

1 **IN THE SUPREME COURT OF THE STATE OF NEW MEXICO**

2 **Opinion Number:** _____

3 **Filing Date:** March 3, 2016

4 **NO. S-1-SC-33884**

5 **CONCEPTION AND ROSARIO ACOSTA et al.,**

6 Plaintiffs/Intervenors-Petitioners,

7 v.

8 **SHELL WESTERN EXPLORATION AND**
9 **PRODUCTION, INC., and SHELL OIL COMPANY,**

10 Defendants-Respondents.

11 **ORIGINAL PROCEEDING ON CERTIORARI**

12 **Freddie Joseph Romero, District Judge**

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1 **OPINION**

2 **DANIELS, Justice.**

3 **I. INTRODUCTION**

4 {1} From the 1920s through 1993, Defendants Shell Western Exploration and
5 Production, Inc. and Shell Oil Company (collectively, Shell) engaged in oil and gas
6 operations in Hobbs, New Mexico. Environmental contamination from these
7 operations was discovered years later, and over two hundred residents of the
8 contaminated area brought this toxic tort action against Shell for personal injury
9 damages that included systemic lupus erythematosus (lupus) and other autoimmune
10 disorders. Plaintiffs allege that toxic chemicals from crude oil caused their
11 autoimmune disorders. They challenge the district court’s exclusion of the scientific
12 evidence and expert testimony they offered in support of this theory, and they
13 challenge the resulting partial summary judgment in favor of Shell.

14 {2} We hold that the district court applied an incorrect standard of admissibility in
15 its evidentiary rulings and that Plaintiffs’ causation evidence should have been
16 admitted. Because summary judgment as to Shell’s culpability for the autoimmune
17 disorders was granted to Shell as a result of this improper exclusion of evidence, we
18 reverse the summary judgment and remand to the district court for further
19 proceedings.

1 **II. BACKGROUND**

2 {3} Plaintiffs are residents of the Westgate subdivision in Hobbs. Westgate was
3 built in the late 1970s on and near an unlined storage pit where, during its oil drilling
4 operations, Shell had placed toxic hydrocarbons in direct contact with the earth from
5 the 1940s until Shell covered the pit with “fill dirt” during the 1960s. Shell did not
6 conduct any environmental risk assessment of the pit while it was in operation or after
7 it was covered. Shell never reported releases or leaks of toxic chemicals to the New
8 Mexico Oil Conservation Division and did not notify the Westgate subdivision
9 builder that the hydrocarbon storage pit existed beneath Tasker Drive in the new
10 subdivision.

11 {4} Shell had conducted oil and gas operations on the Grimes lease. The operations
12 included storing crude oil in the Grimes tank battery, located just west of the Tasker
13 pit. Shell decommissioned the Grimes tank battery in 1993 and turned the Grimes
14 lease over to Altura Energy, Ltd. by 1997. Massive hydrocarbon contamination of the
15 soil, extending sixty-five feet below ground level and into the aquifer, was discovered
16 while dismantling the Grimes tank battery in 1997. Later that year, home builders in
17 Westgate discovered a hard layer of hydrocarbon contaminants one to two feet below
18 the ground surface that varied in thickness from several inches to several feet. Below

1 that layer was oily soil saturated with toxic hydrocarbons. The contamination
2 extended across properties on both sides of Tasker Drive. Parts of the area remained
3 contaminated at the time of trial, despite years of attempted remediation involving
4 removal of hundreds of truckloads of contaminated earth, massive tents, the closure
5 of part of Tasker Drive, noise, foul smells, and dusty air.

6 {5} Plaintiffs asserted claims against Shell for negligence, strict liability, nuisance,
7 and trespass and alleged that they had suffered injuries from their exposure to
8 contamination from Shell's oil operations. The alleged injuries included lupus and
9 other autoimmune disorders, neurological diseases, and respiratory diseases. Only the
10 claims involving autoimmune disorders are at issue in this appeal.

11 {6} Plaintiffs sought to offer the expert testimony of Dr. James Dahlgren that
12 Plaintiffs' lupus and other autoimmune disorders were caused or aggravated by
13 long-term exposure to a mixture of benzene and other organic solvents, hydrocarbons
14 such as pristane and phytane, and mercury (the agents), all of which are toxic
15 chemicals found in crude oil. As support for this causation opinion, Dahlgren
16 provided numerous animal and human studies that linked the agents to immune
17 system disruption, autoimmune diseases, and lupus.

