# MANAGING UNCERTAIN CAUSATION IN TOXIC EXPOSURE CASES: LESSONS FOR THE EUROPEAN COURT OF HUMAN RIGHTS FROM U.S. TOXIC TORT LITIGATION

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## INTRODUCTION

Scientific uncertainty is often cited as being among the most daunting challenges in adjudicating cases involving environmental harm.[1] Problems engendered by scientific uncertainty emerge when courts have to identify the legally relevant cause of the unlawful harm based on uncertain scientific facts. The ways in which judges handle scientific evidence and the inherent uncertainty that flows from the statistical and probabilistic nature of scientific evidence, play a definitive role in shaping the prospects of success for victims' environmental claims. Notably, courts differ in their approaches to adjudicate claims burdened with scientific uncertainty. While some judges hesitate to decide cases on the basis of highly technical, scientific evidence on the grounds of their lack of expertise, others go to great lengths to evaluate scientific inputs and decide such cases on the merits.

This article scrutinizes two markedly different judicial approaches to handling this challenge: the practice of the European Court of Human Rights (Strasbourg Court) in claims for toxic injuries and that of United States courts in toxic torts. The Strasbourg Court avoids a causal analysis based on scientific evidence in favor of an overall assessment of the non-causal aspects of the case when it decides whether a state is to be held liable for a toxic exposure.[2] In more than two decades of environmental jurisprudence, the Court has consistently avoided considering scientific proof of causation and has refused to rely on probabilistic, statistical evidence.[3] In contrast, United States courts have developed ample evidentiary and causal techniques to accommodate the special features of scientific evidence in toxic torts. Even though scientific evidence is "likely

1. For problems arising in front of U.S. courts see Carl F. Cranor, *The Challenge of Developing Science for the Law of Torts*, *in* PERSPECTIVES ON CAUSATION 261, 261 (Richard Goldberg ed., 2011) (identifying three sources of concern that U.S. courts face in adapting tort law). For challenges posed for international courts and tribunals see Jorge E. Viñuales, *Legal Techniques for Dealing with Scientific Uncertainty in Environmental Law*, 43 VAND. J. TRANSNAT'L L. 437, 439 (2010). *See generally* Jean D'Aspremont & Makane Moise Mbengue, *Strategies of Engagement with Scientific Fact-Finding in International Adjudication*, 5 J. INT'L DISP. SETTLEMENT 240, 248, 251 (2014) (discussing the increasing prevalence of science in international adjudications).

2. *See infra* Part III.

3. *See* David Hart, *Public Interest Environmental Litigation in Strasbourg*, U.K. HUMAN RIGHTS BLOG (July 7, 2013), https://ukhumanrightsblog.com/2013/07/07/public-interest-environmental-litigation-in-strasbourg/ [https://perma.cc/4YQJ-TU6R] (considering *López Ostra v. Spain* in 1994 to be one of the leading environmental cases brought under Article 8).

to stress and strain the law,"[4] United States courts are willing to hold tortfeasors liable on the basis of statistical probabilities presented by scientific proof of causation.

One may argue that the difference in how these courts handle uncertain causal links is justified by the different legal basis on which they adjudicate cases.[5] While United States courts hear cases under tort law, the Strasbourg Court has a human-rights-based mandate and adjudicates toxic exposure claims under the right to respect for private and family life (Article 8) and the right to life (Article 2) enshrined in the European Convention on Human Rights (Convention).[6] I will contend, however, that this difference is not relevant for the causal analysis of toxic exposure claims and, thus, that it does not justify the Strasbourg Court's less-nuanced causal inquiry. The Court has a tort law function[7] because it provides pecuniary and non-pecuniary damages for human rights violations caused by environmental pollution,[8] which requires a thorough causal inquiry. This shared function suggests that the practices United States courts employ in assessing statistical evidence in toxic tort cases can profitably guide the inquiry of the Strasbourg Court.

Thus far, scholars have paid little attention to the Strasbourg Court's mode of causal analysis in toxic exposure cases. The most authoritative commentary on its environmental jurisprudence was delivered by Boštjan M. Zupančič, a current judge at the Court and a former President of its

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4. Cranor, *supra* note 1, at 261.

5. Major differences lie in the source of obligation (the International Human Rights Convention versus the common law and statutory law), the subject of obligation (states versus private and public parties), and in the definition of damage (interference with rights versus causing physical or psychological harm). *See infra* Parts II.A, IV.A.

6. Convention for the Protection of Human Rights and Fundamental Freedoms arts. 2, 8, Nov. 4, 1950, E.T.S. No. 005 [hereinafter European Convention on Human Rights].

7. Some authors explicitly call the Strasbourg regime a "system of tort law." Ken Oliphant & Katarzyna Ludwichowska, *Damage*, *in* TORT LAW IN THE JURISPRUDENCE OF THE EUROPEAN COURT OF HUMAN RIGHTS 397, 447 (Attila Fenyves et al. eds., 2011).

8. There are three international human rights conventions that either explicitly guarantee a specific right to environment, or in the lack of express environmental provision, the respective human rights court interprets conventional human rights as requiring a certain level of environmental protection. These conventions are: the European Convention on Human Rights (central to this paper, its environmental relevance will be discussed later), European Convention on Human Rights, *supra* note 6; the American Convention on Human Rights (Article 11: "right to a healthy environment"), Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights "Protocol of San Salvador" art. 11, Nov. 17, 1988, O.A.S.T.S. No. 069; and the African Charter on Human and Peoples' Rights (Article 24: "peoples' right to a satisfactory environment"), African (Banjul) Charter on Human and Peoples' Rights, art. 24, Jane 10, 1981, 21 I.L.M. 58. *See generally* DONALD K. ANTON & DINAH L. SHELTON, ENVIRONMENTAL PROTECTION AND HUMAN RIGHTS 335–55 (2011) (discussing sources of human rights in environmental contexts).

Third Chamber.[9] Judge Zupančič criticizes the Court for subscribing to an "archaic perception of causation," meaning that it refuses to hold a state liable on the basis of probabilistic proof of causation.[10]

Despite this opening, no comprehensive analysis has been made of the ways in which the Strasbourg Court's unwillingness to address causation on the basis of probabilistic proof impacts the enforceability of toxic exposure claims before it. This article aims to provide such an analysis by examining the Court's reasoning for finding, or not finding, a violation. The Court announced in the *López Ostra* case that a violation takes place if severe environmental pollution that is attributable to a state adversely affects the applicant's wellbeing, even if it did not cause actual health injuries to the applicant.[11] Yet in the Court's practice, virtually no applicant was able to successfully prove a violation by claiming health injuries that had been allegedly caused by severe environmental pollution. This article contends that the principal reason for this lies in the Court's approach to causal inquiry in toxic exposure cases.

This research into the toxic exposure case law of the Strasbourg Court reveals that instead of investigating the actual cause of health injuries, the Court decides cases by assessing certain proxies of cause. This proxy-based method hollows out the tort law function of the Strasbourg system by allowing injuries to escape judicial scrutiny; additionally, it leads to different outcomes in factually similar cases. By avoiding complex causal inquiries and evidentiary assessments, the Strasbourg Court sacrifices predictable and nuanced judicial decision-making and leaves future plaintiffs without guidance as to the court's evidentiary requirements. These shortcomings, if left unaddressed, could undermine the Court's reputation of being a leading advocate of environmental protection based on human rights.[12]

In contrast to the Strasbourg practice, United States toxic tort case law shows that uncertainty is not an obstacle to establishing causation and allocating liability based on probabilistic scientific proof. This article analyzes the innovative causal and evidentiary methods of United States

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9. *Boštjan M. Zupančič*, REVOLVY, https://www.revolvy.com/main/index.php?s=Bo%C5%A1tjan%20Zupan%C4%8Di%C4%8D [https://perma.cc/CAV8-GXPH] (last visited Mar. 20, 2017).

10. Boštjan M. Zupančič, *Causation in Cases of Environmental Degradation: The Missing Link in Adjudicating Human Rights*, 3 Y.B. POLAR L. 113, 118 (2011).

11. López Ostra v. Spain, 303-C Eur. Ct. H.R. (ser. A) at 15 (1994).

12. The Strasbourg Court has the oldest and most extensive case law on human right violations caused by environmental pollution. *See* Alan Boyle, *Human Rights or Environmental Rights? A Reassessment*, 13 FORDHAM ENVTL. L. REV. 471, 484 (2007) (focusing on Europe because that is where most cases on human rights and the environment have been decided).

courts and highlights three that appear to be readily transferable to the Strasbourg system. It is argued that by applying these techniques, the Strasbourg Court could respond more effectively to the challenges of uncertainty in making thorough causal assessments.

The article proceeds in five main parts. Part I addresses the challenge posed for courts in both regimes by various forms of uncertain causation in toxic exposure cases. Part II analyzes the causal links between a state's conduct, toxic exposure, and the harmful consequences that invite assessment under Article 2 (right to life), Article 8 (right to respect for private and family life), and Article 41 (just satisfaction).[13] These links could, and should, play a more decisive role in the Strasbourg Court's analysis when it decides on a violation. Part III analyzes the Court's proxy-based method of assessing violations and the ways it handles probabilistic scientific proof of uncertain causation in its judgments. Part IV examines the approaches of United States courts, which are known for modifying their causal assessment and evidentiary rules in order to decide cases on the merits, even on the basis of uncertain scientific evidence.[14] Finally, Part V concludes with the proposal that the Strasbourg Court borrow techniques from United States toxic tort case law in order to improve its decision-making related to uncertain scientific facts. This part further advances reasons for adopting these techniques and discusses procedural aspects of their adoption.

## I. THE CHALLENGE OF UNCERTAIN CAUSATION: ESTABLISHING CAUSAL LINKS BASED ON UNCERTAIN SCIENTIFIC EVIDENCE

In both United States tort law and the Strasbourg regime, victims must establish a causal link between the harm and the allegedly wrongful conduct in order to prove the breach or the tortious conduct and receive damages.[15] This requirement entails adducing pieces of scientific evidence concerning the victim's health condition and the extent of environmental pollution that allegedly caused the injury.[16]

The prospects of success for a toxic exposure claim are substantially influenced by hurdles arising from the law–science interface in both tort

13. European Convention on Human Rights, *supra* note 6, at arts. 2, 8, 41.

14. With respect to the confines of this paper, it will not address the procedural aspects of dealing with scientific expert evidence (admissibility criteria, cross-examination, etc.).

15. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 26 (AM. LAW. INST. 2010); Ken Oliphant, *European Tort Law: A Primer for the Common Lawyer*, 62 CURRENT LEGAL PROBS. 440, 445 (2009).

16. Note, *Causation in Environmental Law*: *Lessons from Toxic Torts*, 128 HARV. L. REV. 2256, 2268 (2015).

and human rights law. The following section explores the causes of these difficulties, namely, the fundamental difference in the way law and science treat the concepts of cause and causation, their different approaches to what constitutes valid evidence, and their different levels of tolerance toward uncertainty.

