must determine whether there is admissible specific-causation evidence. *Id.* In toxic-tort cases, an expert may be able to testify that a chemical can cause the plaintiff's illness, but not that this chemical caused this particular illness. *Id.* Differential etiology is a methodology commonly used to determine the cause of an illness. *Id.* The doctor rules in all of the potential causes, and then, by systematically ruling out causes that would not apply to this plaintiff, the doctor arrives at what is the likely cause of the illness. *Id.* Whether such a methodology supporting an expert's opinion is reliable is determined on a case-by-case basis. *Id.*

Appellant obtained Roger Wabeke, an industrial hygienist and toxicologist, and Nachman Brautbar, M.D., who is board-certified in internal medicine, nephrology, and forensic medicine, as expert witnesses. With supporting opinions from its own experts, appellee moved to exclude their opinions on the grounds that they were unreliable and did not meet the requirements of Arkansas Rule of Evidence 702 and the United States Supreme Court's decision in *Daubert v. Merrill Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), which the Arkansas Supreme Court adopted in *Farm Bureau Mutual Insurance Company of Arkansas, Inc. v. Foote*, 341 Ark. 105, 14 S.W.3d 512 (2000). Rule 702 (2011) provides: "If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the

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evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise.”<sup>1</sup> Under *Daubert* and *Foote*, the circuit court must make a preliminary assessment of whether the reasoning or methodology underlying expert testimony is valid and whether the reasoning and methodology used by the expert has been properly applied to the facts of the case. *Coca-Cola Bottling Co. of Memphis v. Gill*, 352 Ark. 240, 100 S.W.3d 715 (2003).

In *Daubert*, the United States Supreme Court imposed an obligation upon a trial judge to ensure that any and all scientific testimony or evidence admitted is not only relevant, but reliable. A primary factor for a trial court to consider in determining the admissibility of scientific evidence is whether the scientific theory can be or has been tested; other factors include whether the theory has been subjected to peer review and publication, the potential error rate, and the existence and maintenance of standards controlling the technique’s operation. *Id.* It is also significant whether the scientific community has generally accepted the theory. *Id.* The Court established the following inquiry to be conducted by a trial judge when faced with a proffer of expert scientific testimony:

[T]he trial judge must determine at the outset, pursuant to Rule 104(a), whether the expert is proposing to testify to (1) scientific knowledge that (2) will assist the trier of fact to understand or determine a fact in issue. This entails a preliminary assessment of whether the reasoning or methodology underlying the testimony is scientifically valid and of whether that reasoning or methodology properly can be applied to the facts in issue . . . . Many factors will bear on the inquiry, and we do not presume to set out a definitive checklist or test.

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<sup>1</sup>When *Daubert* was decided, Arkansas Rule of Evidence 702 was identical to Federal Rule of Evidence 702.

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509 U.S. at 592–93.

The Court stated that some general observations, however, are appropriate:

Ordinarily, a key question to be answered in determining whether a theory or technique is scientific knowledge that will assist the trier of fact will be whether it can be (and has been) tested . . . .

Another pertinent consideration is whether the theory or technique has been subjected to peer review and publication. Publication (which is but one element of peer review) is not a *sine qua non* of admissibility; it does not necessarily correlate with reliability . . . and in some instances well-grounded but innovative theories will not have been published . . . . The fact of publication (or lack thereof) in a peer reviewed journal thus will be a relevant, though not dispositive, consideration in assessing the scientific validity of a particular technique or methodology on which an opinion is premised.

Additionally, in the case of a particular scientific technique, the court ordinarily should consider the known or potential rate of error . . . .

Finally, “general acceptance” can yet have a bearing on the inquiry. A “reliability assessment does not require, although it does permit, explicit identification of a relevant scientific community and an express determination of a particular degree of acceptance within that community.” *United States v. Downing*, 753 F.2d, at 1238. See also 3 Weinstien & Berger ¶ 702[03], pp. 701–41 to 702–42. Widespread acceptance can be an important factor in ruling particular evidence admissible, and “a known technique which has been able to attract only minimal support within the community,” *Downing*, 753 F.2d, at 1238, may properly be viewed with skepticism.

509 U.S. at 593–94.

The Court also indicated that certain devices, such as vigorous cross-examination, presentation of contrary evidence, careful instruction on the burden of proof, or the entry of a directed verdict, rather than wholesale exclusion, are appropriate safeguards where the basis of “shaky but admissible” scientific evidence meets the standards of Rule 702. 509 U.S. at 596. The Court explained:

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The inquiry envisioned by Rule 702 is, we emphasize, a flexible one. Its overarching subject is the scientific validity and thus the evidentiary relevance and reliability—of the principles that underlie a proposed submission. The focus, of course, must be solely on principles and methodology, not on the conclusions that they generate.

509 U.S. at 594–95. The Court stressed in *Daubert* that the inquiry envisioned by Rule 702 analysis is a flexible one, that many factors will bear on the inquiry, and that it did not presume to give a definitive checklist.

In *Kumho Tire Co. v. Carmichael*, 526 U.S. 137 (1999), the United States Supreme Court held that the trial judge’s basic gatekeeping function imposed in *Daubert* applies to all, and not just scientific, expert testimony; it emphasized that the trial court has broad latitude in determining the reliability of an expert’s testimony and that the *Daubert* factors may or may not be pertinent in assessing reliability, depending on the nature of the issue, the expert’s particular expertise, and the subject of his testimony. The Court discussed the objective of the trial judge’s gatekeeping requirement as follows:

The objective of that requirement is to ensure the reliability and relevancy of expert testimony. It is to make certain that an expert, whether basing testimony upon professional studies or personal experience, employs in the courtroom the same level of intellectual rigor that characterizes the practice of an expert in the relevant field. Nor do we deny that, as stated in *Daubert*, the particular questions that it mentioned will often be appropriate for use in determining the reliability of challenged expert testimony. Rather, we conclude that the trial judge must have considerable leeway in deciding in a particular case how to go about determining whether particular expert testimony is reliable. That is to say, a trial court should consider the specific factors identified in *Daubert* where they are reasonable measures of the reliability of expert testimony.

The trial court must have the same kind of latitude in deciding *how* to test an expert’s reliability, and to decide whether or when special briefing or other

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proceedings are needed to investigate reliability, as it enjoys when it decides *whether or not* that expert's relevant testimony is reliable. Our opinion in [*General Electric Co. v. Joiner* [522 U.S. 136 (1997)]] makes clear that a court of appeals is to apply an abuse-of-discretion standard when it "review[s] a trial court's decision to admit or exclude expert testimony." 522 U.S., at 138-139, 118 S. Ct. 512. That standard applies as much to the trial court's decisions about how to determine reliability as to its ultimate conclusion. Otherwise, the trial judge would lack the discretionary authority needed both to avoid unnecessary "reliability" proceedings in ordinary cases where the reliability of an expert's methods is properly taken for granted, and to require appropriate proceedings in the less usual or more complex cases where cause for questioning the expert's reliability arises. Indeed, the Rules seek to avoid "unjustifiable expense and delay" as part of their search for "truth" and the "jus[t] determin[ation]" of proceedings. Fed. Rule Evid. 102. Thus, whether *Daubert's* specific factors are, or are not, reasonable measures of reliability in a particular case is a matter that the law grants the trial judge broad latitude to determine. See *Joiner, supra*, at 143, 118 S. Ct. 512.