18 {7} Lupus is a complex and potentially fatal inflammatory disorder that can affect

1 various parts of the body, including the joints, skin, kidneys, heart, lungs, blood
2 vessels, and brain. Physicians diagnose lupus when a patient presents with at least
3 four of the American College of Rheumatology's "Eleven Criteria of Lupus." These
4 criteria include rashes, ulcers, arthritis, and immunological disorders.

5 {8} Humans and mice with lupus also demonstrate a deficit of natural killer cells
6 (NKC) that play a critical role in the normal functioning of a healthy immune system.
7 Dahlgren proffered his own published and peer-reviewed epidemiological study that
8 quantified Plaintiffs' exposure to the agents, gathered Plaintiffs' medical histories,
9 studied their medical conditions, compared these results with those of a control group
10 in a nonexposed community, and discussed a number of toxicological studies on mice
11 that associated autoimmune disorders with exposure to pristane (the animal studies).

12 {9} Dahlgren's study obtained medical records and questionnaire responses from
13 all Plaintiffs, samples of blood from a volunteer subgroup of Plaintiffs, samples of
14 house dust from some of their Westgate homes, and analysis results of the air
15 monitored by Shell at multiple locations in the exposed Westgate neighborhood. The
16 sample analysis results were used to measure the presence of the agents in the
17 subjects' environment and in the volunteer subjects themselves. As compared to the
18 analysis results of equivalent samples obtained from volunteers in the control

1 community and from their surroundings, Dahlgren measured elevated levels of
2 pristane and phytane in Plaintiffs' blood samples and elevated levels of mercury,
3 pristane and phytane, benzene, and other hydrocarbons in Plaintiffs' home
4 environments.

5 {10} Dahlgren also compiled the medical histories and physical examination results
6 from a "volunteer sample of 90 adult[]" Plaintiffs of the Westgate subgroup and from
7 members of the nonexposed control community to compare the occurrence of disease
8 and symptoms in the two communities. He observed an "[i]ncreased prevalence[] of
9 symptoms thought to be predictive of autoimmune disorder" in Plaintiffs' community.

10 The NKC were significantly fewer in the Westgate residents than in residents of the
11 control community while the presence of B-lymphocytes was significantly greater in
12 the Westgate population. The deficit of NKC in combination with elevated
13 B-lymphocytes indicated abnormalities in Plaintiffs' immune systems.

14 {11} Dahlgren's study of Plaintiffs "by questionnaire and medical record review"
15 identified thirteen diagnosed cases of lupus on two blocks in the area of the Westgate
16 neighborhood on or near the Tasker pit. In the Westgate community, diagnoses of
17 lupus and rheumatic disease, another autoimmune disorder, were ten times those in
18 the control community. Plaintiffs "got the diseases . . . after moving into the

1 neighborhood,” and many of them reported a lessening or even a total remission of
2 the symptoms after leaving the Westgate neighborhood. To explain the prevalence of
3 these diseases in Westgate compared to the unexposed control community, Dahlgren
4 concluded that the agents caused the statistically significant elevation in occurrences
5 of autoimmune disorders.

6 {12} Dahlgren’s study acknowledged that it could not point definitively to any
7 human cases of pristane-induced lupus, but it referred to a number of other studies
8 demonstrating that mercury is “conclusively known” to cause immune system
9 disruption in animals and humans and that benzene adversely impacts the immune
10 system in humans. Dahlgren also referred to at least thirteen animal studies
11 establishing that pristane exposure in mice induces autoimmunity and lupus, one
12 study stating that pristane could be involved in some cases of human lupus, and one
13 study indicating that phytane would have a similar effect due to its comparable
14 molecular structure and toxicity.

15 {13} In his affidavit, Dahlgren asserted that his study was conducted pursuant to the
16 methodological standards set by the Federal Judicial Center’s *Reference Manual on*
17 *Scientific Evidence* (2d ed. 2000). Dahlgren’s study included (1) an analysis of
18 Plaintiffs’ medical conditions through patient history, medical records, physical

1 examination, and diagnostic testing, (2) an analysis of exposure information and the
2 temporal relationship between exposure and illness, (3) a review of the medical and
3 scientific evidence to determine whether the exposure can cause the illness (“general
4 causation”), and (4) an application of the general knowledge to the specific
5 circumstances of the case to determine whether the exposure did cause the illness,
6 including consideration of other possible causes (“specific causation”).

7 {14} Dahlgren presented evidence that extrapolation of the results of the animal
8 studies referenced in his study provided the scientifically valid basis for his causation
9 opinion in this case. He determined that the dose of pristane Plaintiffs received from
10 prolonged household exposure, adjusted for the weight of a human, was within the
11 range of the potentially “harmful dose” determined in the animal studies. He
12 discussed several other studies of oilfield outbreaks of autoimmune disease, one of
13 which cited a rate of lupus that was well above the national rate but only one eighth
14 the rate of lupus found in Westgate.