### *A. The Gap Between Legal and Scientific Notions of Causation, Evidence, and Uncertainty*

#### 1. Causes and Causal Inference

Causes of legal relevance (i.e., factual causes) are of narrower scope than naturally occurring factors that lead to the same outcome. Although there is a virtually infinite number of the naturally occurring factors, not all of them are equally relevant for the purposes of law.[17] Reflecting these qualitative differences in approach to causal argument, H.L.A. Hart and Tony Honoré distinguish between causally relevant factors (causes) and "mere conditions."[18] Those factors identified as causal have legal relevance, while mere conditions do not form part of legal inquiry. Accordingly, typical causal questions in law emerge as to whether a specific harm was caused by a certain human conduct or omission.[19]

Legal regimes, thus, adopt certain tests to establish the causes they regard as legally appreciable among the various conditions of an outcome.[20] According to the Third Restatement of the Law of Torts (Third Restatement), "a conduct is a factual cause of a harm when the harm would not have occurred absent the conduct."[21] This definition allows that there can be several factual causes of an outcome;[22] as long as a conduct is necessary for the outcome, it is regarded as a factual cause (cause-in-fact, but-for cause).[23] Therefore, a particular conduct need only be *a* cause and not *the* cause of the harm for qualifying as a factual cause.[24] A causal agent is regarded as a cause-in-fact if, but for its presence, the result would not

17. Examples from everyday experiences that illustrate this point are weather conditions "causing" slippery roads before a car accident or an enduring drought that "generates" dry leaves, feeding a bush fire.

18. H.L.A. HART & TONY HONORE, CAUSATION IN THE LAW 113 (2d ed. 1985).

19. *Id.* at 84.

20. *Id.* at 112–13.

21. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 26 (AM. LAW. INST. 2010).

22. *Id.*

23. *Id.*

24. *Id.*

have occurred or would have occurred later.[25] Other causal agents that complement the necessary causal sets are regarded as background causes.[26]

The Third Restatement provides further guidance with respect to more complicated causal scenarios. In exceptional cases, there are multiple acts, each of which would have been a factual cause of the outcome alone in the absence of the other acts.[27] This situation is known in tort law as the "multiple sufficient causes" scenario.[28] According to the Third Restatement, each of the multiple sufficient causes should be regarded as a cause-in-fact,[29] even though none is by itself a but-for cause of the harm.[30] This scenario is often called causal overdetermination.[31] Multiple sufficient causes are to be distinguished from multiple causes, as the latter simply accounts for a scenario when there are multiple but-for causes of a certain outcome.[32]

Multiple sufficient causal sets can also emerge consecutively, in what is called the preemptive causes scenario.[33] In that case, the supervening act or omission, the so-called duplicative factor, cannot be regarded as a factual cause[34] as the harm would have occurred anyway.[35] Different tort law causal theories handling the above causal scenarios will be addressed later.[36]

The concept of causation in law is different in many respects from the causal concepts used in science.[37] Carl F. Cranor suggests that the scientific understanding of causation is "more complex than the law legitimates."[38] The but-for test of legal causation favors a "mechanistic understanding of causation" that is predicated upon the metaphor of a causal chain consisting of discrete events, where each event is dependent upon the previous one.[39]

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25. *See, e.g.*, Sander Greenland, *Relation of Probability of Causation to Relative Risk and Doubling Dose: A Methodologic Error that Has Become a Social Problem*, 89 AM. J. PUB. HEALTH 1166, 1166 (1999) ("[E]xposure is a contributory cause of the plaintiff's disease if, but for exposure, that disease would have occurred later in life or not at all.").

26. RESTATEMENT (THIRD) OF TORTS § 26.

27. *Id.* § 27.

28. *Id.*

29. *Id.*

30. *Id.* § 26.

31. SANDY STEEL, PROOF OF CAUSATION IN TORT LAW 18–20 (2015).

32. RESTATEMENT (THIRD) OF TORTS § 26.

33. *Id.*

34. *Id.*

35. The textbook example of a duplicative factor is hitting an already deceased man with a car.

36. *See infra* Part IV.B.

37. Troyen A. Brennan, *Causal Chains and Statistical Links: The Role of Scientific Uncertainty in Hazardous-Substance Litigation*, 73 CORNELL L. REV. 469, 471 (1987).

38. Cranor, *supra* note 1, at 261.

39. Brennan, *supra* note 37, at 485–86.

However, in fact, elements of the chain might be independent of the first triggering action and hence, the causal process is better conceived as a "complex set of conditions."[40] Consequently, judges often run into difficulties when they try to select a certain event from the hypothetical chain of events to be the but-for cause of the injury.[41]

Finally, law and science also differ in their methods of reasoning. Consistent with their thinking in terms of the metaphor of a causal chain, lawyers tend to apply deductive reasoning.[42] But, this approach in itself creates the illusion of causality because it is necessarily loaded with causal assumptions.[43] As a result, the substantiated causal link may only result from the method of deductive reasoning.[44] Scientists, in contrast, normally use inductive reasoning.[45]

2. Standard of Required Proof: Acceptance of Probabilistic Evidence

Legal regimes establish a particular standard of proof to determine the required level of proof above which a causal claim is to be accepted as valid and legally appreciable. Tort law, for instance, uses the preponderance of the evidence standard, i.e., the balance of probability.[46] By contrast, there is no generally agreed standard for proof of causality in science.[47]

These different approaches toward proof of causation might be attributable to the fact that the basis of scientific inquiry is the rejection of the null hypothesis that posits that the factors examined are random variables.[48] In fact, scientists, by collecting statistically significant evidence, "*disprove* the null hypothesis" instead of proving the actual hypothesis.[49]

There is also a striking difference in the approach of lawyers and scientists toward probabilistic evidence. While statistical evidence is treated as normal in science, it is conceived only as "a second best" option in law.[50] The robustness of evidence in science is assessed in terms of the level of

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40. HART & HONORE, *supra* note 18, at 72.
41. Brennan, *supra* note 37, at 486.
42. *Id.* at 482.
43. *Id.*
44. *Id.*
45. *Id.*
46. STEEL, *supra* note 31, at 50.
47. Peter Feldschreiber et al., *Biostatistics and Causation in Medicinal Product Liability Suits*, *in* PERSPECTIVES ON CAUSATION 179, 190 (Richard Goldberg ed., 2011).
48. Brennan, *supra* note 37, at 511.
49. *Id.* (emphasis added).
50. *Id.* at 490.

significance (so-called p value), which is conceived to be a statement of probability.[51]

In contrast to the approach used in science, judges often do not want to engage in probabilistic reasoning [52] and tend not to regard the preponderance rule as a purely mathematical question according to which a statistical chance bigger than 50% automatically results in a finding of causation.[53] One reason for this difference might be that this so-called naked statistical-evidence approach can easily lead to counterintuitive results. The *Smith v. Rapid Transit* case well illustrates the dilemmas of basing the preponderance rule solely on one mathematical probability calculation.[54] In the material case, a bus pushed the plaintiff's car off a road on which one company, Rapid Transit, had the exclusive right to run coach service.[55] The court was not ready to accept, purely on the basis of mathematical calculations of probability, that Rapid Transit was the actual tortfeasor.[56] Evaluating the conclusion of the court, Sandy Steel emphasizes the importance of subjective belief embedded in the preponderance rule, as it requires "that the factfinder believe[s] that p actually occurred not merely that probably p [occurred]."[57]

The same theoretical problem arises when courts must decide whether to rely on naked statistical evidence, such as epidemiological data, in toxic exposure cases. Similarly to the *Rapid Transit* dilemma, courts' approach to statistical scientific evidence in such cases largely depends on the factfinders' subjective understanding of the scientific evidence.[58] For this reason, the gaps between legal and scientific approaches to causation and evidence affect the evidentiary standards that courts apply.

### 3. Comfort with Uncertainty in Law and in Science

Scientific facts underlying environmental harm are highly complex and uncertain. Furthermore, their effects are temporally and spatially spread out.[59] In scientific literature, the concept of scientific uncertainty, in the broad sense, means that human knowledge will always remain imperfect

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51. *Id.* at 482.
52. *Id.* at 490–91.
53. *Id.* at 493.
54. Smith v. Rapid Transit, 58 N.E.2d 754, 755 (Mass. 1945).
55. *Id.*
56. *Id.*
57. STEEL, *supra* note 31, at 92.
58. *See Smith*, 58 N.E.2d at 755 (explaining that an objective understanding, such as knowing that relatively few men die of cancer, is insufficient to "warrant a finding that a particular man did not die of cancer").
59. RICHARD J. LAZARUS, THE MAKING OF ENVIRONMENTAL LAW 20 (2004).

when it comes to understanding and describing highly complex natural phenomena.[60] In the narrow sense, scientific uncertainty stands for the fact that scientific research can only provide probabilistic results, as some uncertainty always remains as to the precise value of a given parameter[61] due to imperfect measurement devices,[62] scarce and ambiguous data,[63] simplifying models,[64] or natural variability.[65] Throughout this article, uncertainty is used in this narrow sense.[66]

It is common knowledge among scientists that scientific uncertainty is inherent to some degree in all scientific results and can never be fully eliminated.[67] Lawyers, however, often do not have a proper understanding of the true nature of scientific uncertainty.[68] As Troyen A. Brennan warns, courts tend to subscribe to the "positivist" philosophy of science, which assumes a constant expansion of scientific knowledge, and to hold associated belief to a view that uncertainty can be fully eliminated.[69] In the last century, scientists abandoned this view on account of their increasing awareness of the ever uncertain[70] and probabilistic nature of scientific results.[71] Still, judges seem to be reluctant to accept the concept of irreducible uncertainty.[72]

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60. *See* James D. Brown, *Prospects for the Open Treatment of Uncertainty in Environmental Research*, 34 PROGRESS PHYSICAL GEOGRAPHY 75, 77 (2010) (discussing scientific uncertainty as a result of imperfect knowledge).

61. Donald Ludwig et al., *Ecology, Conservation, and Public Policy*, 32 ANN. REV. ECOLOGY EVOLUTION & SYSTEMATICS 481, 487 (2001). This is why scientists attach a confidence interval to every result. This indicates the range in which the parameter lies in a given percentage of the time. As a scientific consensus, the 95% confidence interval stands for a statistically significant finding. Brennan, *supra* note 37, at 510.

62. Helen M. Regan et al., *A Taxonomy and Treatment of Uncertainty for Ecology and Conservation Biology*, 12 ECOLOGICAL APPLICATIONS 618, 618 (2002).

63. *Id.*

64. *Id.* at 620.

65. *Id.* at 618, 620.

66. In legal literature, scientific uncertainty is sometimes used to describe the lack of conclusive evidence regarding the health effects of a hazardous substance. Mark Geistfeld, *Scientific Uncertainty and Causation in Tort Law*, 54 VAND. L. REV. 1011, 1012 (2001). This paper uses scientific uncertainty in a somewhat broader sense, referring to the statistical, probabilistic nature of scientific results.