526 U.S. at 152-53.

The Arkansas Supreme Court first applied the *Daubert* analysis in *Foote, supra*, affirming the trial court's refusal to allow an Arkansas State Police investigator to testify about the superior ability of his canine partner to detect the presence of accelerants after a fire. The court noted that, according to *Daubert*, a key consideration is whether the scientific theory or technique can be or has been tested and that other considerations include whether the theory or technique has been subjected to peer review and publication, the potential rate of error, the existence and maintenance of standards controlling the technique's operation, and the general acceptance in the scientific community. The court explained its decision as follows:

In the present case, we conclude that the proffered testimony concerning the dog's alleged superior ability to detect the presence of accelerants does not pass muster using either the *Daubert* or *Prater* [*v. State*, 307 Ark. 180, 820 S.W.2d 429 (1991)]

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analysis. Farm Bureau simply did not make any showing regarding the scientific validity of the evidence. For instance, Estes did not produce the study allegedly conducted by Lockridge, so there was no way of ascertaining the techniques used or the potential rate of error. There was no evidence that this scientific theory had ever been tested or subjected to peer review, or that it had been otherwise embraced by the particular scientific community. In short, Farm Bureau, as the proponent of the novel scientific evidence, failed to carry its burden of proof on the issue of reliability.

341 Ark. at 117, 14 S.W.3d at 520. As in *Kumho*, the Arkansas Supreme Court has held that the requirements of Rule 702 apply equally to all types of expert testimony, not simply to scientific expert testimony. *Coca-Cola Bottling Co.*, *supra*.

In *Wood v. State*, 75 Ark. App. 22, 53 S.W.3d 56 (2001), this court followed *Foote*, *supra*, and applied the *Daubert* guidelines in affirming the trial judge's refusal to admit, as unreliable, the testimony of an expert witness as a defense to the crimes with which the appellant had been charged (raping his stepsons). The witness opined that Paxil, an antidepressant, caused deviant sexual behavior; however, she had conducted no clinical studies or laboratory research and had based her opinion on drug-experience reports and medical literature. This court explained:

The record contains no testimony or evidence that Dr. Tracy cited to demonstrate that the use of Paxil would cause a person to engage in deviant sexual activity or that Paxil specifically caused appellant to rape his stepsons. Moreover, the record demonstrates that the trial judge considered the factors enumerated in *Foote* in making his decision to exclude Dr. Tracy's testimony. The court noted that Dr. Tracy's methodology in conducting studies and reaching her conclusions were suspect and did not follow any accepted scientific method. The court further stated that Dr. Tracy's proffered testimony displayed prejudice toward an entire series of drugs or classification of drugs, and that Dr. Tracy appeared to be on a crusade to eliminate the use of certain drugs, including Paxil. The court concluded that Dr. Tracy's testimony would not be reliable or relevant and that even if the evidence were relevant, the testimony would mislead and confuse the jury.

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Trial judges serve as evidentiary gatekeepers for ensuring the reliability of proposed expert testimony. In this case, appellant failed to demonstrate 1) that the scientific community generally accepted Dr. Tracy's theory that Paxil would cause a person to engage in deviant sexual activity, 2) that the theory could be or had been tested, 3) that the theory had been subject to peer review and publication, 4) the potential error rate of the theory, and 5) the existence and maintenance of standards of control. We hold that the trial court did not abuse its discretion by excluding Dr. Tracy's testimony after finding that her methodology in conducting studies and reaching the conclusions on which her testimony was based were suspect and likely to mislead or confuse the jury.

75 Ark. App. at 28–29, 53 S.W.3d at 60–61.

In the present case, appellee argued in support of its motions in limine and for summary judgment that appellant had no evidence of his actual level of exposure; that Roger Wabeke's and Dr. Brautbar's opinions lacked valid methodology, reliability, and helpfulness; and that Dr. Brautbar's causation opinion should also be excluded because it lacked valid and reliable methodology. Appellant's deposition was an exhibit to appellee's brief in support of its motions in limine and for summary judgment. Appellant testified about his work conditions with appellee from 1971 until 2006. He described his job duties and how they brought him into contact with diesel exhaust, diesel fuel, and creosote-coated railroad ties. He also described his physical symptoms resulting from that exposure.

Appellee also offered the deposition of Roger Wabeke as an exhibit to its motions in limine and for summary judgment. Wabeke testified that he read appellant's deposition to get a sense of his work-place exposures; the affidavits of two of appellant's co-workers, Fred Carrigan and Randy Smith; and a work history of appellant provided by his counsel. He said that, although he saw air measurements taken by appellee, he did not believe that it had

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followed the standard of care for monitoring workplace exposure. He considered appellant's exposure to diesel exhaust to be chronic, severe, extensive, and, at times, acute; he said that diesel-exhaust exposure generally results in a respiratory response and eye irritation; that he would measure respirable particulates in the breathing zone of locomotive-operating personnel and compare them to ambient concentrations of respirable particulates; and that the railroad's air-monitoring tests were not taken within the breathing zone of operating personnel. He said that appellee failed to protect employees from exposures in locomotive cabs and that it failed to provide mechanical local-exhaust ventilation at the fuel rack at its North Little Rock railyard, which he had not personally inspected. He said that benzene, which is present in gasoline and diesel, has been recognized as a human carcinogen by the Environmental Protection Agency, the American Conference of Governmental Industrial Hygienists, and the National Institute for Occupational Safety and Health. He said that benzene in diesel will pass through human skin and is distributed systematically, including to the bone marrow. He added that, at some level, benzene is ubiquitous. Wabeke's reports to appellant's counsel included abstracts of several research articles that he had studied. In his September 8, 2009 report, he stated:

I apologize for not including abstracts of several research articles that I studied in preparing my report. These articles are attached to this letter.

I did not perform an exhaustive review of the scientific literature on cancer and the relationship to diesel exhaust, benzene, and herbicides. It was not necessary. Over the years of my practice, I studied many too numerous to count. Some recent are attached. The epidemiology of benzene as a hematopoietic carcinogen spans many decades that precede Mr. Richardson's employment.

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These are enough for any corporate medical and occupational health department and their physicians and the industrial hygienists to treat as significant sentinel alerts for their employees. As I stated in my report, Union Pacific Railroad has an affirmative duty to preserve health of employees from exposures to all harmful toxicants. Occupational health professionals never wait for the nth study before they intervene. The evidence in these articles is sufficiently compelling to implement an occupational health program for the diesel fuel-, diesel exhaust-, and herbicide-exposed employees of Union Pacific.