15 {15} Dahlgren also ruled out several possible alternative explanations for the
16 elevated occurrence of autoimmune disorders in Westgate, such as genetic
17 susceptibility or drug-induced autoimmunity. He then hypothesized that the agents
18 found in the Westgate community, including pristane, phytane, benzene, and mercury,

1 have a synergistic effect and are more toxic in combination than their additive,
2 comparable, individual toxicities. He cited the *Reference Guide on Toxicology* and
3 the Environmental Protection Agency guidelines regarding the concerted effect of
4 mixtures of toxic agents on the body. *See* Bernard D. Goldstein & Mary Sue Henifin,
5 *Reference Guide on Toxicology*, in Fed. Jud. Ctr., *Reference Manual on Scientific*
6 *Evidence* 401, 429, 436 (2d ed. 2000); Guidelines for the Health Risk Assessment of
7 Chemical Mixtures, 51 Fed. Reg. 34014, 34014-34022 (Sept. 24, 1986). Even Shell's
8 expert agreed that it is important for an expert to consider how multiple chemicals
9 interact and to use scientific judgment to determine whether they interact.

10 {16} Dahlgren considered all of this evidence and more before concluding that
11 Plaintiffs' inhalation, ingestion, and absorption of the combination of various toxins
12 from Shell's oil and gas operations caused or aggravated their lupus and other
13 autoimmune disorders.

14 {17} The district court excluded Dahlgren's study of blood pristane data and his
15 determination of Plaintiffs' cumulative dose from prolonged exposure as unreliable,
16 and Plaintiffs did not challenge those rulings on appeal. But the district court also
17 excluded the animal studies and Dahlgren's study itself as not relevant, reasoning
18 they failed to show general causation between the mixture of identified chemicals and

1 lupus. Contrary to Dahlgren’s affidavit, the district court found that he had not
2 considered the dose-response relationship necessary for inferring causation in humans
3 from toxicological results in animals and stated that the animal studies were “so
4 dissimilar to the facts presented [t]herein that the [district c]ourt d[id] not find them
5 relevant.” It concluded that Dahlgren’s study had “limited value as a basis for a causal
6 connection opinion” because it was a “hypothetical” study “admittedly done only for
7 comparison purposes” and therefore that it had failed to “bridge the gap from
8 association to causation” and could not stand alone to support Plaintiffs’ claims of a
9 causal relationship between the alleged mixture and lupus. As a result, the district
10 court excluded Dahlgren’s causation opinion due to “insufficient” evidentiary support
11 and, based on the consequential lack of causation evidence, granted Shell’s motion
12 for summary judgment on Plaintiffs’ claims for damages from lupus and other
13 autoimmune disorders.

14 {18} Plaintiffs appealed the grant of summary judgment, challenging the district
15 court’s exclusions of the animal studies and Dahlgren’s study based on relevance and
16 its exclusion of Dahlgren’s causation opinion for “insufficient” evidence. *Acosta v.*
17 *Shell W. Expl. & Prod., Inc.*, 2013-NMCA-009, ¶¶ 1, 12, 293 P.3d 917. The Court of
18 Appeals affirmed the district court’s grant of summary judgment, holding that the

1 district court did not abuse its discretion when it concluded that Dahlgren’s study and
2 the animal studies were “not sufficient” in either bridging the analytical gap from
3 association to causation or in establishing causation between the agents and
4 Plaintiffs’ lupus and autoimmune disorders. *Id.* ¶¶ 27, 30, 33.

5 {19} The Court of Appeals interpreted the district court’s evidentiary ruling that
6 Dahlgren’s study did not “fit” the case as an issue of relevance. *See id.* ¶¶ 20, 28
7 (stating that “the district court specifically chose not to address whether Dr.
8 Dahlgren’s methodology was reliable” and instead “excluded Dr. Dahlgren’s
9 epidemiologic study and his opinion testimony on the basis of relevance”). The Court
10 of Appeals agreed with the district court, stating that “Plaintiffs could not articulate
11 any study, other than Dr. Dahlgren’s own study of the Westgate population, that
12 would support the opinion that the petrochemical mixture caused the lupus and other
13 autoimmune disorders identified in this case” and that “Dr. Dahlgren’s study is only
14 relevant to show a generally higher incidence of certain medical disorders in two
15 community groups but is insufficient to establish a general causation link to lupus and
16 other autoimmune disorders.” *Id.* ¶¶ 26, 32. We granted certiorari and now reverse the
17 Court of Appeals and the district court. *See Acosta v. Shell W.*, 2012-NMCERT-012.