67. Richard A. Carpenter, *Uncertainty in Managing Ecosystems Sustainably*, *in* SCIENTIFIC UNCERTAINTY AND ENVIRONMENTAL PROBLEM SOLVING 118, 126 (John Lemons ed., 1996).

68. Brennan, *supra* note 37, at 478.

69. *Id.* at 479.

70. KENNETH R. HAMMOND, HUMAN JUDGMENT AND SOCIAL POLICY: IRREDUCIBLE UNCERTAINTY, INEVITABLE ERROR, UNAVOIDABLE INJUSTICE 13 (1996).

71. Brennan, *supra* note 37, at 481.

72. *Id.* at 491.

Nevertheless, uncertainty is not alien to law because law itself "never requires absolute certainty."[73] This, however, "does not mean comfort with error."[74] This especially holds true for tort law, which serves two main goals: deterrence and corrective justice.[75] Tort law causation theory is key to serving the latter goal by requiring that the tortious conduct be a but-for cause of the harm, and only those responsible for causing the harm are compelled to pay compensation.[76]

### *B. Multiple Sources of Uncertain Causation in Toxic Exposure Cases*

Tort law causation theories are often disrupted by uncertain causation (also referred to as causal uncertainty,[77] indeterminate causation,[78] and causal indeterminacy):[79] that is, our incomplete knowledge about "the empirical causal truth" in the given case.[80] This phenomenon is ubiquitous in all tort situations and is in no way unique to environmental cases. Causal uncertainty typically arises from: the multiplicity and similarity of possible causes; the passage of time, which impedes gathering relevant evidence; unobservability of causation; incomplete knowledge of causal mechanisms; the counterfactual nature of causation; human error, especially that of experts, which has obvious repercussions on expert evidence; and the costs of obtaining causal knowledge.[81]

However, in toxic exposure cases, scientific uncertainty further aggravates these ordinary sources of uncertain causation. As a result of peculiar challenges present in these cases, judges in the Strasbourg regime and in toxic tort law face a specific set of evidentiary problems in establishing causality.

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73. Andrew R. Klein, *Causation and Uncertainty: Making Connections in a Time of Change*, 49 JURIMETRICS 5, 6 (2008).

74. *Id.* at 6.

75. *Id.* at 10.

76. *Id.* at 10–11.

77. STEEL, *supra* note 31, at 5.

78. John Paterson, *Law's Approach to Harm Under Uncertainty*, *in* PERSPECTIVES ON CAUSATION 383, 385 (Richard Goldberg ed., 2011). Paterson uses the term in a narrower sense, as a reference to the scenario when the plaintiff's harm and the defendants' breach of duty are established; however, it is not possible under the current state of scientific knowledge to determine with the balance of probability which of the defendants was the actual cause of the harm. *Id.* This scenario combines two problems: defendant indeterminacy and the threshold of burden of proof, which will be addressed separately. *See infra* Parts IV.B.3, IV.C.1.

79. David Rosenberg, *The Causal Connection in Mass Exposure Cases: A "Public Law" Vision of the Tort System*, 97 HARV. L. REV. 849, 858 (1984).

80. STEEL, *supra* note 31, at 15.

81. Steel provides a detailed analysis of these sources. *Id.* at 7–10.

Throughout the article, uncertain causation is understood as referring to the following specific problems common to toxic exposure cases:

(i) The most typical difficulty is illustrated by the accident metaphor.[82] In a car accident, the cause of physical injuries is readily discernible and can rarely be attributed to anything else other than the collision. However, in toxic exposure cases, identifying the cause of injury can be particularly complicated as there might be numerous possible sources of exposure, as in occupational-disease cases.[83] Moreover, when there is an accident, the cause-and-effect relations between the collision and the injuries are plausibly justified in our everyday experiences.[84] However, in toxic exposure cases, the mechanism of disease development is usually not well understood and not directly observable.[85]

(ii) An injury may have a long latency period,[86] even trans-generational,[87] that may render the identification of a causal link especially challenging. Latency periods complicate the finding of general causation, and the lapse of time impedes identifying past exposures.[88]

(iii) Though human epidemiological studies provide the most precise and certain proof of causal links surrounding human health impairment, such studies are often not conducted for ethical reasons.[89] Observational data on human exposure might be available; however, they can easily fall short of statistical significance due to the infrequency of the outcome of interest.[90] In the absence of human studies, experimental animal studies may be relied on, but the need to extrapolate from such results weakens their probative value.[91]

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82. Alan Rudlin et al., *Causation and the Use of Experts*, *in* TOXIC TORT LITIGATION 139, 139 (Arthur F. Foerster & Christine Gregorski Rolph eds., 2013).

83. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 (AM. LAW. INST. 2010).

84. *Id.*

85. *Id.*

86. CARL F. CRANOR, TOXIC TORTS: SCIENCE, LAW, AND THE POSSIBILITY OF JUSTICE 173 (2006).

87. For instance, the DES litigation concerned a drug containing diethylstilbestrol, the harmful effects of which manifested in the offsprings of the women who took the miscarriage prevention drug during their pregnancy. *See infra* Part IV.B.3.

88. Michael D. Green, *The Future of Proportional Liability: The Lessons of Toxic Substances Causation*, *in* EXPLORING TORT LAW 352, 373 (M. Stuart Madden ed., 2005).

89. CRANOR, *supra* note 86, at 9–10.

90. This obstacle arose in the *In re Neurontin* case where the causal factor leading to suicide was disputed. *In re* Neurontin Mktg., 612 F. Supp. 2d 116, 121–22, 126 (Mass. 2009). The court noted that the infrequency of suicide diminishes the probative value of the small number of such occasions. *Id.*

91. CRANOR, *supra* note 86, at 10.

(iv) Epidemiological studies are resource intensive; therefore, research results concerning a particular toxin are often not readily available.[92] The costs are compounded if one faces a rare disease, which requires studies involving larger samples.[93]

(v) Toxins rarely have signature effects that allow fingerprinting the causal agent.[94] It is far more common that several disease factors contribute to a symptom common to all of them.[95] Additionally, the same causal agent might cause numerous health impairments, while only a few of them are unique enough that they can be regarded as signature diseases.[96] For instance, while asbestos might cause asbestosis, mesothelioma, lung cancer, and fibrosis, only asbestosis and mesothelioma are regarded as signature diseases.[97]

(vi) Uncertainty may surround the diagnosis of injury. Certain diseases can only be fully recognized after death has occurred, and some commentators highlight possible biases on the experts' side if they are aware of the dose of exposure when making the diagnosis.[98]

(vii) The level of exposure is often uncertain;[99] yet in the case of certain diseases, exposure occurring within a specific time can be of particular relevance.[100] Quantifying the latter can be difficult.

(viii) Epidemiological studies are group-based, meaning that they can only describe the incidence of a disease in a group and not the cause of a given individual's disease within that group.[101] Specific problems arise in the context of determining whether the association of data indicates a causal connection.[102] In group-based studies, selection bias and random error are particularly relevant.[103] Even if the sample data are correct, attributing the group-based epidemiological findings to individual cases inevitably involves uncertainty.[104]

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92. *Id.* at 9.
93. *Id.* at 173–74.
94. *Id.* at 175.
95. *Id.*
96. ROBIN KUNDIS CRAIG ET AL., TOXIC AND ENVIRONMENTAL TORTS: CASES AND MATERIALS 159 (2010).
97. *Id.*
98. Green, *supra* note 88, at 379.
99. KUNDIS CRAIG ET AL., *supra* note 96, at 159.
100. Green, *supra* note 88, at 378. In certain cases, early or peak doses can be relevant, while in others, the total length of the exposure is more critical than magnitude. *Id.*
101. *Id.* at 352.
102. Austin Bradford Hill, *The Environment and Disease: Association or Causation?*, 108 J. ROYAL SOC'Y MED. 32, 36 (2015).
103. Green, *supra* note 88, at 380–81.
104. Brennan, *supra* note 37, at 512.

To avoid such problems of group-based data, it might be advisable to supplement them with "particularized" evidence describing the individual plaintiff's characteristics.[105] However, the individualized approach does not preclude other types of uncertainty because the role that toxic exposure and individual background risks play in developing a given disease may be in doubt.[106] And, even if science can substantiate the existence of genetic background risks, it remains uncertain whether the exposure and the genetic risk factor have additive, antagonistic, or synergetic effects.[107]

(ix) Finally, multiple competing causal agents may be present,[108] among which some have only "weak causal effects," i.e., they create only a small incremental increase in disease risk, while others are of "strong causal effects," conferring a substantial increase of risk.[109]

United States courts in toxic torts and the Strasbourg Court face all these complexities when they must identify the legally relevant causes of a toxic harm. The following sections analyze their solutions to make such decisions.

## II. THE EUROPEAN COURT OF HUMAN RIGHTS CONFRONTS UNCERTAIN CAUSATION.

Although Judge Zupančič dubs causation the "missing link in adjudicating human rights" at the Strasbourg Court,[110] human rights scholars have noted the challenges of assessing causation in environmental pollution cases without analyzing the Court's solutions. Dinah Shelton takes note of the role of causality in developing the substantive content of a right to a healthy environment,[111] and Philippe Sands acknowledges that proving environmental damage "is notoriously difficult,"[112] while Alan Boyle highlights the evidentiary burdens of establishing proof of causation based on scientific facts.[113] The following sections develop an analytic

105. Steve C. Gold, *The More We Know, the Less Intelligent We Are? — How Genomic Information Should, and Should Not, Change Toxic Tort Causation Doctrine*, 34 HARV. ENVTL. L. REV. 370, 392 (2010).

106. *Id.* at 394.

107. *Id.*

108. Sanne H. Knudsen, *The Long-Term Tort: In Search of a New Causation Framework for Natural Resource Damages*, 108 NW. U. L. REV. 475, 530 (2014).

109. CRANOR, *supra* note 86, at 176.

110. Zupančič, *supra* note 9, at 113.

111. Dinah L. Shelton, *Developing Substantive Environmental Rights*, 1 J. HUM. RTS. & ENV'T 89, 114–16 (2010).

112. Philippe Sands, *Human Rights, Environment and the* Lopez-Ostra *Case: Context and Consequences*, 1996 EUROPEAN HUM. RTS. L. REV. 597, 615.

113. Alan Boyle & James Harrison, *Judicial Settlement of International Environmental Disputes: Current Problems*, 4 J. INT'L DISP. SETTLEMENT 245, 270 (2013).

framework for examining situations involving uncertain causation in toxic exposure cases before the Strasbourg Court under Articles 2, 8 and 41 of the Convention.