These abstracts were of articles written by various authors, covering topics such as “Herbicides and cancer”; “Diesel asthma”; “Cancer mortality among licensed herbicide applicators”; “A retrospective cohort study of lung cancer and diesel exhaust exposure in railroad workers”; “An update on the immuno-pathogenesis of asthma as an inflammatory disease enhanced by environmental pollutants”; “Differences between cytokine release from bronchial epithelial cells of asthmatic patients and non-asthmatic subjects; effect of exposure to diesel exhaust particles”; “Respiratory effects of exposure to diesel traffic in persons with asthma”; “Respiratory effects of diesel exhaust emission”; “Different airway inflammatory responses in asthmatic and healthy humans exposed to diesel”; “Diesel exhaust enhances airway responsiveness in asthmatic subjects”; “Cancer incidence among pesticide applicators”; “Italian multicentre case-control study of hemoto-lymphopoietic malignancies”; “Pesticides and cancer risks in agriculture”; and “Paradigm change in the assessment of myeloid and lymphoid neoplasms associated with occupational benzene exposure.” Wabeke also submitted OSHA’s “Generic Cancer Policy” to support his opinion that appellant inhaled excessive benzene vapor and diesel-exhaust particulates.

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The deposition of Dr. Nachman Brautbar was an exhibit to appellee's brief in support of its motions in limine and for summary judgment. He said that he did a physical examination of appellant on July 18, 2007, and reviewed the medical literature, using the methodology of physicians in the fields of occupational medicine and toxicology to determine general causation, and then, specific causation. He also reviewed Mr. Wabeke's report. He stated:

It [appellant's exposure] is not quantitative, measured by parts per million, but it is qualitative. I did not make assumptions. I relied on Mr. Wabeke's reports and what Mr. Richardson told me, what he described in his deposition, as to the conditions, frequency and severity of his exposure to diesel exhaust. Mr. Wabeke's report talks of qualitative exposure as being substantial and extreme. He said inhalation exposures were not only excessive but would have been easily preventable by the railroad. The reports and depositions speak for themselves. The exposure to diesel exhaust was excessive, and it was more than someone not working on the railroad would be exposed to.

Dr. Brautbar described the peer-reviewed, scientific studies and articles that he had reviewed to support his opinion. He said that, although benzene levels can be measured in some circumstances, he had seen nothing to indicate that appellee had measured any of appellant's work stations in his time with the railroad. "I did not have any quantitative number to evaluate his exposure. In occupational toxicology, it is rare to have a quantitative number. That's why the standard of practice in this field requires a qualitative analysis—that is, frequency, extent and duration of exposure." He stated that it was his opinion, with reasonable medical probability, that a substantial cause of appellant's multiple myeloma was his exposure to diesel exhaust, creosote, herbicides, and pesticides. On cross-examination by

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appellee's counsel, he agreed that benzene is everywhere and that we all are exposed to it at one level or another. He stated that it was not absolutely known how benzene causes leukemia, but the research over the last fifteen years had recognized that benzene damages many types of DNA. He stated, "Among experts you will always find some disagreements, but in the weight of the literature and with experts including toxicologists, epidemiologists, and occupational physicians, it is generally accepted that benzene causes multiple myeloma."

The studies relied upon by Dr. Brautbar included: "Benzene Exposure and Multiple Myeloma, A detailed Meta-analysis of Benzene Cohort Studies," by Peter Infante; "A Case-Control Study of Multiple Myeloma Nested in the American Cancer Society Prospective Study" by P. Boffetta; "Airborne Concentrations of Benzene Due to Diesel Locomotive Exhaust in a Roundhouse" by Amy Madl; and "Is There a Causal Relationship Between Exposure to Diesel Exhaust and Multiple Myeloma?" by Otto Wong. Appellee also submitted the affidavit of Peter Valberg, Ph.D., a toxicologist. He stated that very little is known about the etiology of multiple myeloma; that various studies have not found an increased risk of multiple myeloma due to exposure to diesel fuel or diesel-engine exhaust; that there were serious flaws in Dr. Brautbar's opinion; and that the articles Dr. Brautbar relied upon did not support his opinion. In detail, he described many flaws in Dr. Brautbar's assertions:

52. Mr. Richardson's exposure to herbicides was likely extremely limited when compared to typical exposures in occupations such as farming, and herbicide manufacture and application. In the 21-year time period between 1972 and 1992, Mr. Richardson rode the train that sprayed for weed containment along the right of ways approximately four or five times in total. The spraying process usually lasted for 2-3 weeks per track, and Mr. Richardson was on the train for a few days at a time in 10-

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12 hr shifts. Mr. Richardson does not know the names of chemicals used for weed spraying. He would sit on the lead car (boxcar and not the engine, and upwind of the spraying) and watch workers spraying the tracks on each side right beside him. The boxcar was not air conditioned but had windows, and was approximately 10 feet by 20 feet in dimension. Mr. Richardson agreed that he never handled chemicals or had them on his person, and that he never experienced adverse symptoms associated with the weed spray.

53. In summary, all studies discussed in this section, and cited in Dr. Brautbar's report, likely involved much higher exposures to herbicides than Mr. Richardson encountered during the few times that he was on the weed spraying train. Even in these literature studies, there is limited to no evidence for herbicide use being associated with increased incidence of MM. Alexander et al. (2007) reached a similar determination regarding the lack of evidence in the epidemiologic literature for exposures to pesticides or herbicides, including those of applicators or sprayers, as a risk factor for multiple myeloma, concluding, "[R]esults among pesticide production workers, applicators, handlers and licensed users have been inconsistent; and collectively, do not provide strong support for an underlying causal association." Caution is warranted when interpreting the outcomes of these studies because exposure was based on questionnaires and in some instances the questions were answered by proxy, *i.e.*, by the partner or family member of the deceased, which renders the result heavily subject to recall bias. None of the reported associations were based on actual measurements of occupational and non-occupational dermal or inhalation exposure to herbicides, and the length of use of these chemicals was absent in most cases. Moreover, the majority of the studies cited by Dr. Brautbar do not identify specific herbicides, rather they identify whether subjects had been exposed to any type of herbicide. Importantly, none of the studies cited by Dr. Brautbar identified railroad workers as being at increased risk for MM. Overall, based on my review of the relevant scientific literature and the information provided by Mr. Richardson on his possible exposure to herbicides during his employment with Union Pacific Railroad, it is my opinion that his exposure to herbicides cannot be expected to have been a substantial contributing factor to his developing MM.

## Conclusions

54. In summary, I am not aware that any public-health or occupational-health agency has concluded that multiple myeloma is an established health risk for railroad workers. Moreover, one of the more recent comprehensive reviews of the epidemiologic literature for multiple myeloma (Alexander et al., 2007) concluded,

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“There are currently no reliable or consistent predictors of risk for developing multiple myeloma, beyond race, age, and sex.” Considering the weight of available evidence, it is my opinion, to a reasonable degree of scientific certainty, that there is no sound toxicology or epidemiologic basis for concluding that Mr. Richardson’s work history with the Union Pacific Railroad and with diesel-engine locomotives caused or contributed to his multiple myeloma.