18 **III. STANDARD OF REVIEW**

1 {20} Generally, the admission or exclusion of evidence is reviewed on appeal for
2 abuse of discretion. *State v. Downey*, 2008-NMSC-061, ¶ 24, 145 N.M. 232, 195 P.3d
3 1244. But in this case, the threshold question is whether the district court applied the
4 correct evidentiary standard, a legal question we review de novo. *State v. Torres*,
5 1999-NMSC-010, ¶ 28, 127 N.M. 20, 976 P.2d 20. We also review de novo the
6 related inquiry of whether the district court properly granted Shell’s motion for partial
7 summary judgment. *See Smith v. Durden*, 2012-NMSC-010, ¶ 5, 276 P.3d 943 (“We
8 view the facts in the light most favorable to the party opposing the summary judgment
9 and indulge all reasonable inferences in favor of a trial on the merits.”). Summary
10 judgment is appropriate only where “there is no genuine issue as to any material fact
11 and . . . the moving party is entitled to a judgment as a matter of law.” Rule 1-056(C)
12 NMRA.

13 **IV. DISCUSSION**

14 {21} “Admissibility is a minimal standard for individual items of evidence,
15 including expert opinions.” *State v. Consaul*, 2014-NMSC-030, ¶ 67, 332 P.3d 850.
16 “[T]o be admissible an item of evidence need only add something to the debate; it
17 need only have a ‘tendency to make a fact more or less probable than it would be
18 without the evidence.’” *Id.* (quoting Rule 11-401 NMRA).

1 **A. The Admissibility of Expert Testimony Under New Mexico Law**

2 {22} The admissibility of expert testimony in New Mexico is guided by Rule 11-702
3 NMRA, which sets out three requirements: “(1) that the expert be qualified; (2) that
4 the testimony be of assistance to the trier of fact; and (3) that the expert’s testimony
5 be about scientific, technical, or other specialized knowledge with a reliable basis.”
6 *Downey*, 2008-NMSC-061, ¶ 25.

7 {23} The district court found that Dahlgren was qualified to provide opinions
8 regarding specific and general causation in this case. Further, the district court
9 “[d]isregard[ed] the questions of invalid data, unreliable methodology and the other
10 issues raised by Shell,” focusing instead on the second admissibility requirement of
11 whether Dahlgren’s testimony would assist the trier of fact. This requirement “goes
12 primarily to relevance” as “[e]xpert testimony which does not relate to any issue in
13 the case is not relevant and, ergo, non-helpful.” *Daubert v. Merrell Dow Pharm., Inc.*,
14 509 U.S. 579, 591 (1993) (internal quotation marks and citation omitted).

15 {24} Shortly after *Daubert*, this Court stated that the “pertinent inquiry” for
16 determining whether expert testimony will assist the trier of fact under the second
17 requirement of Rule 11-702 “must focus on the proof of reliability of the scientific
18 technique or method upon which the expert testimony is premised.” *State v. Alberico*,

1 1993-NMSC-047, ¶ 53, 116 N.M. 156, 861 P.2d 192. A court must determine whether
2 the proffered expert testimony is “sufficiently tied to the facts of the case that it will
3 aid the jury in resolving a factual dispute.” *Downey*, 2008-NMSC-061, ¶ 30 (internal
4 quotation marks and citation omitted). “[T]he scientific methodology [must] ‘fit[]’ the
5 facts of the case and thereby prove[] what it purports to prove.” *Id.* The inquiry is “a
6 flexible one,” and its focus “must be solely on principles and methodology, not on the
7 conclusions that they generate.” *Daubert*, 509 U.S. at 594-95; *see also Alberico*,
8 1993-NMSC-047, ¶ 72 (“There is no requirement that a scientific technique or
9 method prove conclusively what it purports to prove.”). As the United States Supreme
10 Court emphasized, “it would be unreasonable to conclude that the subject of scientific
11 testimony must be ‘known’ to a certainty; arguably, there are no certainties in
12 science.” *Daubert*, 509 U.S. at 590. Rather, “the scientific procedure which supports
13 the testimony [must be] capable of supporting opinions based upon a reasonable
14 probability rather than conjecture.” *Alberico*, 1993-NMSC-047, ¶ 98 (internal
15 quotation marks and citation omitted).