### *A. Primer on the Strasbourg Framework*

Although the Convention contains no express provision on environmental protection,[114] the Court gradually began discerning environmental considerations from various provisions[115] by interpreting the text "as a living instrument."[116] The Strasbourg Court hears claims[117] concerning toxic exposures predominantly under Article 2 (right to life)[118] and Article 8 (right to private and family life)[119] of the Convention.

Although the environmental scope of the two provisions is similar,[120] the magnitude of the risk involved determines the applicable provision. Article 2 applies only to life-threatening circumstances; thus, harms failing

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114. This is unsurprising given that it was drafted in 1950. BERNADETTE RAINEY ET AL., JACOBS, WHITE & OVEY: THE EUROPEAN CONVENTION ON HUMAN RIGHTS 4 (6th ed. 2014).

115. Environmental considerations are present under Article 2 (right to life), Article 6 (right to fair trial and access to courts), Article 8 (right to private and family life), Article 10 (Right to information), Article 1 of Additional Protocol No 1 (right to property). European Convention on Human Rights, *supra* note 6, at arts. 2, 6, 8, 10; Protocol to the Convention for the Protection of Human Rights and Fundamental Freedoms art. 1, Mar. 20, 1952, E.T.S. No. 009 [hereinafter Protocol to the European Convention on Human Rights].

116. Soering v. United Kingdom, 161 Eur. Ct. H.R. (ser. A) at 33 (1989) (quoting Tyrer v. United Kingdom, 26 Eur. Ct. H.R. (ser. A) at 12 (1978)).

117. The Strasbourg Court may hear a complaint if the applicant exhausted at least one of the effective remedies provided under domestic law and if the application is filed within six months from the date on which the final decision was made. European Convention on Human Rights, *supra* note 6, at art. 35(1). The Strasbourg Court shall render a claim inadmissible if the complaint's subject matter is substantially the same as have been previously examined or is "manifestly ill-grounded." *Id.* at art. 35(2)(b), (3)(a).

118. *Id.* at art. 2 ("(1) Everyone's right to life shall be protected by law. No one shall be deprived of his life intentionally save in the execution of a sentence of a court following his conviction of a crime for which this penalty is provided by law. (2) Deprivation of life shall not be regarded as inflicted in contravention of this Article when it results from the use of force which is no more than absolutely necessary: (a) in defence of any person from unlawful violence; (b) in order to effect a lawful arrest or to prevent the escape of a person lawfully detained; (c) in action lawfully taken for the purpose of quelling a riot or insurrection.").

119. *Id.* at art. 8 ("(1) Everyone has the right to respect for his private and family life, his home and his correspondence. (2) There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national security, public safety or the economic wellbeing of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others.").

120. Brincat v. Malta, App. Nos. 60908/11, 62110/11, 62129/11, 62312/11 and 62338/11, 2014 Eur. Ct. H.R. at 25–26.

to meet this relatively high threshold will be assessed under Article 8.[121] Many toxic exposure cases are dealt with under Article 8.[122]

The table below provides a brief overview of the doctrinal framework of inquiries under Articles 2 and 8 of the Convention in toxic exposure cases.

| | Article 2<br>(right to life) | Article 8<br>(right to private life) |
|---|---|---|
| Subject of protection | Individual | |
| Party under obligation | State | |
| Triggering conditions for application | The physical integrity of an applicant was threatened (i) by the action of the state (or state agent) or<br>(ii) by a third party's action[123] when the state had regulatory obligations *vis-á-vis* the third party.[124] | (i) Pollution exceeding a minimum level of severity[125]<br>(ii) which is caused by a state directly or indirectly (in a failure to regulate private industry) and<br>(iii) which has a "direct adverse effect" on the individuals' private or family life or well-being.[126] |
| Obligation of state | (i) Negative: refrain from unlawful killing[127]<br>(ii) Positive: to take appropriate measures to safeguard lives or prevent avoidable loss of lives in cases of | (i) Positive: to adopt measures *vis-á-vis* private actors causing environmental harm to guarantee the right to private life.[132] A "failure to regulate private |

121. *Id.* at 26.
122. *See* discussion *infra* Part II.B.2.
123. *Brincat*, 2014 Eur. Ct. H.R. at 24.
124. COUNCIL OF EUROPE, MANUAL ON HUMAN RIGHTS AND THE ENVIRONMENT 18 (2d ed. 2012).
125. Fadeyeva v. Russia, 2005-IV Eur. Ct. H.R. 255, 277.
126. COUNCIL OF EUROPE, *supra* note 124, at 20; Guerra & Others v. Italy, App. No. 116/1996/735/932, 1998-I Eur. H.R. Rep. at 16.
127. RAINEY ET AL., *supra* note 114, at 143.

| | | |
|---|---|---|
| | dangerous activities and natural disasters[128] by putting in place a legislative and administrative framework[129] and enact regulations for practical measures[130]<br>Procedural (positive): In case of loss of lives on account of an infringement of the right, the state should provide adequate response (by investigating and providing civil, administrative, or disciplinary remedies).[131] | industry" can raise the state's liability.[133]<br>(ii) Negative: to refrain from undue interference with private life (when polluting entity is owned, operated or controlled by the state)[134] |
| Cases when the state can be held liable for injuries caused by private entities | States' positive obligations also arise when human lives are at "real and immediate risk" due to private companies' activity in case the state had known or ought to have known about the risks.[135] | If there is a "sufficient nexus" between the polluter and the state[136] (in such a case the "state could reasonably be expected to act so as to prevent and to put an end to the alleged infringements")[137] |

132. *Id.* at 53; Gómez v. Spain, 2004-X Eur. Ct. H.R. 327, 342. The Strasbourg Court explicitly stated that States' responsibility "may arise from a failure to regulate private industry." *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 282 (citations omitted).

128. COUNCIL OF EUROPE, *supra* note 124, at 37.

129. Öneryildiz v. Turkey, 2004-XII Eur. Ct. H.R. at 79.

130. *Brincat*, 2014 Eur. Ct. H.R. at 33–34.

131. COUNCIL OF EUROPE, *supra* note 124, at 19.

133. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 282.

134. *Id.*

135. *Id.* at 37.

136. *Id.* at 283.

137. *Id.* at 282.

| | | |
|---|---|---|
| Actionable damage | (i) Death or<br>(ii) real and imminent risk to life[138] | Direct interference with private and family life[139] |
| Causation should be established between: | The conduct and the applicant's death or imminent threat to her life[140] | Pollution and "direct adverse effect" on private life[141] |
| Causal test | No specific test has been announced. | No causal test exists, the case is decided by assessing proxies. |
| Judicial test of finding a violation | States have a wide margin of appreciation; thus, impossible or disproportionate burden must not be imposed on them without considering their choices and resources.[142] | (i) Negative obligations: emissions exceeding domestic safety levels from a state-owned source is automatically unlawful.[143]<br>(ii) Positive obligations: States have a wide margin of appreciation (deferential review).[144] The test is whether national authorities have struck a fair balance between the individual's right and the interest of the community in furthering economic development.[145] |
| Burden of proof | On the applicant[146] | |
| Standard of proof | Beyond reasonable doubt (met by "the coexistence of sufficiently strong, clear and concordant | |

138. *Id.* at 18.
139. Oliphant & Ludwichowska, *supra* note 7, at 430–31.
140. European Convention on Human Rights, *supra* note 6, at art. 2 (right to life); *see also Brincat*, 2014 Eur. Ct. H.R. (high threshold of life-threatening circumstances, § 8 applies to all other circumstances).
141. Hardy v. United Kingdom, App. No. 31965/07, 2012 Eur. Ct. H.R. at 43 (2012).
142. Budayeva v. Russia, 2008-II Eur. Ct. H.R. 267, 290.
143. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 284, 292.
144. *Id.* at 284–85.
145. *Id.* at 293.
146. *Id.* at 277.

| | |
|---|---|
| | inferences or of similar unrebutted presumptions of fact").[147] It allows flexibility with a view to the evidentiary difficulties.[148] |
| Remedy (under Article 41) | (i) Obligation to put an end to the breach[149]<br>(ii) Just satisfaction: pecuniary and non-pecuniary damages or finding of a violation[150] (damages are not automatic consequences) and costs and expenses[151] |

Table 1. Doctrinal Framework of Articles 2 and 8 of the Convention in Toxic Exposure Cases

### *B. Uncertain Causal Links Before the Strasbourg Court in Toxic Exposure Cases*

Although causal analyses remain hidden or, at best, marginal in the Strasbourg Court's judgments, certain causal requirements have been flagged in few cases. These causal links impact the applicability of Articles 2 and 8, the violation of these provisions, or the awarding of damages under Article 41.

#### 1. Relevance of Uncertain Causation Under Article 2

In cases decided under the right to life, the causal link between the alleged violation and the applicant's death or imminent threat to her life lies at the core of the inquiry.[152] The *L.C.B. v. United Kingdom* case illustrates that a state's positive obligations are triggered by a probable causal link between the injury and the state measure.[153] This case featured claims by an applicant who had suffered from leukemia since her early childhood, allegedly due to her father's exposure to radiation during his service at a United Kingdom nuclear military base before the applicant was born.[154] The judgment clearly articulates that "the State could only have been required of

147. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 279.
148. *Id.*
149. Scozzari v. Italy, 2000-VIII Eur. Ct. H.R. 471, 528.
150. Elisabeth Steiner, *Just Satisfaction Under Art. 41 of the ECHR: A Compromise in 1950 – Problematic Now*, *in* TORT LAW IN THE JURISPRUDENCE OF THE EUROPEAN COURT OF HUMAN RIGHTS 3, 14–15 (Attila Fenyves et al. eds., 2011).
151. *Id.* at 15.
152. *See* COUNCIL OF EUROPE, *supra* note 124, at 37 (describing how the Court in *Budayeva and Others v. Russia* found a causal link to the administrative flaw and applicant's death); *see Budayeva*, 2008-II Eur. Ct. H.R. at 295–96 (stating the Court's finding of a causal link).
153. L.C.B. v. United Kingdom, App. No. 23413/94, 1998-III Eur. H.R. Rep. at 13.
154. *Id.* at 3–4.

its own motion to take steps in relation to the applicant if it had appeared likely at that time that any such exposure of her father to radiation might have engendered a real risk to her health."[155] A failure to demonstrate such causal link, thus, is fatal to a claim under Article 2.

### 2. Uncertain Causation Under Article 8

In claims brought under the right to private life, causality is relevant at several stages of the inquiry: first, in deciding the applicability of the provision, and subsequently, as to the finding of a breach.