In response, appellant submitted Dr. Brautbar’s affidavit; the Infante article; the Boffetta article; Wabeke’s affidavit, with exhibits, including the affidavits of Fred Carrigan and Randy Smith; Material Data Safety Sheets; appellee’s responses to discovery; air-monitoring reports from 1986 and 1987; an article authored by Susan Woskle, “Estimation of the Diesel Exhaust Exposures of Railroad Workers”; and OSHA’s Generic Cancer Policy.

Along with the depositions, appellee submitted the affidavit of James Shea, Jr., a certified industrial hygienist, who criticized the methodology and the reliability of Dr. Brautbar’s and Mr. Wabeke’s opinions in detail and concluded that appellant was not exposed to unreasonable or unacceptable levels of diesel exhaust constituents or other chemicals during his employment. Appellee submitted Shea’s supplemental affidavit thoroughly criticizing Wabeke’s opinion. It further filed the affidavit of Bill Tranum, M.D., who is board-certified in internal medicine, hematology, and oncology. Dr. Tranum averred that the etiology of multiple myeloma remains unknown, although risk factors have been identified. He stated, “Exposure to irradiation has been the only consistent association with an increase in the development of multiple myeloma. Benzene, as a pure agent, or as a constituent of fuels, fumes, or vapors has been the most frequently investigated chemical . . . .” He further stated:

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10. In the major summary article by Dr. Infante, *BENZENE EXPOSURE AND MULTIPLE MYELOMA*, *Ann. N.Y. Acad. Sci.* 1076: 90-109 206, he reviews 8 cohort studies. In 7 of the studies, there is no statistically significant association between benzene exposure and the development of multiple myeloma. The remaining study involves the Pliofilm cohort from Ohio. In preparation of a water repellent sheeting, pure benzene and raw rubber were mixed. This study by Rinsky et al. had the most complete monitoring of benzene exposure and the development of disease than any published study. An elevated incidence of acute myeloid leukemia was noted in workers exposed to chronic elevated levels of benzene. In this study, published in 1987, there was a marginally elevated incidence of multiple myeloma. The same cohort of exposed workers was updated in a report by Rinsky et al. in 2002. Between the 1987 report and the 2002 update, there had been 4 additional cases of multiple myeloma identified, 3 in the control group and 1 in the exposed group. The statistical analysis at the time of the update failed to show a significant increase in the group exposed to benzene. They concluded that chronic exposure to inhaled benzene did not result in an increased incidence of multiple myeloma.

11. In the review article by Dr. Infante referred to above, he included the 1987 report by Rinsky which had a marginal increase in multiple myeloma, but did not include the 2002 update which had no increase in multiple myeloma. My observation is that 8 cohort studies that show no statistical relationship between benzene exposure and the development of multiple myeloma are made no more reliable by applying selected exclusion and pooling of data to imply that a relationship does exist.

12. In an attempt to put to rest the notion that benzene and multiple myeloma are related, 5 of the leading myeloma clinicians, and 2 of the leading epidemiologists on the effect of benzene, authored a review article, Bergsagel, D.E. et. al., *BENZENE AND MULTIPLE MYELOMA: APPRAISAL OF THE SCIENTIFIC EVIDENCE*, *Blood* 94:1174 1999. Their conclusion was: “there is no scientific evidence to support a causal relationship between exposure to benzene or other petroleum products and the risk of developing multiple myeloma.”

At an evidentiary hearing on February 5, 2010, appellee presented the testimony of Dr. Peter Valberg, James Shea, and Dr. Bill Trantum. The circuit court granted appellee’s motion in limine, making the following ruling:

In support of his allegations, Richardson retained Mr. Wabeke as an industrial hygiene expert and Dr. Brautbar as medical doctor of toxicology expert. Mr. Wabeke

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concluded that Richardson was excessively exposed to diesel exhaust, herbicides, and other substances during his employment, relying heavily upon anecdotal testimony and one result of Union Pacific carbon monoxide testing performed in July 1986.

Richardson's causation expert, Dr. Brautbar, concluded that Richardson's exposure to diesel exhaust fumes, creosotes, herbicides and pesticides caused his multiple myeloma. Dr. Brautbar cited to many medical journal articles in support of his opinions, but testified that three articles upon which he relies are Flodin, U. et al. *Multiple Myeloma and Engine Exhausts, Fresh Wood, and Creosote: a Case-referent Study*, Am. J. Ind. Med. 1987; 12(5):519-29; Bofetta, P. et al. *A Case-control Study of Multiple Myeloma Nested in the American Cancer Society Prospective Study*, Int. J. Cancer, 1989 Apr. 15;43(4):554-9; and Infante, P. et al. *Benzene Exposure and Multiple Myeloma: A Detailed Meta-analysis of Benzene Cohort Studies*, 2006 Ann. N.Y. Acad. Sci. 1076:90-109.

Union Pacific filed a motion to exclude the opinions of Mr. Wabeke and Dr. Brautbar. In support of its motion, Union Pacific offered the affidavits and testimony of Jim Shea, a certified industrial hygienist; Peter A. Valberg, Ph.D., a toxicologist; and Bill Trantum, M.D., a board certified oncologist and hematologist. Union Pacific also submitted various medical journal articles and other evidence in support of its motion. In opposition to the motion, Richardson submitted affidavits of Mr. Wabeke and Dr. Brautbar, which also attach various depositions, articles, and other documents.

The Court agrees with Union Pacific that the opinions of Richardson's experts, Mr. Wabeke and Dr. Brautbar, do not meet the Ark. R. Evid. 702 and *Daubert* standards. With regard to Dr. Brautbar, it is apparent his literature citations are selective and, in part, are misconstrued and/or not relevant to the issues presented. He fails to consider numerous studies on the issues presented or to explain his rationale for not doing so, and he relies upon studies where the authors themselves limit or qualify the implications of their findings. Unsupported conclusions that do not consider relevant data lack reliability and the scientific methodology necessary to be considered valid expert opinions. Dr. Brautbar also lacks a reliable analysis, using generally accepted criteria, as to whether a finding of causation (as opposed to association) is supported. See *Federal Judicial Center, Reference Manual on Scientific Evidence* 333, 336, 375 (2nd ed. 2000).

With regard to Mr. Wabeke, he has no evidence as to Plaintiff's actual exposure levels, and his opinions are not the result of a valid, reliable methodology that would be helpful to the factfinder. The lack of a valid, reliable methodology is demonstrated, in part, by: exposure opinions based upon anecdotal testimony without reliable

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scientific corroboration; the rejection, and rationale thereof, of Union Pacific industrial hygiene testing reports; and the citation to one Union Pacific testing result allegedly beneficial to his position, despite rejecting the validity of this and the remaining results.

Under these circumstances, the opinions of Mr. Wabeke and Dr. Brautbar remain nothing more than guesswork and are unreliable and unhelpful to the factfinder. *See Savage v. Union Pac. R.R. Co.*, 67 F. Supp. 2d 1021 (E.D. Ark. 1999); *see also Wright v. Willamette Indus., Inc.*, 91 F.3d 1105, 1106 (8th Cir. 1996); *Ramsey v. Consolidated Rail Corp.*, 111 F. Supp. 2d 1030 (N.D. Ind. 2000). Based on the evidence submitted, the Court hereby grants Union Pacific's Motion in Limine.