16 {25} Since *Daubert*, the federal courts have continued to refine the standards for
17 admissibility of expert testimony, but New Mexico has not followed these changes
18 in lockstep with the federal courts. In *Kumho Tire Co. v. Carmichael*, the United

1 States Supreme Court extended a trial court’s gate-keeping function under *Daubert*
2 to include expert testimony based on nonscientific experience and training. *See*
3 *Kumho Tire Co.*, 526 U.S. 137, 151 (1999). Yet, in *Torres*, this Court limited
4 application of the *Daubert/Alberico* requirements to expert testimony that requires
5 scientific knowledge. *See Torres*, 1999-NMSC-010, ¶ 43. Accordingly, committee
6 commentary on Rule 11-702 warns of the differences between federal and New
7 Mexico law in applying the *Daubert* requirements. *See* Rule 11-702 comm. cmt.
8 (“New Mexico has not adopted the changes made to the federal rule in 2000 to
9 incorporate the requirements of *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509
10 U.S. 579 (1993), in light of the differences between federal law and New Mexico law
11 regarding whether *Daubert* applies to nonscientific testimony.”); *see also Banks v.*
12 *IMC Kalium Carlsbad Potash Co.*, 2003-NMSC-026, ¶ 19, 134 N.M. 421, 77 P.3d
13 1014 (observing that “after *Kumho Tire Co.*, we apply *Daubert* somewhat differently
14 than do the federal courts”).

15 {26} In *General Electric Co. v. Joiner*, the United States Supreme Court affirmed
16 a district court’s determination to exclude an expert’s causation testimony on grounds
17 of relevance, noting that “[a] court may conclude that there is simply too great an
18 analytical gap between the data and the opinion proffered.” 522 U.S. 136, 146 (1997).

1 In the case at bar, both the district court and the Court of Appeals cited this *Joiner*
2 proposition as a key reason for excluding Dahlgren’s general causation testimony
3 pertaining to Plaintiffs’ development of lupus and other autoimmune conditions and
4 determined that the analytical gap between the evidence presented and the inference
5 drawn on the ultimate issue of causation was too wide. *See Acosta*, 2013-NMCA-009,
6 ¶¶ 23-24, 27.

7 {27} But New Mexico has never adopted the *Joiner* rule that a judge may reject
8 expert testimony where the “analytical gap” between the underlying evidence and the
9 expert’s conclusions is “too great,” *see* 522 U.S. 146, and we refuse to do so in this
10 case. Historically, this Court has placed great value on allowing a jury to hear
11 evidence and decide a case on the merits. *See, e.g., Zamora v. St. Vincent Hosp.*,
12 2014-NMSC-035, ¶¶ 10-11, 335 P.3d 1243 (stating that this Court has maintained
13 New Mexico’s notice pleading requirements based on our “policy of avoiding
14 insistence on hypertechnical form and exacting language” and on a rationale of
15 resolving disputes on their merits); *Romero v. Philip Morris Inc.*, 2010-NMSC-035,
16 ¶ 8, 148 N.M. 713, 242 P.3d 280 (“New Mexico courts, unlike federal courts, view
17 summary judgment with disfavor, preferring a trial on the merits.”).

18 {28} *Joiner* is inconsistent with longstanding New Mexico law that leaves

1 credibility determinations and weighing of the evidence to the trier of fact. *See, e.g.*,
2 *State v. Hughey*, 2007-NMSC-036, ¶¶ 15, 17, 142 N.M. 83, 163 P.3d 470 (concluding
3 that evidentiary rulings based on witness credibility usurp the role of the jury and that
4 doubt as to scientific conclusions should be resolved not by exclusion but by cross-
5 examination, rebuttal evidence, and argumentation). “Given the capabilities of jurors
6 and the liberal thrust of the rules of evidence, we believe any doubt regarding the
7 admissibility of scientific evidence should be resolved in favor of admission, rather
8 than exclusion.” *Lee v. Martinez*, 2004-NMSC-027, ¶ 16, 136 N.M. 166, 96 P.3d 291.
9 “Vigorous cross-examination, presentation of contrary evidence, and careful
10 instruction on the burden of proof are the traditional and appropriate means of
11 attacking shaky but admissible evidence.” *Id.* ¶ 48 (quoting *Daubert*, 509 U.S. at
12 596).

13 **B. Proof of Causation in Toxic Tort Litigation**

14 {29} Although litigation of toxic torts is often complex, this does not alter the
15 district court’s gatekeeping function. The crucial issue in this case is causation. To
16 prove causation in a toxic tort case, a plaintiff must first show that a suspected cause
17 actually “is capable of causing a particular injury or condition in the general
18 population.” *Norris v. Baxter Healthcare Corp.*, 397 F.3d 878, 881 (10th Cir. 2005).