#### a. Pollution that Triggers Application

According to the Strasbourg case law, which is consistent on this point, Article 8 is applicable when there is pollution caused by the state directly or indirectly in a failure to regulate private industry,[156] when the pollution exceeds a certain minimum level of severity,[157] and when it has a "direct adverse effect" on the individual's private and family life or wellbeing.[158] There is no arguable claim if the detriment is "negligible in comparison to the environmental hazards inherent to life in a modern city."[159]

In the case of toxic emissions, the Strasbourg Court may find a "direct effect" even when the pollution did not seriously impair the victim's health.[160] In *Brânduşe v. Romania*, a prisoner suffering from noxious odors from a nearby rubbish tip succeeded with his claim in the clear absence of any health injury.[161] The Court found that wellbeing can be affected even in such cases.[162] The test of applicability focuses on whether the interference was capable of causing the harm at hand, or in other words, whether it was "potentially harmful."[163]

In practical terms, this requirement means that proving a causal link between the pollution and the health impairment is a sufficient, but not necessary, requirement for applying Article 8.

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155. *Id.* at 13.

156. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 282 (stating that state's responsibility "may arise from a failure to regulate private industry").

157. *Id.* at 277.

158. COUNCIL OF EUROPE, *supra* note 124, at 20; Guerra, 1998-I Eur. H.R. Rep. at 16.

159. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 277.

160. *See* COUNCIL OF EUROPE, *supra* note 124, at 47 (providing a summary of the Strausbourg Court's decision in *Brânduse v. Romania* and *López Ostra v. Spain*).

161. Brânduşe v. Romania, App. No. 6586/03, 2009 Eur. Ct. H.R. at 15, 21.

162. *Id.* at 19; *see also* Dzemyuk v. Ukraine, App. No. 42488/02, 2014 Eur. Ct. H.R. at 14.

163. *Dzemyuk*, 2014 Eur. Ct. H.R. at 14–15.

### b. The Necessary Causal Link for Finding a Violation—That Remains Hidden in the Analysis

As addressed above, states have a negative obligation to refrain from interference with private life by engaging in severely polluting activity. Furthermore, by virtue of their power to regulate potentially harmful industrial activities, they have a positive duty to prevent others from interfering with the enjoyment of the amenities of one's home and family life.[164]

In order to decide whether severe pollution—whether caused by a public or a private actor—constitutes a breach of Article 8, the Strasbourg Court requires "the *existence of proven* and serious consequences for the health of the applicant" as this triggers states' positive obligation "to adopt and implement reasonable and appropriate measures that protect [applicant's] well-being."[165] Accordingly, a state cannot be held liable for a failure to regulate private industry if the harm complained of is a result of preexisting conditions and not that of the emission at hand. This formulation of the Court's test renders causal links a prerequisite in finding a violation.

Problems engendered by preexisting conditions, which appear as competing possible causes (also referred to as plurality of causes),[166] are pervasive in toxic exposure cases. The Strasbourg Court makes clear in *Ledyayeva and Others v. Russia* that even though "serious industrial pollution negatively affects public health in general[,] . . . it is often impossible to quantify its effects in each individual case[] and distinguish them from the influence of other relevant factors, such as age, profession, etc."[167] Such statements, however, are never followed by a causal inquiry deciding the causal link. The Strasbourg Court, instead, "refrain[s] from making any conclusive findings as to whether or not the industrial pollution was the cause of the applicants' specific diseases."[168]

It is notable that an applicant has almost never successfully proven causation based on uncertain evidence when the causal link is disputed by the other party. Instead, violations are declared when the defendant government does not contest the causal link surrounding the harmful

164. Hatton v. United Kingdom, 2003-VIII Eur. Ct. H.R. at 22–23.

165. Bacila v. Romania, App. No. 19234/04, 2010 Eur. Ct. H.R. at 12 (emphasis added). The judgment is available in French only, translation by the author.

166. Tătar v. Romania, App. No. 67021/01, 2009 Eur. Ct. H.R. at 37. The author translated "pluralité de leurs causes" from French.

167. Ledyayeva v. Russia, App. Nos. 53157/99, 53247/99, 53695/00, and 56850/00, 2006 Eur. Ct. H.R. at 18 (2006).

168. *Id.* at 21.

effects.[169] This provides a convenient factual basis for the Strasbourg Court to find a violation without assessing the probative value of scientific evidence. In exceptional cases, when the Strasbourg Court has found a violation, it has not elaborated on the reasons for accepting the evidence submitted; rather, it has simply concluded that it "has accepted the link between the medical conditions . . . and the exposure."[170]

The relevance of causal links is also demonstrated by the *Leon* judgment, where the Strasbourg Court dismissed the application with reference to the applicant's failure to submit "a valid claim supported by medical record" demonstrating adverse health effects caused by the lawful noise pollution.[171] This statement implies that the Strasbourg Court might consider finding a violation even if the pollution did not exceed domestic safety standards, provided that its adverse health effects and the respective causal link are established.

### 3. Uncertain Causation Under Article 41—Latency Periods

A causal connection between the violation and the damage sustained is also relevant to awarding compensation.[172] The Strasbourg Court is often criticized for its restrictive view when it comes to assessing causation under Article 41, even in cases when the underlying facts do not involve complex scientific expert evidence.[173]

The Court is normally reluctant to engage in speculation as to what would have happened had the violation not taken place.[174] This is even more the case when the Court faces complex medical issues in which long latency periods disrupt the finding of a causal link with the pollution. The lack of causality, in turn, precludes awarding damages. The problem of latency periods is well illustrated by the judgment in which the Strasbourg

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169. *Bacila*, 2010 Eur. Ct. H.R. at 13; Dubetska v. Ukraine, App. No. 30499/03, 2011 Eur. Ct. H.R. at 17; *see generally* Malgosia Fitzmaurice, *The European Court of Human Rights, Environmental Damage and the Applicability of Article 8 of the European Convention on Human Rights and Fundamental Freedoms*, 13 ENVTL. L. REV. 107 (2011) (reviewing cases on Article 8 of the Convention).

170. *Brincat*, 2014 Eur. Ct. H.R. at 41.

171. Leon v. Poland, App. No. 12605/03, 2009 Eur. Ct. H.R. at 13.

172. Marcus Kellner & Isabelle C. Durant, *Causation*, *in* TORT LAW IN THE JURISPRUDENCE OF THE EUROPEAN COURT OF HUMAN RIGHTS 449, 455 (Attila Fenyves et al. eds., 2011).

173. *See* Christa Kissling & Denis Kelliher, *Compensation for Pecuniary and Non-Pecuniary Loss*, *in* TORT LAW IN THE JURISPRUDENCE OF THE EUROPEAN COURT OF HUMAN RIGHTS 579, 590 (Attila Fenyves et al. eds., 2011) (referring to the question of compensation as "ancillary" to the question of a violation under the Convention).

174. Franz Bydlinski, *Methodological Approaches to the Tort Law of the ECHR*, *in* TORT LAW IN THE JURISPRUDENCE OF THE EUROPEAN COURT OF HUMAN RIGHTS 29, 72–73 (Attila Fenyves et al. eds., 2011).

Court denied pecuniary damages for loss of earnings associated with the health impairment caused by the violation.[175] Among the reasons for awarding no pecuniary damages, the Strasbourg Court explicitly referred to the "prevailing perceptions and lack of precise knowledge at the material time about the possible long-term effects."[176] This reveals latency periods to be an additional source of uncertain causation that burdens the applicant in toxic exposure cases.

## III. TECHNIQUES OF THE EUROPEAN COURT OF HUMAN RIGHTS TO MANAGE UNCERTAIN CAUSATION

The Strasbourg Court uses different tests for assessing alleged violations of negative and positive obligations. In terms of the negative obligations of states, Article 8(2) explicitly provides that a state's interference with the right to private life can only be justified if it is in accordance with the law.[177] In the context of toxic pollution, this means that a state-owned company's emissions in excess of domestic safety standards automatically constitute a violation.[178]

In contrast, the test for finding a violation of a state's positive obligations is not so straightforward. In such cases, the applicant claims that the interference with her private life resulted from a failure of the state to ensure the effective enjoyment of her right. As the domestic legality of a regulatory measure complained of is not a conclusive test for complying with positive obligations,[179] a breach of a given domestic law does not automatically trigger a violation of the Convention. Due to the great deference that the Court accords under Articles 2 and 8,[180] by according them a wide margin of appreciation,[181] states can freely choose among the alternative avenues provided under domestic law in order to comply with their positive duties.[182] For this reason, the Court has recourse to various tests for assessing whether the state's conduct amounts to a violation of positive duties. This section analyzes and evaluates these judicial methods.

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175. Vilnes v. Norway, App. Nos. 52806/09, 22703/10, 2013 Eur. Ct. H.R. at 73.

176. *Id.*

177. European Convention on Human Rights, *supra* note 6, at art. 8(2) (providing in that "there shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of . . . the economic well-being of the country").

178. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 283 (explaining that a direct interference by the state that causes a breach of domestic law necessarily violates the Convention).

179. *Id.* at 284.

180. RAINEY ET AL., *supra* note 114, at 403.

181. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 283.

182. *Id.*

### *A. Using Proxies to Substitute Causal Assessment of Uncertain Evidence*

The Strasbourg Court has never expressly articulated its methodology for finding a violation of positive obligations under Article 8. Based on a survey of case law, I argue that the Strasbourg Court has recourse to certain proxies when it decides about violations and does not assess the existence of a legally appreciable causal link between the toxic pollution and the health injury claimed. By virtue of this proxy-based methodology, the Court can adjudicate environmental cases without reexamining complex scientific evidence, which undoubtedly eases and accelerates its procedure. However, this proxy-based judicial approach has serious shortcomings.[183]

#### 1. Decoupling Article 8 Obligations from the Uncertain Causal Link

The proxy-based approach is a corollary of the test announced in the *López Ostra* case, where the Strasbourg Court decoupled Article 8 obligations from the requirement of causing health impairment to the plaintiff.[184] In the material case, the first occasion when the Strasbourg Court found a violation regarding pollution, the Court awarded damages to the applicant who suffered from excessive toxic air pollution emanating from a neighboring plant.[185]

The *López Ostra* test is formulated as follows: "severe environmental pollution may affect individuals' well-being and . . . affect their private and family life adversely without . . . seriously endangering their health."[186] As a consequence, the applicant does not need to prove causation between the environmental pollution and its harmful physical or mental consequences to support his or her claim. The test, in fact, circumvents the problems arising from uncertain causation by requiring a "sufficiently close link" between the state's measure—or omission—and the sphere of private life, not the actual health injury itself.[187] Under the judicially protected sphere of Article 8, the scope of the right to private life is thus broader than health. It encompasses not only protection against health injuries, but also other aspects of wellbeing. However, health injuries caused by a state's action or omission remain relevant under Article 8 as being the most direct form of interference that is prohibited by the provision.[188]

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183. *See infra* Part III.B.
184. *López Ostra*, 303-C Eur. Ct. H.R. (ser. A) at 15.
185. *Id.*
186. *Id.*
187. *Dzemyuk*, 2014 Eur. Ct. H.R. at 13; *Hardy*, 2012 Eur. Ct. H.R. at 43.
188. Atanasov v. Bulgaria, App. No. 12853/03, 2010 Eur. Ct. H.R. at 21; *Guerra*, 1998-I Eur. H.R. Rep. at 16.