Appellant argues that the trial court erred in granting the motion in limine, acknowledging that the general rule is that whether to allow a witness to give expert testimony rests largely within the sound discretion of the trial judge, and that determination will not be reversed absent an abuse of that discretion. *Coca-Cola Bottling Co.*, *supra*. In this case, however, he argues that the "abuse-of-discretion" rule should not apply; instead, he frames the issue on appeal as one of law, for which the appropriate standard of review is de novo. *See Brown v. Pine Bluff Nursing Home*, 359 Ark. 471, 199 S.W.3d 45 (2004). He states:

But this standard of review is employed when examining how trial courts apply the applicable Rules of Evidence when the standards for their application are well known. This case is different. It examines precisely what the Rules of Evidence and the *Daubert/Foote* analysis require trial courts to do in reaching their decisions on scientific evidence in toxic tort cases where highly-qualified experts disagree on complex scientific issues. In other words, this case asks what the rules on admissibility are, not how they are to be applied.

Appellant contends that this court should establish the correct legal standards to be applied for expert testimony in toxic tort cases by following the Nebraska Supreme Court's decisions in *King v. Burlington Northern Santa Fe Railway Co.*, 762 N.W.2d 24 (Neb. 2009), and *Epp v. Lauby*, 715 N.W.2d 501 (Neb. 2006), and the Nebraska Court of Appeals's decision in *Boren*

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*v. Burlington Northern & Santa Fe Railway*, 637 N.W.2d 910 (Neb. Ct. App. 2002). Appellant asserts that the trial court erred, as a matter of law, in requiring him to prove, with a precise parts-per-million measurement, his exact exposure to toxic chemicals, and that, in doing so, it exceeded the *Daubert* “gatekeeper” role. “[W]hile the trial court acts as the evidentiary gatekeeper, it is not a goalkeeper.” *King*, 762 N.W.2d at 43.

We think that appellant’s argument has mischaracterized the trial court’s ruling as requiring precise proof of the degree of exposure to toxic chemicals, and we decline to adopt the Nebraska authorities urged by appellant. The rules of admissibility, even for toxic-tort cases in which experts disagree, were established in *Daubert* and *Foote*, and the controlling issue in this appeal is whether the trial court abused its discretion in applying those rules. In *Kumho*, *supra*, the United States Supreme Court made it clear that the appellate court is to apply an abuse-of-discretion standard in reviewing a trial court’s decision to admit or exclude evidence, adding, “That standard applies as much to the trial court’s decisions about how to determine reliability as to its ultimate conclusion.” 526 U.S. at 152. Furthermore, the Arkansas Supreme Court has already rejected the precise argument raised by appellant, *i.e.*, that a *de novo* standard of review should apply to review of a trial court’s ruling regarding the admissibility of evidence in the context of *Daubert*. In *Green v. Alparma, Inc.*, *supra*, a case involving the admissibility of expert testimony concerning a purported relationship between exposure to an arsenical compound in chicken litter and leukemia, the Arkansas Supreme Court refused to apply a *de novo* standard of review. Adhering to well-established,

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longstanding precedent holding that the appellate courts review the admission of expert testimony under an abuse-of-discretion standard, that court stated, “In discussing our standard of review for evidentiary rulings, we have said that circuit courts have broad discretion and that a circuit court’s ruling on the admissibility of evidence will not be reversed absent an abuse of that discretion.” 373 Ark. at 397, 284 S.W.3d at 43. In concluding that the trial court had not abused its discretion in excluding expert testimony, the supreme court emphasized that it gives the circuit court considerable leeway in deciding how to determine whether particular expert testimony is reliable and that the person offering such proof carries the burden of proof on the issue of reliability.

In *King, supra*, the Nebraska Supreme Court reversed a trial court’s entry of summary judgment for a railroad, holding that it had erred in determining that the expert opinion offered by the appellant (the administratrix of the estate of the decedent, a former railroad employee who died of multiple myeloma) was unreliable. The expert opined that the decedent’s exposure to diesel-exhaust fumes while working for the railroad more likely than not was a contributing cause of his disease. He testified that a body of evidence, including human data and toxicology studies, supported his conclusions but did not cite any epidemiological study concluding that exposure to diesel exhaust caused multiple myeloma. The railroad’s expert testified that the causes of multiple myeloma were unknown and that the majority of epidemiological studies failed to show that diesel exhaust can cause multiple myeloma. The trial court excluded the appellant’s expert under *Daubert* on the grounds that

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his opinion did not have general acceptance in the field, that the studies he relied on failed to conclusively state that exposure to diesel fuel exhaust causes multiple myeloma, and that his differential etiology was unreliable. The trial court then granted summary judgment to the railroad. The appellate court reversed, noting that the trial court had not inquired into the methodology used by the expert and held that individual epidemiological studies need not draw definitive conclusions on causation before experts can conclude that an agent can cause a disease.

The court began its analysis with an explanation of the distinction between general causation and specific causation:

Other courts have similarly distinguished between general and specific causation. In a toxic tort case, general causation addresses whether a substance is capable of causing a particular injury or condition in a population, while specific causation addresses whether a substance caused a particular individual's injury. To prevail, a plaintiff must show both general and specific causation. But a court should first consider whether a party has presented admissible general causation evidence before considering the issue of admissible specific causation evidence.

The Federal Judicial Center's Reference Manual on Scientific Evidence (Reference Manual) explains that epidemiology focuses on general causation rather than specific causation. Plaintiffs do not always need epidemiological studies to prove causation. Yet, frequently, plaintiffs find epidemiological studies indispensable in toxic tort cases when direct proof of causation is lacking.

762 N.W.2d at 34–35.

The court explained, at length, the types of studies that epidemiologists use to determine whether an association exists between a suspected agent and a disease, ways to assess their reliability, and the inferences that can be drawn from them. It noted that precise

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information about the exposure necessary to cause harm and the plaintiff's exact exposure level are not always necessary to demonstrate that a substance is toxic to humans with substantial exposure; in occupational settings, humans are rarely exposed to chemicals in a manner permitting quantitative determination of adverse outcomes. It noted that the Eighth Circuit Court of Appeals had held, in *Bonner v. ISP Technologies, Inc.*, 259 F.3d 924 (8th Cir. 2001), that a plaintiff need not produce a mathematically precise table equating levels of exposure with levels of harm to show that he was exposed to a toxic level of a substance:

The court concluded that a plaintiff's claim does not fail simply because the medical literature had not yet conclusively shown the connection between the toxic substance and the plaintiff's condition. Thus, the court held that a plaintiff adduces sufficient evidence if a reasonable person could conclude that the plaintiff's exposure probably caused her injuries.

We have similarly upheld an expert's reliance on evidence of the plaintiff's substantial exposure to a known toxic substance. So allowing semiquantitative or qualitative estimates of exposure from occupational studies and the plaintiff's testimony seems appropriate here. The evidence shows that the safe exposure levels to diesel exhaust are set low because it can unquestionably cause some diseases.