1 After establishing such general causation, the plaintiff must then demonstrate specific
2 causation: that the suspected cause did actually cause the plaintiff's injury. *Id.*
3 Because the district court determined that Dahlgren's study and the proffered
4 testimony would not assist the trier of fact in determining whether the chemical
5 mixture at issue in this case is capable of causing lupus or other autoimmune
6 disorders, it never reached the question of specific causation.

7 {30} "When the connection between an agent and disease is strong and well
8 documented, general-causation issues fade into the background." Restatement (Third)
9 of Torts: Physical and Emotional Harm § 28 cmt. c(3) (Am. Law Inst. 2010). But
10 demonstrating that a chemical is capable of causing a particular injury in the general
11 population is often difficult in first-exposure cases where it has not been the subject
12 of extensive scientific analysis.

13 {31} We agree with other jurisdictions that "[t]he first several victims of a new toxic
14 tort should not be barred from having their day in court" simply because scientific
15 analysis on a particular chemical cause has not yet been fully developed. *Turner v.*
16 *Iowa Fire Equip. Co.*, 229 F.3d 1202, 1209 (8th Cir. 2000); *see also Best v. Lowe's*
17 *Home Ctrs., Inc.*, 563 F.3d 171, 180-81 (6th Cir. 2009) ("[T]here is no requirement
18 that a medical expert must always cite published studies on general causation in order

1 to reliably conclude that a particular object caused a particular illness.” (internal
2 quotation marks and citation omitted)); *Norris*, 397 F.3d at 882 (“In cases where there
3 is no epidemiology challenging causation available, epidemiological evidence would
4 not necessarily be required.”).

5 {32} In some cases where epidemiology is absent, jurists and scientists have
6 employed the nonformulaic guidelines of Sir Austin Bradford Hill to assess whether
7 an epidemiological study’s finding of an association between a substance and an
8 injury supported an inference of causation. Michael D. Green, D. Michal Freedman,
9 & Leon Gordis, *Reference Guide on Epidemiology*, in Fed. Jud. Ctr., *Reference*
10 *Manual on Scientific Evidence* 599-600 & 599 n.141 (3d ed. 2011). The Bradford Hill
11 factors that guide experts in making judgments about causation include: (1) temporal
12 relationship, (2) strength of the association, (3) dose-response relationship, (4)
13 replication of the findings, (5) biological plausibility (coherence with existing
14 knowledge), (6) consideration of alternative explanations, (7) cessation of exposure,
15 (8) specificity of the association, and (9) consistency with other knowledge. *Id.* at
16 600. These criteria are nonexclusive, and no one factor is dispositive in the general
17 causation inquiry. *See id.*

18 {33} In essence, the Bradford Hill factors measure the ability of an epidemiological

1 study to determine whether an association found by the study is sufficient to satisfy
2 an ultimate question of fact regarding causation or whether the association is merely
3 spurious. *See Milward v. Acuity Speciality Prods. Grp., Inc.*, 639 F.3d 11, 17 (1st Cir.
4 2011) (describing the Bradford Hill factors as a scientific method of weighing the
5 evidence to make causal determinations, involving “a mode of logical reasoning often
6 described as ‘inference to the best explanation.’” (citation omitted)); Green et al.,
7 *supra* at 598 (“[E]pidemiology cannot prove causation; rather, causation is a
8 judgment for epidemiologists and others interpreting the epidemiologic data.”). As
9 the First Circuit noted, “[i]n this mode of reasoning, the use of scientific judgment is
10 necessary,” and “[t]he fact that the role of judgment in [this] approach is more readily
11 apparent than it is in other methodologies does not mean the approach is any less
12 scientific.” *Milward*, 639 F.3d at 18.

13 {34} While the relevance of a particular methodology depends on the relationship
14 of the methodology to the facts and circumstances of each case, *see Downey*, 2008-
15 NMSC-061, ¶ 30, application of the Bradford Hill factors in assessing general
16 causation is widely accepted. *See, e.g.*, Green et al., *supra* at 598-606 (describing
17 application of the Bradford Hill criteria in determining whether an established
18 association between exposure to an agent and development of a disease is causal);

1 Restatement (Third) of Torts: Physical and Emotional Harm § 28 cmt. c(3) (Am. Law
2 Inst. 2010) (describing the Bradford Hill criteria for assessing whether an association
3 is causal in an analysis of general causation); Ian S. Spechler, *Physicians at the Gates*
4 *of Daubert: A Look at the Admissibility of Differential Diagnosis Testimony to Show*
5 *External Causation in Toxic Tort Litigation*, 26 Rev. Litig. 739, 742 (2007) (“General
6 causation testimony should rely on hard science, and courts should evaluate the
7 reliability of that science under the Bradford Hill criteria.”).