The *López Ostra* test indicates a conscious turn away from assessing scientific evidence relevant to adjudicating causes of toxic exposure. Tellingly, the European Commission of Human Rights, which examined the case as to admissibility at a quasi-preliminary stage of the Strasbourg Court's proceeding, concluded that the plant at hand "could endanger the health of those living nearby and that there could be a causal link between those emissions and the applicant's daughter's ailments."[189] Given that the judgment itself cites this finding, it is difficult to escape the conclusion that the Strasbourg Court purposefully formulated the *López Ostra* test so as to circumvent the issue of causation by not requiring proof of a causal link involving the health injury.

The *López Ostra* decision is usually praised by human rights scholars[190] because it has brought considerable benefits in terms of enforcing environmental claims, especially in light of the Strasbourg Court's previous practice, which was to dismiss environmental pollution claims.[191] Indeed, relying on the abstract and less tangible concept of private life alleviates the evidentiary burden that rests with the applicant as it enables the Strasbourg Court to find violations even when the causal link between the pollution and the harm cannot be substantiated.[192]

As a consequence of this approach, one might expect that human-rights-based environmental protection would entail "a slight easing of the requirements for scientific proof of causation."[193] However, in the practice of the Strasbourg Court, plaintiffs rarely win toxic exposure cases for reasons that will be explored later in the analysis.

### 2. The Proxies that Substitute for Causal Inquiry: Identification and Assessment

The Strasbourg Court evaluates whether defendants' conduct amounted to a breach of their positive obligation based on certain criteria that intuitively seem to be reliable factors for estimating the harmful nature of

189. *López Ostra*, 303-C Eur. Ct. H.R. at 14.

190. Richard Desgagné, *Human rights—Environment—European Convention for the Protection of Human Rights and Fundamental Freedoms—Protected Right Based upon Environmental Degradation*, 89 AM. J. INT'L L. 788, 789 (1995).

191. Powell v. United Kingdom, 172 Eur. Ct. H.R. (ser. A) at 21 (1990).

192. Indeed, judgments declaring a violation often note that the causal link with the injury claimed was dubious. *See Fadeyeva*, 2005-IV Eur. Ct. H.R. at 279 (stating that the applicant did not present evidence that would "clearly connect" the environmental pollution to the applicant's illness); *see Ledyayeva*, 2006 Eur. Ct. H.R. at 7 (stating that the medical documents produced did not certify a causal link between the pollution and illness); *see also* Grimkovskaya v. Ukraine, App No. 38182/03, 2011 Eur. Ct. H.R. at 15–16 (stating that it is impossible to determine what caused the illnesses).

193. Boyle & Harrison, *supra* note 113, at 270.

the pollution at hand. Although the Court has never articulated its proxy-based methodology as a doctrinal approach to evaluating states' conduct, it justifies its findings of a violation with reference to the non-causal criteria that I dub here as proxies.

The Strasbourg Court uses the assessment by proxies as a substitute for a cause-and-effect inquiry. Instead of providing an elaborate causal assessment reconstructing the elements of the causal scenario that led to the injurious interference, the Court relies on the overall impression of the case. This approach enables the Court to circumvent assessing the uncertain causal link between the pollution and the injury and eliminates the peculiar scientific aspects of the case in order to avoid confrontation with its scientific (and uncertain) details. Even when the causal link could be established based on scientific evidence, the Strasbourg Court justifies its finding of a breach with reference to other criteria. This approach, however, can only result in rough justice. As will be seen shortly, the majority of the proxies cannot be justified scientifically and, therefore, do not offer persuasive legal tests for distinguishing cases concerning factually comparable pollution.

I argue that six such proxies can be discerned from the Court's environmental jurisprudence: (1) the distance between the polluter and the applicant's home; (2) whether the pollution was ongoing or only a byproduct of previous industrial activity; (3) the occurrence of prior accidents producing large-scale pollution; (4) the lawfulness of the toxic emission under domestic law; (5) exceptional facts bearing on the case or the egregiousness of the circumstances; (6) whether the state's decision-making process failed to comply with rule of law or procedural guarantees.

In some instances, the Court examines several of the proxies while in others, it only considers one of them. These proxies have not been articulated as exclusive criteria for applying Article 8 or for finding a breach under the provision. The Court did not announce the proxies *a priori*, rather, it developed them gradually in response to particular circumstances. However, the fact that the Strasbourg Court dismissed a claim expressly because it did not meet its proxies suggests that it tends to regard them as exclusive criteria.[194] Nevertheless, the Court is certainly free to add new proxies. What follows is a discussion of each of the proxies.

(1) The Strasbourg Court tends to attach particular relevance to the distance between the polluter's location and the applicant's home,[195] which is used as a proxy for assessing the "direct effect" of the toxic pollutant, a

194. *Atanasov*, 2010 Eur. Ct. H.R. at 20–22.

195. *See* Sands, *supra* note 112, at 615 (noting that the Strasbourg Court was "particularly impressed by the fact that the applicant lived just 12 meters from the offending plant").

criterion for applying Article 8.[196] As a reason for refusing to apply Article 8 in *Atanasov v. Bulgaria*, the Strasbourg Court referred to the fact that the applicant's home was "a considerable distance" from the tailings pond of a former copper mine, the source of the pollution.[197] In this case, justifying the claim's dismissal by the distance proxy was problematic in light of the risk assessment report of the national authority, which showed heavy metal concentration in the pond's sludge in excess of statutory levels, and estimated a risk of contamination within a radius of ten kilometers around the pond.[198] Given that the applicant lived only one kilometer away from the pond (and thus, within the zone of possible contamination), the facts of the case would have enabled the Strasbourg Court to find a direct effect, had it engaged in proper evidentiary inquiry instead of relying solely on the formalistic distance proxy.

This proxy is objectionable from a scientific point of view as the toxicity and the associated health risks of pollution cannot be examined merely with reference to the distance between the source and the exposed individual. Further, this proxy-based decision is also inconsistent with *Guerra and Others v. Italy*, where the polluting factory was similarly one kilometer away from the applicants' home;[199] yet, the distance did not prevent the Strasbourg Court from finding a violation under Article 8.

(2) When it comes to assessing the conformity of state conduct with the Convention, the Strasbourg Court also weighs whether the pollution is a "result of an active production" that "can lead to the sudden release of large amounts of" toxins.[200] This proxy, however, cannot be justified from a scientific point of view either. Hazardous substances released from a former industrial site can well remain dangerous for many decades;[201] thus, the fact that the factory ceased to operate has, in fact, no bearing on the toxic nature of the site.

(3) In terms of Article 8 obligations, the Strasbourg Court also considers whether prior incidents occurred involving the industrial activity under consideration.[202] Prior industrial accidents were an explicit ground

196. *See Atanasov*, 2010 Eur. Ct. H.R. at 17 (finding that the severity of toxic substances contained in sludge that directly affected the applicant triggered Article 8).

197. *Id.* at 20.

198. *Id.* at 7.

199. *Guerra*, 1998-I Eur. H.R. Rep. at 4.

200. *Atanasov*, 2010 Eur. Ct. H.R. at 20.

201. *See, e.g.*, Ron Stodghill, *Decades After a Plant Closes, Waste Remains*, N.Y. TIMES (July 29, 2007), http://www.nytimes.com/2007/07/29/business/yourmoney/29spill.html [https://perma.cc/MW93-7CA2] (describing the health effects that still occur after a New Jersey Ford plant stopped dumping hazardous waste in 1971).

202. *Atanasov*, 2010 Eur. Ct. H.R. at 20.

for finding a violation of Article 8 in *Guerra and Others v. Italy*.[203] However, this proxy is clearly too permissive as it identifies only the most egregious instances of pollution. As discussed above, the protected sphere of private life under the *López Ostra* test is much broader than prohibiting interference caused by severe industrial accidents.[204]

(4) The lawfulness of an emission under domestic law is another important proxy for assessing the facts of a case. A state-owned entity's unlawful emission automatically triggers a violation, while a private industrial actor's unlawful emission is only one relevant factor out of many for deciding whether a state has fulfilled its positive obligations.

The Strasbourg Court attaches a causal presumption to this proxy by holding that where pollution exceeds domestic safety levels it "becomes potentially harmful to the health and well-being of those exposed to it. This is a presumption, which may not be true in a particular case."[205] Applying the presumption, the Strasbourg Court may find that "the applicant's health deteriorated as a result of her prolonged exposure to the industrial emissions."[206]

The presumption is evoked with two caveats. First, it is only triggered by pollution "significantly above statutory levels."[207] Thus, pollution that only slightly exceeds statutory limits—which is often the case—falls short.[208] Second, the applicant needs to establish a "very strong combination of indirect evidence," which is contingent upon the Strasbourg Court's approach to appraising scientific evidence.[209] As will be seen shortly, the Court applies a rather strict approach to scientific evidence and tends not to rely on statistical probabilities, which narrows the scope of the presumption.

Nevertheless, the domestic legality proxy is the only one that can be justified on scientific grounds. In cases when the pollution exceeds health-based standards, the proxy directly relates to the toxic nature of the pollution and, thus, approximates the causal link between the exposure and the injury. Accordingly, when the Strasbourg Court has invoked the presumption, it has noted that the applicable domestic safety levels were

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203. *Id.* (distinguishing *Atanasov* from *Guerra* on the grounds of lack of prior incidents).
204. *López Ostra*, 303-C Eur. Ct. H.R. at 15.
205. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 281.
206. *Id.*
207. Bor v. Hungary, App. No. 50474/08, 2013 Eur. Ct. H.R. at 5; *see also Gómez*, 2004-X Eur. Ct. H.R. at 342 (stating that the volume of the noise rose above permitted levels triggering Article 8); Deés v. Hungary, App. No. 2345/06, 2010 Eur. Ct. H.R. at 5.
208. *See* Martínez v. Spain, App. No. 61654/08, 2013 Eur. Ct. H.R. 10–11.
209. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 281.

health-based standards.[210] However, domestic safety levels may be established irrespective of the pollution's health effects (e.g., technology-based standards).[211] In these cases, this proxy can be over-inclusive, namely, it can result in a violation even if the adverse health effects were not caused by the toxic emissions. Overall, this proxy leads to mixed results because it provides a less precise outcome than a causal assessment based on the evidence of the particular case.

(5) As Professor Sands noted regarding the *López Ostra* case, "it is . . . difficult to escape . . . the conclusion that the exceptional facts of this case provided the principal basis for the Court's finding."[212] This stance holds true for subsequent decisions as well. Thus, the egregiousness of the circumstances (such as the death toll among exposed individuals,[213] the duration of pollution,[214] and the obsolete nature of industrial technology involved)[215] serves as an additional proxy. Although this proxy can undoubtedly be useful for finding a violation where the dirtiest polluters are involved, state-of-the-art technology that is equally destructive to the individual's wellbeing would escape scrutiny. Similarly, the duration of unabated pollution would certainly work well as a proxy for violation to find a breach in cases of long-standing emissions. However, it falls short of catching transient, though injurious, emissions.