762 N.W.2d at 41.

The court exhaustively set forth broad standards to assist trial courts in determining the reliability of expert testimony based on epidemiological evidence, stating that the significance of epidemiological studies with weak positive associations is a question of weight, not admissibility, and that it would decline to impose a statistical-significance requirement if an expert shows that others in the field would nonetheless rely on the study to support a

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causation opinion and that the probability of chance causing the study's results is low. It had the following to say about the number of studies relied upon by an expert:

Epidemiological studies assume an important role in determining causation when they are available, and particularly when they are numerous and span a significant period. Courts should normally require more than one epidemiological study showing a positive association to establish general causation, because a study's results must be capable of replication. But courts are understandably reluctant to set a specified minimum number of studies showing a positive association before an expert can reliably base an opinion on them—particularly when there are other, nonepidemiological studies also supporting the expert's opinion.

But we do not preclude a trial court from considering as part of its reliability inquiry whether an expert has cherry-picked a couple of supporting studies from an overwhelming contrary body of literature. Here, however, we need not determine whether Frank relied on a sufficient number of epidemiological studies. While BNSF contests Frank's studies on other grounds, it acknowledges that several studies have shown positive associations between multiple myeloma and exposure to diesel exhaust or benzene.

762 N.W.2d at 48.

The appellate court concluded that the district court had erred in concluding that the appellant's expert witness's causation opinion was unreliable because he could not point to a study that concluded that exposure to diesel exhaust caused multiple myeloma:

As explained, individual epidemiological studies need not draw definitive conclusions on causation before experts can conclude that an agent can cause a disease. If the expert's methodology appears otherwise consistent with the standards set out above, the court should admit the expert's opinion. But here, the court did not inquire into Frank's methodology.

Instead, the court summarily dismissed Frank's testimony as showing his reliance "on the 'totality of information regarding multiple myeloma, benzene and diesel exhaust' to reach his own subjective conclusions." Yet Frank, while admitting that studies existed finding no relationship, testified that a body of evidence supported his conclusion that diesel exhaust can cause multiple myeloma. The evidence he cited

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included human data studies, animal studies, and toxicology studies. Contrary to the district court's finding, Frank's testimony did not reflect a disconnect between an expert opinion and the underlying data. Frank's inquiry required him to consult the relevant scientific literature and draw a conclusion. We recognize that we have not previously set out legal standards for trial courts to follow in these cases. But, here, the court only considered whether the studies Frank relied upon showed a definite conclusion on a causal relationship. The court erred in applying a "conclusive study" standard.

It is true that King's evidence has some deficiencies. For some of the supporting studies Frank relied on, King only submitted to the court an abstract, or synopsis, of the study. And Frank failed to explain the criteria he used to reach his conclusion on causation. But these failures do not prove fatal here.

Although Frank did not personally conduct studies on the relationship between diesel exhaust and multiple myeloma, he was qualified to interpret studies on that relationship. And his reasoning appears consistent with the causation criteria discussed above. More important, these deficiencies played no role in the district court's decision because it only considered whether a study's results showed a conclusive causal relationship. We reverse the decision of the Court of Appeals with directions to remand the cause to the district court for further proceedings, and the parties can present methodology evidence on remand.

We recognize that a court's wrestling with this type of evidence is no small task. On remand, however, the district court may conduct a *Daubert/Schafersman* [*v. Agland Coop*, 631 N.W.2d 862 (Neb. 2001)] hearing. It should resolve any questions that it has or that BNSF raises regarding the sufficiency of the underlying studies or the reliability of Frank's opinion testimony. But the court should remember that regarding the sufficiency of the underlying studies, it should focus on whether no reasonable expert would rely on the studies to find a causal relationship—not whether the parties dispute their force or validity. And regarding the admissibility of Frank's opinion, the focus must be on the validity of his methodology and whether good grounds exist for his opinion—not whether his ultimate conclusion differs from that of other experts.

762 N.W.2d at 48–49.

On the issue of specific causation, the court further held that the trial court had erred in determining that the appellant's expert's differential etiology (which refers to determining

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the causes of a disease or disorder) was unreliable. It concluded that “the primary admissibility issue for Frank’s opinion on specific causation is whether he had good grounds for ruling in Bradley’s diesel exhaust exposure as a plausible cause of his cancer.” 762 N.W.2d at 51.

In *Epp v. Lauby*, *supra*, the court held that, when an expert bases his opinion on a reliable methodology, a court should not exclude it solely because a disagreement exists between the parties’ qualified experts.

In *Boren v. Burlington*, *supra*, the Nebraska Court of Appeals affirmed a trial court’s entry of judgment on a jury verdict for a plaintiff’s toxic-tort claim under FELA for harm caused by long-term exposure to toxic chemicals while working for the railroad. On appeal, the railroad argued that the trial court had erred in denying its motions for summary judgment and in allowing the plaintiff’s experts to testify. It contended that the medical-causation experts lacked a proper factual basis for their opinions because they did not have information on the specific chemicals that the plaintiff had been exposed to or on the specific doses, length, or level of exposures. The court concluded that there was sufficient evidence of both the specific chemicals to which the plaintiff was exposed and the level of exposure:

There is no dispute that Boren was unable to present any specific information concerning the dose or level of any of the chemicals to which he was exposed. Burlington asserts that such evidence was necessary before the proffered expert opinions could be deemed admissible. As noted, this argument comprises the bulk of Burlington’s brief on appeal. However, we conclude that Boren did not need any more specific evidence than was presented on this issue.

Boren presented general testimony concerning how often he would use the various chemicals and for how long he would use them on various occasions. Other employees of Burlington that testified also testified concerning how long various tasks

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would take, during which time an employee would be exposed to the chemicals. However, Boren had no specific evidence concerning exact dosage levels.

Dr. Frank testified that in his experience as a specialist in occupational medicine, information on specific dosage levels is generally unavailable. He testified that there is generally no way for an employee to measure such levels or doses of exposure and that the only way such information would be available would be if the employer were to make measurements and keep records. Dr. Frank testified, however, that such specific information is not necessary to form an opinion on causation. Dr. Frank testified that such specific information is not necessary when conducting a differential diagnosis because there was evidence that Boren was exposed to the variety of chemicals over a period of years, that there was evidence that such exposure could cause the medical problems experienced by Boren, and that there was evidence to rule out other possible causes of Boren's medical problems. In addition, Dr. Frank testified that the fact that Boren had acute reactions to the chemicals on a number of occasions, including skin reactions, breathing problems, and headaches, was indicative of the level of exposure being adequate to form an opinion on causation.