8 **C. Dahlgren’s Testimony and the Studies He Relied on Were Probative of**
9 **Causation and Should Have Been Admitted**

10 {35} Dahlgren’s causation opinion, his study, and the animal studies it relied on are
11 relevant and admissible if they demonstrate a valid scientific relationship that is
12 probative of causation, regardless of their sufficiency to sustain Plaintiffs’ entire
13 burden of proof. *See Ambrosini v. Labarraque*, 101 F.3d 129, 135 (D.C. Cir. 1996)
14 (“The dispositive question [concerning relevance] is whether the testimony will assist
15 the trier of fact to understand the evidence or to determine a fact in issue, not whether
16 the testimony satisfies the plaintiff’s burden on the ultimate issue at trial.” (internal
17 quotation marks and citation omitted)).

18 {36} Relying on *Joiner*, the district court excluded the animal studies because it
19 found them “not . . . relevant” as “studies . . . so dissimilar to the facts” associated

1 with Plaintiffs’ exposures, and it emphasized the need to consider the “dose-response
2 relationship” when “inferring human causation from animal studies.” The district
3 court concluded that in the absence of such “scientifically reliable evidence . . . to
4 support general causation between the [agents] and lupus . . . , the study does not ‘fit’
5 any issue to be presented to the jury, and is inadmissible.”

6 {37} The science of toxicology provides evidence that a certain dose of a particular
7 chemical causes particular effects in the bodies of humans or other animals. *See*
8 Bernard D. Goldstein & Mary Sue Henifin, *Reference Guide on Toxicology*, in Fed.
9 Jud. Ctr., *Reference Manual on Scientific Evidence* 633, 635-37, 641 (3d ed. 2011)
10 (describing dose-response as how the response to the chemical varies with changing
11 dose of the chemical). A dose-response relationship, while not essential evidence of
12 a causal relationship between an agent and disease, is considered strong evidence of
13 a causal relationship. *See Green et al., supra* at 603. In particular, consideration of a
14 dose-response relationship is important when inferring human causation from animal
15 studies. *See id.* at 563.

16 {38} To support Dahlgren’s inference from the animal studies that the agents caused
17 Plaintiffs’ illnesses in this case, the results of the animal studies needed to be adjusted
18 by extrapolation to humans. *See Goldstein & Henifin, Reference Guide on*

1 *Toxicology*, in Fed. Jud. Ctr., *Reference Manual on Scientific Evidence* at 646, 661-63
2 (3d ed. 2011) (describing scientific issues involved with extrapolating the results of
3 an animal study to humans). Contrary to the assertions of the lower courts, Dahlgren
4 presented evidence that the results of the animal studies adjusted by extrapolation to
5 the humans in this case could provide a scientifically valid basis for his inference of
6 causation in Plaintiffs. His methodology reflected that the harmful dose of pristane
7 the mice received, adjusted for the weight of a human, was comparable to Plaintiffs’
8 dose determined by their daily inhaled exposure (dose per day or concentration),
9 adjusted for the prolonged duration of that exposure to convert to dose. *See id.* at 638
10 & n.12 (“Dose is a function of both concentration and duration.”), 681 (defining dose
11 as “[a] product of . . . the concentration of a chemical . . . agent and the duration . . .
12 of exposure”). This result of Dahlgren’s extrapolation from the animal study is
13 evidence that supports an inference of causation. The credibility of the extrapolation
14 and the weight it should be accorded are questions for the jury.

15 {39} The district court’s basis for excluding Dahlgren’s study was the study’s
16 “fail[ure] to bridge the gap from association to causation.” In his study, Dahlgren
17 collected medical and environmental data from the Westgate Plaintiffs and their
18 neighborhood and from the unexposed control community subjects and their

1 neighborhood. He concluded that Plaintiffs' community showed both higher levels
2 of the toxic agents at issue and a dramatic prevalence of lupus and symptoms of
3 autoimmune disease compared to the control community. An epidemiological study
4 compiles information on the determinants of a disease in a population to establish a
5 correlation (or "association") between a toxic agent and the disease and to map the
6 "incidence, distribution, and etiology of [the] disease in human populations." Green
7 et al., *supra* at 551, 623.