(6) Finally, compliance with the rule of law in states' regulatory obligations also seems to play a major role in the Strasbourg Court's analysis. This proxy was relied on in *Taşkın and Others v. Turkey*, which concerned environmental and health risks imposed by a gold mine using cyanide technology.[216] The authorities first refused to give a permit to the mine; however, after the Prime Minister intervened, they ultimately issued authorization.[217] The Strasbourg Court noted that when state organs fail to comply with requirements for the proper administration of justice, the procedural guarantees that the state should ensure under Article 8 are "rendered devoid of purpose."[218] Thus, it declared a violation.[219]

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210. *Id.*

211. *See, e.g.*, *Bor*, 2013 Eur. Ct. H.R. at 5 (finding a violation under Article 8 when noise exceeded permitted levels).

212. Sands, *supra* note 112, at 616.

213. *Guerra*, 1998-I Eur. H.R. Rep. at 17–18.

214. *Bor*, 2013 Eur. Ct. H.R at 6 (noting that it took 16 years for the state to respond adequately and abate the excessive noise pollution).

215. *See Ledyayeva*, 2006 Eur. Ct. H.R. at 2 (describing the steel plant that caused the injury in question); *see Fadeyeva*, 2005-IV Eur. Ct. H.R. at 262 (describing the iron smelter in question).

216. Taşkın v. Turkey, 2004-X Eur. Ct. H.R. at 25.

217. *Id.* at 6–9.

218. *Id.* at 25.

219. *Id.*

### *B. Drawbacks of the Proxy-Based Method*

Although the use of proxies might appear to be suitable for determining the vague scope of private life and, in many cases, provides a remedy against the most severe forms of environmental pollution, this method has several shortcomings.

Because proxies disregard underlying causal links, their use allows certain kinds of pollution to escape judicial scrutiny even when the injury was, in fact, caused by the toxic agent released. This application of the *López Ostra* test runs afoul of its original meaning according to which Article 8 prohibits even less severe interferences than actual health injuries.[220] In avoiding complex causal inquires and evidentiary assessments, the Strasbourg Court sacrifices predictable and nuanced judicial decision-making based on an objective and consistent approach to the scientific evidence available in the casefile. Moreover, the use of proxies can only provide rough justice as the decision results from an overall assessment of the facts rather than from a thorough causal analysis of the harm and the alleged violation and, therefore, risks being over- or under-inclusive.

Without considering scientific evidence of causation, the Strasbourg jurisprudence inevitably leads to highly controversial results by not remedying the very core of the interference with private and family life: namely, the cause of physical injury to the applicant. Equally disturbing outcomes are findings of a violation where the actual harm was not a result of the defendant state's action or omission even though that action satisfied many proxies.[221] Diminishing the role that causation plays in the Court's assessment hollows out the tort law function of the Strasbourg regime and narrows the scope of environmental harm against which the Convention provides protection.

Furthermore, the proxy-based approach yields inconsistent results by leaving certain victims uncompensated. This shortcoming is flagged by sets of cases where, despite similar facts and scientifically comparable harm, the Strasbourg Court has reached different outcomes as to whether they constitute a violation.

One of these sets is *Giacomelli v. Italy* and *Atanasov v. Bulgaria*.[222] The former complaint addressed a waste treatment plant, while the latter focused on a restoration of the tailings pond of a former copper mine that

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220. *López Ostra*, 303-C Eur. Ct. H.R. at 15.

221. *See, e.g.*, *Taşkın*, 2004-X Eur. Ct. H.R. at 25, 29 (holding that the government did not meet its obligation to secure rights related to private and family life under Article 8).

222. Giacomelli v. Italy, 2006-XII Eur. Ct. H.R. 345; *Atanasov*, 2010 Eur. Ct. H.R.

contained heavy metals.[223] Both cases concerned situations where the authorities failed to prepare a proper environmental impact assessment (EIA) study prior to the industrial activity.[224] In *Atanasov*, robust expert evidence suggested the existence of considerable risks of heavy-metal pollution;[225] in *Giacomelli*, there was a risk of toxic-waste leakage.[226] In *Giacomelli*, the applicant did not prove that any harm was sustained, nor did the Strasbourg Court require actual harm for the Court to find a violation.[227] In *Atanasov*, the applicant did not claim harm either as his application concerned pervasive risks of a reclamation scheme that were left unabated by the state.[228]

However, while in *Giacomelli*, the Strasbourg Court found a violation, in *Atanasov*, it reached the opposite outcome.[229] It listed five reasons (proxies) for not finding a violation: (1) the distance between the pond and the applicant's home; (2) the lack of active production on the site; (3) the lack of prior accidents; (4) the absence of proof of an increased morbidity rate; and (5) the lack of a showing of actual harm to the applicant's health.[230] The only proxy whereby *Giacomelli* produced a different result was the presence of active operation.[231] However, this is hardly a scientifically sound reason for treating these cases differently if one considers the grave health risks posed by non-restored former industrial sites.[232] Hence, this proxy cannot justify the different judicial outcome.

Another set concerns the difference in the awarding of pecuniary damages under Article 41 for adverse health consequences. In *Tătar*, the "plurality of causes" problem barred the Strasbourg Court from deciding whether the cyanide leakage was the cause of the applicant's aggravated asthma.[233] As a result, the Court did not award damages to the applicant.[234]

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223. *Giacomelli*, 2006-XII Eur. Ct. H.R. at 347; *Atanasov*, 2010 Eur. Ct. H.R. at 1.
224. *Giacomelli*, 2006-XII Eur. Ct. H.R. at 365; *Atanasov*, 2010 Eur. Ct. H.R. at 5.
225. *Atanasov*, 2010 Eur. Ct. H.R. at 10.
226. *Giacomelli*, 2006-XII Eur. Ct. H.R. at 357.
227. *Id.* at 362.
228. *Atanasov*, 2010 Eur. Ct. H.R. at 1, 22.
229. *See Giacomelli*, 2006-XII Eur. Ct. H.R. at 366 (finding a violation for failing to prepare an EIA); *Atanasov*, 2010 Eur. Ct. H.R. at 20–22 (finding no violation under Article 8).
230. *Atanasov*, 2010 Eur. Ct. H.R. at 21.
231. *See Giacomelli*, 2006-XII Eur. Ct. H.R. at 347 (assessing the operations of an active waste-treatment plant).
232. *See generally* WORLD HEALTH ORG., HUMAN HEALTH IN AREAS WITH INDUSTRIAL CONTAMINATION (Pierpaolo Mudu et al. eds., 2014), http://www.euro.who.int/__data/assets/pdf_file/0006/264813/Human-Health-in-Areas-with-Industrial-Contamination-Eng.pdf [https://perma.cc/6EPT-8YDC] (discussing the effects of industrial chemicals on human health).
233. *Tătar*, 2009 Eur. Ct. H.R. at 37.
234. *Id.* at 43.

In contrast, in *Vilnes*, competing causes were not an obstacle to the finding of a violation and the awarding of non-pecuniary damages.[235] This complaint concerned health damages incurred by seven former divers who worked for oil-drilling companies at the North Sea and sustained damage to their central nervous systems after their employment.[236] To prevent divers from getting decompression sickness, domestic authorities were responsible for enforcing safety standards set out in decompression tables for governing the length of time for decompression.[237] In this case, the Strasbourg Court concluded that the diving company's overly rapid decompression tables "had probably been a strong contributory cause of the applicants' health deteriorations.[238] Possible competing causes, thus, did not preclude the finding of a causal link.

Still, another inconsistency emerges from a comparison of the *L.C.B.* and *Brincat* cases.[239] The judgments in these cases took different directions on whether the defendant state ought to have known about the existence of health risks associated with toxic exposures caused by the state. In the first case, the underlying hazardous activity consisted of nuclear tests run by the United Kingdom between 1952 and 1967 to which the applicant's father was exposed.[240] The second case featured Malta's ship-repair industry, which, from the 1950s, exposed unprotected workers to asbestos who later either died of mesothelioma or sustained various types of cancer.[241]

In both cases, the states submitted that they were not aware of the risks imposed on their citizens.[242] They also contested the causal link between the exposures and the health injuries claimed.[243] A further similarity is that scientific discourse had begun to raise awareness about the pervasive health risks of both types of exposure at the time of the states' conduct.[244] The applicant in *L.C.B.* relied on research that was conducted prior to his exposure—right after the Hiroshima and Nagasaki bombings—which showed a statistical association between the incidence of leukemia and radioactive exposure.[245] In *Brincat*, the Strasbourg Court acknowledged that the World Health Organization (WHO) and the International Labour

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235. *See Vilnes*, 2013 Eur. Ct. H.R. at 36 (showing not a plurality of causes, but a single cause).
236. *Id.* at 3–5.
237. *Id.* at 4.
238. *Id.* at 63.
239. *L.C.B.*, 1998-III Eur. Ct. H.R.; *Brincat*, 2014 Eur. Ct. H.R.
240. *L.C.B.*, 1998-III Eur. Ct. H.R. at 4.
241. *Brincat*, 2014 Eur. Ct. H.R. at 3.
242. *L.C.B.*, 1998-III Eur. Ct. H.R. at 10; *Brincat*, 2014 Eur. Ct. H.R. at 32–33.
243. *L.C.B.*, 1998-III Eur. Ct. H.R. at 10; *Brincat*, 2014 Eur. Ct. H.R. at 23.
244. *L.C.B.*, 1998-III Eur. Ct. H.R. at 4–5, 9; *Brincat*, 2014 Eur. Ct. H.R. at 2.
245. *L.C.B.*, 1998-III Eur. Ct. H.R. at 9.

Organisation (ILO) already began raising awareness about the dangers of asbestos in the 1950s.[246] Therefore, the extent of uncertainty surrounding the harmful effects of both exposures was arguably comparable at the time of the states' injurious conduct; thus, the respective states ought equally to have known about the health hazards.

Despite these similarities, the Strasbourg Court reached different outcomes. In *L.C.B.*, the court subscribed to the view that the United Kingdom should not have known about the risks of nuclear radiation,[247] whereas in *Brincat*, Malta was held liable for violating the workers' right to life because, in the Strasbourg Court's view, Malta ought to have known about the health hazards of asbestos.[248]

Finally, due to the lack of a clear causal inquiry, the Court's reasons for finding or not finding a violation remain obscure, and thus, future plaintiffs are left with little guidance as to the evidentiary requirements of the Strasbourg Court.

### *C. Dismissive Approach Toward Probabilistic Evidence of Causation*

#### 1. Too high a level of certainty is required.

The Strasbourg Court's standard of proof is generally high as it uses the beyond-a-reasonable-doubt standard,[249] which is met by "the coexistence of sufficiently strong, clear and concordant inferences or of similar unrebutted presumptions of fact."[250] While the Court emphasized that it allows flexibility in this respect with regard to the evidentiary difficulties involved,[251] in its practice, it rarely accepts probabilistic proof of causation.