Although Burlington cites this court to a number of federal cases that have held, on their particular facts and records, that expert opinions were inadequate without specific evidence of levels or doses of exposure, we find them unpersuasive in the instant case. See *Curtis v. M & S Petroleum, Inc.*, 174 F.3d 661 (5th Cir. 1999); *Mitchell v. Gencorp, Inc.*, 165 F.3d 778 (10th Cir. 1999) (concerning need for quantifiable evidence of levels of exposure); *Savage v. Union Pacific R. Co.*, 67 F. Supp.2d 1021 (E.D. Ark. 1999). In the present case, there was specific evidence presented that an opinion of causation is not dependent on having evidence of specific levels of exposure. Boren did not need to produce a mathematically precise table equating levels of exposure with levels of harm in order to show that he was exposed to a toxic level of the various chemicals. See *Bonner v. ISP Technologies, Inc.*, 259 F.3d 924 (8th Cir. 2001). Rather, he needed only to present evidence from which a reasonable person could conclude that his exposure probably caused his injuries. See *id.*

On the specific facts of the present case, Boren established that over a period of 30 years, he was exposed to a variety of chemicals. He established in general terms the length of time he would spend using the various chemicals. He testified regarding acute reactions to the symptoms. He presented evidence of other workers to confirm the acute reactions experienced by other workers. He presented evidence that ruled out other causes of his medical condition. He presented evidence that various medical literature has long suggested a causal link between the chemicals he was exposed to and the medical condition he experienced. He also presented evidence that all of these

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factors are sufficient to form the basis of an opinion on causation. On these specific facts, we do not find that the trial court abused its discretion in concluding that Boren presented adequate evidence of levels of exposure.

637 N.W.2d at 922–23.

These Nebraska cases are not in accord with federal precedent based on Arkansas law. In support of its decision in the present case, the trial court cited *Wright v. Willamette Industries, Inc.*, 91 F.3d 1105 (8th Cir. 1996), in which residents near a manufacturing plant brought a negligence action against the plant owner for harm they allegedly suffered from their exposure to emissions of wood-fiber particles that contained formaldehyde. The federal district court entered judgment for the plaintiffs. The Eighth Circuit, however, reversed, holding that the plaintiffs failed to satisfy Arkansas tort law’s requirement that they produce evidence that they were exposed to a hazardous level of formaldehyde. The court of appeals held that a plaintiff in a common-law toxic-tort case must prove the levels of exposure that are hazardous to human beings generally, as well as the plaintiff’s actual level of exposure to the defendant’s toxic substance:

At a minimum, we think that there must be evidence from which the factfinder can conclude that the plaintiff was exposed to levels of that agent that are known to cause the kind of harm that the plaintiff claims to have suffered. . . . We do not require a mathematically precise table equating levels of exposure with levels of harm, but there must be evidence from which a reasonable person could conclude that a defendant’s emission has probably caused a particular plaintiff the kind of harm of which he or she complains before there can be a recovery.

91 F.3d at 1107 (citation omitted).

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In *Savage v. Union Pacific Railroad Co.*, 67 F. Supp. 2d 1021 (E.D. Ark. 1999), the district court granted the defendant railroad's motion to exclude the causation testimony of the plaintiff's experts in a FELA suit. The court held that his expert's opinions that his basal cell carcinoma was caused by exposure to creosote were not scientifically reliable. It recognized the "tension between the *Daubert* standard for admission of expert testimony and the FELA standard on causation for submission of a case to a jury." 67 F. Supp.2d at 1027. Noting that, under FELA, the quantum of evidence sufficient to present a jury question of causation is less than it is in a common-law tort action, it held that even in FELA cases, courts must still demonstrate some causal connection (more than a mere possibility) between a defendant's negligence and their injuries; the negligence of the defendant need not be the sole cause of the plaintiff's injuries.

The court acknowledged that the Eighth Circuit's decision in *Wright* requires hard evidence of levels of exposure, although some other appellate courts have applied a more relaxed standard. It stated:

Of course, knowledge of the extent of exposure to a potentially harmful substance is essential to any reliable expert opinion that the particular substance caused a disease. In 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." *Wright v. Willamette Indus., Inc.*, 91 F.3d 1105, 1106 (8th Cir. 1996). The existence of this requirement is not surprising. As one court has explained, "[t]he underlying predicates of any cause-and-effect medical testimony are that medical science understands the physiological process by which a particular disease or syndrome develops and knows what factors cause the process to occur." *Black v. Food Lion, Inc.*, 171 F.3d 308, 314 (5th Cir. 1999). However, the evidence regarding exposure does

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not have to be “mathematically precise.” *Wright*, 91 F.3d at 1107. The Fourth Circuit has cautioned that

while precise information concerning the exposure necessary to cause specific harm to humans and exact details pertaining to the plaintiff’s exposure are beneficial, such evidence is not always available, or necessary, to demonstrate that a substance is toxic to humans given substantial exposure and need not invariably provide the basis for an expert’s opinion on causation.

*Westberry v. Gislaved Gummi AB*, 178 F.3d 257 (4th Cir. 1999); *see also, Heller v. Shaw Industries*, 167 F.3d 146, 157 (3d Cir. 1999) (noting “that even absent hard evidence of the level of exposure to the chemical in question, a medical expert could offer an opinion that the chemical caused plaintiff’s illness”). fn6

fn6 The more “relaxed” standards described above in *Westberry* and *Heller* appear to be in conflict with the Eighth Circuit’s opinion in *Wright*, which seems to require hard evidence of levels of exposure. However, it is the Court’s opinion that the Plaintiff, Mr. Savage, has not even met the “relaxed” standards of *Westberry* and *Heller*.

67 F. Supp. 2d at 1031–32.

The court held that the plaintiff had failed to present the fundamental information necessary to establish the scientific validity of the expert’s opinions with respect to creosote:

There is sufficient evidence that Plaintiff was around and physically in touch with the creosote. In Dr. Boyd’s view the Plaintiff had “prolonged exposure,” indeed, “years” of exposure. But Plaintiff has produced no scientific data showing the *nature* of creosote exposure required to initiate or promote the development of basal cell carcinoma. Nor has he shown the *level* of such exposure needed to cause such skin cancer in humans generally. Nor does he show with any degree of scientific reliability the level of his own exposure.

67 F. Supp. 2d at 1033–34. *Accord Junk v. Terminix Int’l Co. Ltd. P’ship*, 628 F.3d 439 (8th Cir. 2010); *McLain v. Metabolife Int’l, Inc.*, 401 F.3d 1233 (11th Cir. 2005); *Mitchell v. Gencorp, Inc.*, 165 F.3d 778 (10th Cir. 1999); *Moore v. Ashland Chemical, Inc.*, 151 F.3d 269 (5th Cir.

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1998), *cert. denied*, 526 U.S. 1064 (1999); *Wintz v. Northrop Corp.*, 110 F.3d 508 (7th Cir. 1997); *Allen v. Pennsylvania Eng'g Corp.*, 102 F.3d 194 (5th Cir. 1996); *Missouri Pac. R.R. Co. v. Navarro*, 90 S.W.3d 747 (Ct. App. Tex. 2002).