8 {40} Having established an association between the chemical exposure and
9 Plaintiffs' diseases, Dahlgren then demonstrated, consistent with the widely accepted
10 Bradford Hill guidelines, that the association revealed by his epidemiological study
11 was causal. Consistent with expectations of the dose-response in a causal
12 relationship, his study found that the occurrences of lupus and other autoimmune
13 diseases in the exposed Plaintiffs significantly exceeded the occurrences in the
14 unexposed control group and that the symptoms manifested after Plaintiffs' exposures
15 and lessened or disappeared if Plaintiffs moved away from the area. Dahlgren
16 extrapolated the harmful dose of pristane found to induce lupus in mice to a human
17 equivalent and determined that Plaintiffs had received a dose within that range. In
18 addition to the animal studies involving pristane, Dahlgren cited numerous other

1 studies where environmental contaminants consisting of the agents at issue here or
2 similar chemicals were associated with clusters of autoimmune disorders believed to
3 be environmentally induced. He provided a plausible biological basis for the theory
4 that environmental toxins could induce autoimmune disease by referring to several
5 other studies that had found such correlations. He summarized the current knowledge
6 that benzene and mercury, two of the agents at issue here, adversely affect the human
7 immune system, and he reviewed the studies showing that pristane triggers the
8 formation of lupus-specific autoantibodies in mice. Dahlgren discussed alternative
9 explanations for the association between the agents and Plaintiffs' autoimmune
10 disorders, such as genetic susceptibility or drug-induced autoimmune disorders, and
11 ruled them out. Having performed his study consistent with the Bradford Hill
12 guidelines, Dahlgren was then able to use his expert judgment to assess whether the
13 associations revealed by his own study, the animal studies, and other published
14 studies regarding chemical exposure provided reliable support for an inference of
15 causation in humans. Any question regarding credibility of his judgment or
16 interpretation is proper for the trier of fact to resolve.

17 {41} When the district court found that Dahlgren's study "fail[ed] to bridge the gap
18 from association to causation," it improperly blurred the line between the district

1 court's province to evaluate the reliability of Dahlgren's methodology and the jury's
2 province to weigh the strength of Dahlgren's conclusions. *See Ambrosini*, 101 F.3d
3 at 141 ("By attempting to evaluate the credibility of opposing experts and the
4 persuasiveness of competing scientific studies, the district court conflated the
5 questions of the admissibility of expert testimony and the weight appropriately to be
6 accorded such testimony by a fact finder."). In doing so, "the trial court failed to
7 distinguish between the threshold question of admissibility of expert testimony and
8 the persuasive weight to be accorded such testimony by a jury." *Kennedy v. Collagen*
9 *Corp.*, 161 F.3d 1226, 1228 (9th Cir. 1998). In *Kennedy*, the court focused on the
10 methodology an expert applied to determine whether a medical product was capable
11 of causing autoimmune diseases and stated, "The fact that a cause-effect relationship
12 between [the agent] and lupus in particular [had] not been conclusively established
13 [did] not render [the expert's] testimony inadmissible." *Id.* at 1230. Because the
14 expert "set forth the steps he took in arriving at his conclusion in his deposition" and
15 used "analogical reasoning . . . based on objective, verifiable evidence and scientific
16 methodology of the kind traditionally used by" experts in his field, the court
17 concluded that the proffered testimony was supported by scientific evidence and
18 would assist the trier of fact in weighing the expert's testimony against opposing

1 evidence and in making a judgment about causation. *Id.* at 1230-31.

2 {42} In this case, Dahlgren similarly set forth the steps he took in arriving at his
3 conclusions. His reasoning was based on scientific methodology of the kind
4 traditionally used by experts addressing causation in toxicological epidemiology. We
5 conclude that the methodology of Dahlgren's study supports a valid scientific
6 inference that is probative of causation, even if it does not conclusively establish that
7 the specific chemicals at issue here, the agents, can cause lupus or other autoimmune
8 disorders. Accordingly, Dahlgren's study and his causation testimony should have
9 been admitted.

10 **D. Summary Judgment Was Improperly Granted**

11 {43} Based on an improper conclusion that Plaintiffs' general causation evidence
12 was inadmissible, the district court granted partial summary judgment to Defendants
13 on Plaintiffs' claims concerning lupus and other autoimmune disorders. Because we
14 reverse that determination of inadmissibility, we reverse the grant of summary
15 judgment as the evidence creates a genuine issue of material fact that precludes
16 summary judgment. *See* Rule 1-056(C).

17 **V. CONCLUSION**

18 {44} We reverse the district court's exclusion of Dahlgren's expert causation

1 testimony, his study, and the animal studies on which his study relied. We also
2 reverse the summary judgment granted on the basis of those exclusions. We remand
3 to the district court for proceedings consistent with this opinion.

4 {45} **IT IS SO ORDERED.**

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CHARLES W. DANIELS, Justice

7 **WE CONCUR:**

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BARBARA J. VIGIL, Chief Justice

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11

PETRA JIMENEZ MAES, Justice

12
13

EDWARD L. CHÁVEZ, Justice

14 **JUDITH K. NAKAMURA, Justice, not participating**