In *Navarro, supra*, a railroad worker who had been diagnosed with multiple myeloma brought a FELA action claiming that she had acquired her disease from the diesel exhaust she had been exposed to at work. She obtained a jury verdict. On appeal, the Texas Court of Appeals reversed, holding that her experts' testimony (about the level of her exposure and causation) should not have been admitted. One of her experts relied on the Boffetta article relied on by appellant's expert in this case:

Dr. Hari Dayal, an expert in cancer epidemiology, also testified for Navarro. Dr. Dayal testified that railroad workers who come in contact with diesel exhaust have six times the risk of developing multiple myeloma. He also testified that exposure to diesel exhaust contributed to the development of Manuela's multiple myeloma. In reaching his opinion, he looked at many studies. One study he relied on is the *Boffetta* study, conducted by the American Cancer Society, which, according to Dr. Dayal, showed that railroad workers have a six times greater risk of developing multiple myeloma. The *Boffetta* study, however, does not reach the same conclusion Dr. Dayal reaches. In the *Boffetta* study, there were only three cases of multiple myeloma in railroad workers reported. Thus, the authors of the *Boffetta* study concluded that the results regarding railroad workers (and several other occupations) and multiple myeloma were inconclusive because they were either statistically insignificant or based on only a small number of exposed subjects. The authors concluded that people who reported they had been exposed to diesel exhaust had no statistically significant increased risk of getting multiple myeloma. The *Boffetta* study does show diabetes as a risk factor for multiple myeloma. It is undisputed that Manuela and others in her family suffered from diabetes.

Dr. Dayal also relied on the *Hansen* study. According to Dr. Dayal, the *Hansen* study shows a statistically significant relationship between being a truck driver extensively exposed to diesel exhaust and developing multiple myeloma. Dr. Dayal conceded that the author of the *Hansen* study actually concludes there is no

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relationship, but he believes that finding is a false negative. In other words, even though the study says there is no relationship, he believes there really is a relationship because the measurement of exposure was not perfect.

Dr. Hansen, the author of the *Hansen* study, admits there are problems with the data in her study. She concluded that, based on the observation of only five deaths from multiple myeloma, the finding was statistically significant but may have been due to chance. Dr. Dayal, however, does not agree with Dr. Hansen's conclusion.

90 S.W.3d at 752.

The railroad's expert, Dr. Wong, testified that it was his opinion that there is no causal relationship between exposure to diesel exhaust and the risk of developing multiple myeloma, that he had performed his own study, and that he had looked at the Boffetta and Hansen studies:

The *Boffetta* study found only half of the railroad workers in the study were even exposed to diesel exhaust and concluded the risk factor for railroad workers was not statistically significant or it was based on too small a number of exposed subjects. Dr. Wong also reviewed the *Hansen* study and determined it showed a significant risk, but the numbers are too small to rely on. He reviewed other studies that show no increased risk. The majority of the studies show no statistically significant risk. Dr. Wong testified that in this case there has been no quantification of the exposure levels of a particular chemical agent. Dr. Wong did state that when there are no records of exposure levels, the best we can do is look at individual job titles and consider the exposure levels for those respective job titles.

90 S.W.3d at 753.

The court found that Dr. Dayal's methodology was unreliable:

The author of the *Boffetta* study noted that because there were only three railroad worker deaths from multiple myeloma in the study, there was no statistical significance between railroad workers and multiple myeloma. Further, the *Boffetta* study recognized that less than 50% of railroad workers even reported exposure to diesel exhaust. Thus it is impossible to tell whether any or all of the three railroad workers who developed multiple myeloma were even exposed to diesel exhaust. Dr.

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Dayal disagreed with Boffetta's refusal to find a statistically significant relationship. In other words, Dr. Dayal took the data collected by Boffetta and reached a conclusion regarding causation that Boffetta himself was unwilling to make.

The *Hansen* study is similar to the *Boffetta* study in that the author likewise refused to find that exposure to diesel exhaust causes multiple myeloma. Dr. Hansen concluded that, although the finding was statistically significant, it may have been due to chance. Dr. Dayal disagreed and chose to rely on the *Hansen* report for his opinion that exposure to diesel exhaust causes multiple myeloma. Dr. Dayal's methodology for determining causation has been rejected as unreliable. See *General Electric Co. v. Joiner*, 522 U.S.136, 145, 118 S.Ct. 512, 139 L.Ed.2d 508 (1997) (holding where authors of study on which plaintiff's experts relied were unwilling to find causal relationship between exposure to toxic substance and plaintiff's disease, such study does not support plaintiff's expert's causation conclusion).

Dr. Dayal also looked at several other studies, some of which he stated were almost statistically significant. And, he admitted there were other studies which showed no association between diesel exhaust and multiple myeloma. He chose to ignore those studies, however, and only relied on his interpretation of the data collected by Boffetta and Hansen. Dr. Dayal's testimony is further flawed in that he was unable to testify as to what level of diesel exhaust would create a risk of multiple myeloma.

90 S.W.3d at 757.

The court also held that another expert's testimony, that there is no safe level of exposure to certain components of diesel exhaust, should not have been admitted because that reasoning had been rejected in other cases. It concluded:

The theory that diesel exhaust causes multiple myeloma has been tested in the many epidemiological studies that were reviewed in this case by the experts. None of the studies found a causal relationship—Navarro's experts are the only ones who have been willing to make the connection, based on only two studies, whose authors expressly declined to find causation. The theories Navarro's experts relied on are quite subjective, given the fact that no scientific studies support their opinions. The theory that exposure to diesel exhaust causes multiple myeloma has been subjected to peer review and the majority found no heightened risk. The technique's potential rate of error is incapable of being analyzed. The evidence clearly shows Navarro's witnesses' theories have not been generally accepted as valid by the scientific community and the

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theories have been put to no non-judicial uses. The record shows that Navarro's expert witnesses are alone in the scientific community in their opinions that exposure to diesel exhaust causes multiple myeloma. Their opinions were developed solely for the purpose of using them to prove causation in this lawsuit. Opinions that have been formed only for the purpose of testifying are more likely to be biased toward a particular result. [*E.I. du Pont de Nemours & Co. v. Robinson*, 923 S.W.2d [549, 559].

90 S.W.3d at 758.

Applying the applicable abuse-of-discretion standard, we cannot say that the trial court abused its discretion in granting the motion in limine. The fact that some studies showed that higher levels of benzene could cause multiple myeloma does not prove that the lower levels of that chemical found in diesel exhaust and fuel played a role in causing appellant's disease. Appellant produced no reliable data of his actual exposure to diesel exhaust or benzene.

Dr. Brautbar's reliance on Infante's study was misplaced, in view of the fact that it analyzed chemical workers, not railroad employees, with direct exposure to nearly-pure benzene. Dr. Brautbar's reliance on the Boffetta study was also misplaced, as the study's author did not conclude that diesel exhaust caused multiple myeloma. He did not explain the limitations of the Flodin study and its author's recognition of those limitations. The Hansen study, on which Dr. Brautbar also relied, was expressly rejected in *Navarro*. Appellee also demonstrated that Dr. Brautbar ignored studies that did not support his opinion. Wabeke only relied on anecdotal testimony about that subject and, in fact, refused to consider appellee's test results, and defined "excessive exposure" as anything above ambient levels. We agree with those courts that have rejected Wabeke's belief that any dose above background levels can cause multiple myeloma. See *Missouri Pac. R.R. Co. v. Navarro, supra*.

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Affirmed.

HART and ROBBINS, JJ., agree.