The Court's approach to statistical evidence was at the core of the decision reached in *Tătar v. Romania*.[252] Several pieces of evidence were not refuted by the Strasbourg Court; however, it still refused to accept them as adequate proof of causation.[253] A report jointly issued by the United Nations Environment Programme (UNEP) and the Romanian authorities established the existence of excessive cyanide pollution near the applicant's home.[254] The city hospital reported an increased number of respiratory

246. *Brincat*, 2014 Eur. Ct. H.R. at 2.
247. *L.C.B.*, 1998-III Eur. Ct. H.R. at 13.
248. *Brincat*, 2014 Eur. Ct. H.R. at 32–34.
249. DAVID HARRIS ET AL., LAW OF THE EUROPEAN CONVENTION ON HUMAN RIGHTS 148 (3rd ed. 2014).
250. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 279.
251. *Id.*
252. *Tătar*, 2009 Eur. Ct. H.R. at 47–48.
253. *Id.* at 37.
254. *Id.* at 35.

diseases among local children, and many experts agreed that cyanide might cause irritation to the respiratory tract.[255] However, the Court found that these pieces of evidence were insufficient "to create a causal probability" between the cyanide leaching and the aggravated asthma.[256] The Court refused to engage in "probabilistic reasoning"[257] as in its view, this would only be acceptable if the claim is "accompanied by sufficient and convincing statistics."[258]

In his dissent, Judge Zupančič heavily criticized the Strasbourg Court for the overly formalistic "classical causal approach," which "does not know the concept of uncertainty."[259] Later, he also emphasized that:

> It is disappointing that the European Court of Human Rights remains . . . in the . . . not really enlightened perception of what is cause and effect in law – in a situation in which the environmental pollution is at least one of the major contributing factors to problems that led the plaintiff to the Court.[260]

As is demonstrated by the case of *Brincat and Others v. Malta*, even when the Strasbourg Court finds a breach, it avoids evaluating uncertain scientific proof of causation.[261] This case concerned liability for a state's omission that resulted in health injuries.[262] The Strasbourg Court "accepted the link between the medical conditions affecting the relevant applicants and their exposure to asbestos" but did not provide any reasoning for its causal findings.[263] This stance is interesting because the underlying facts were far from being entirely clear, and the Court has a high threshold for accepting scientific claims. Thus, the finding of a causal link would certainly have deserved a more in-depth discussion.

The medical certificate of the deceased worker only indicated that the death was "*likely* to be a result of asbestos exposure."[264] Also, the National Cancer Institute held that whether asbestos-related diseases develop

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255. *Id.* at 37.
256. *Id.*
257. *Id.* The author translated "raisonnement probabiliste" from French.
258. *Id.* The author translated "scientifique accompagnée d'éléments statistiques suffisants et convaincants" from French.
259. *Id.* at 46 The author translated "la démarche causale classique" and "qui ne maîtrise pas la notion d'incertitude" from French.
260. Zupančič, *supra* note 9, at 122.
261. *Brincat*, 2014 Eur. Ct. H.R.
262. *Id.* at 2–3 (noting the lack of information regarding asbestos dangers by the employer, which led to health implications for the employees).
263. *Id.* at 41.
264. *Id.* at 23 (emphasis added).

depends on a number of factors, among them, smoking.[265] This is especially important given that some of the applicants were smokers.[266] However, instead of weighing the contradictory evidence, the Strasbourg Court found Malta liable for endangering the lives of the applicants on the grounds that, on account of its ILO membership, the government "knew or ought to have known" about the dangers of asbestos.[267] This statement implies that the Court was convinced that the asbestos was the cause of the harm sustained, although not primarily on the basis of the expert evidence but on account of widely held views on the toxic nature of asbestos.

The *ad hoc* weighing of non-scientific evidence is objectionable from a doctrinal point of view as it obfuscates the evidentiary requirements of the Strasbourg Court. Liability for a state's omission that allegedly resulted in health injuries simply cannot be decided without considering the evidence on causality. This is not to say that the outcome of the judgment could not have been justified from a moral, or even from a scientific, point of view; nevertheless, it illustrates the Court's ambivalent approach toward scientific evidence.

Interestingly, the Strasbourg Court has generally been more open to evaluating (and finding) causal links when facing non-scientific uncertainties. The Court appears to be more comfortable coping with ordinary causes of uncertain causation that are relatively common in everyday life. This is evidenced by the decision in *Kolyadenko and Others v. Russia*, where the Court heard claims under Article 2 after a flood that occurred subsequent to a heavy rainfall and threatened human lives.[268] In this case, the Court confronted uncertainty surrounding the causal role of the state's negligent maintenance of the river channels in generating life-threatening circumstances.[269] Irrespective of the causal role of excessive rain, the Strasbourg Court had no doubt that there was a legally appreciable causal link between the negligence and the endangerment of lives.[270] This instance suggests that the Court's dismissive approach to the establishment of causal links is heavily influenced by the peculiarities of scientific facts and causal concepts.

265. *Id.*
266. *Id.* at 3 (inferring that some applicants were smokers).
267. *Id.* at 31–33.
268. Kolyadenko v. Russia, App. No. 17423/05, 20534/05, 20678/05 and 35673/05, 2012 Eur. Ct. H.R. at 32, 34.
269. *Id.* at 33–34.
270. *Id.*

### 2. Probabilistic Evidence—Rare and Exceptional Acceptance

The Strasbourg Court famously considered the possibility to engage in "probabilistic reasoning" in *Tătar*; though, ultimately, it decided not to find a causal link based on the statistical evidence submitted to it.[271] In contrast, a more recent decision suggests that the Court is moving to the laudable direction of assessing probabilistic scientific evidence.

The Court accepted a probabilistic proof of causation for the first time in *Vilnes and Others v. Norway*.[272] Despite the lapse of time between the applicants' diving and the manifestation of their health impairments, during which many possible competing causes could have emerged, the Court found "a *strong likelihood* that the applicant's health had significantly deteriorated as a result of decompression sickness."[273] This time, the likelihood provided a sufficient basis for the Court to find a violation.

It should be noted, however, that much of the credit for the Strasbourg Court's turn in this instance belongs to the domestic court. The Court only reiterated the relatively straightforward statement of the Norwegian High Court, which acknowledged the existence of a causal link between the overly rapid decompression tables and the victims' health injuries.[274] Nevertheless, this case might also be an indication of the Strasbourg Court's growing understanding of the true nature of probabilistic scientific evidence, which is a core prerequisite to creating an effective judicial remedy against environmental harms.

## IV. REMEDYING HEALTH INJURIES CAUSED BY POLLUTION UNDER U.S. TOXIC TORT LAW

The Strasbourg Court's heavy reliance on proxies in making causal findings raises the question of the legal techniques that could be used to make scientifically based causal assessments. A ready answer can be found in United States toxic tort law. The Strasbourg Court could borrow from United States toxic tort law approaches in order to enhance its responsiveness to uncertain causation.

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271. *Tătar*, 2009 Eur. Ct. H.R. at 34, 37. The author translated "raisonnement probabiliste" from French.

272. See *supra* Part III.B above for the facts of the case.

273. *Vilnes*, 2013 Eur. Ct. H.R. at 64 (emphasis added).

274. *Id.* at 34.

### *A. Primer on the U.S. Toxic Tort Law Framework*

Toxic tort cases involve claims of personal injury, such as physical or psychological harm caused by exposure to a hazardous substance,[275] which can include a variety of causal agents, from pathogens to chemicals and radiation.[276]

In order to keep pace with the advancement of science and technology, traditional tort law theories adapted to the peculiarities of toxic exposure. They provide remedies for an expanding scope of "harm" under the theory of trespass, negligence, public and private nuisance, strict liability, and product liability.[277] In toxic tort cases, United States courts award damages for physical harm, increased risk of disease, medical monitoring, and psychological distress, such as fear of future harm.[278] With radical developments in the genomic sciences, it became feasible to detect cellular injuries that fall short of clinically detectable adverse changes.[279] Some commentators see great potential in this "genomic revolution" of toxic torts,[280] referring to the possibility of expanding the scope of actionable damages.[281] However, the majority of courts still require more than proof of subclinical changes.[282]

### *B. Causation Theories in U.S. Toxic Tort Cases: Adaptation to Uncertain Causation*

#### 1. The Two-Step Cause-in-Fact Inquiry

Perhaps the most salient way in which scientific evidence modifies traditional causal inquiry is the emergence of two distinct elements: general and specific causation.[283] Courts first assess general causation, i.e., whether

275. L. Neal Ellis, Jr., *Introduction* to TOXIC TORT LITIGATION 3, 3 (Arthur F. Foerster & Christine Gregorski Rolph eds., 2013). Environmental torts allow recovery for natural-resource damages. Bruce Jones et al., *Theories of Liability and Damages*, *in* TOXIC TORT LITIGATION 9, 47 (Arthur F. Foerster & Christine Gregorski Rolph eds., 2013). These will be not addressed in detail as they fall outside the scope of the paper.

276. Rudlin et al., *supra* note 82, at 139.

277. Ellis, *supra* note 275, at 5.

278. Jones et al., *supra* note 275, at 35.

279. Jamie A. Grodsky, *Genomics and Toxic Torts: Dismantling the Risk-Injury Divide*, 59 STAN. L. REV. 1671, 1674 (2007).

280. *Id.* at 1684.

281. *Id.* at 1675.

282. Jones et al., *supra* note 275, at 39.

283. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 26 (AM. LAW. INST. 2010).

the causal agent at hand is capable of causing the harm complained of.[284] Normally, the inquiry only reaches the question of specific causation if the factfinder is satisfied that the test of general causation has been met.[285] Two caveats apply here. First, when group-based data are unavailable, the two analytic steps merge into one.[286] Second, in cases of well-known signature diseases, courts generally find causation if the exposure and the manifestation of the disease are both established.[287]

If general causation is found to be established, the court investigates specific causation, i.e., whether the causal agent did actually cause the plaintiff's harm.[288] In this respect, courts should examine whether the plaintiff: (1) was indeed exposed to a dose at least comparable to that for which general causation is established; (2) was exposed to other potential causal agents; and (3) has individual genetic or behavioral characteristics that might present a background risk of the harm that occurred.[289]

### 2. But-for Causation, Substantial Factor Test

The primary test of tort law causation is the but-for (*sine qua non* or factual) causal test.[290] However, all tort law systems acknowledge certain exceptions from this general-causation theory.[291] The Third Restatement endorses the substantial-factor test in cases of multiple sufficient causal sets, i.e., when none of the causal sets in itself would be a but-for cause.[292] The substantial-factor test can also be used for ruling out causal agents that only have a *de minimis* causal contribution.[293] Moreover, courts employ the substantial-factor test in enhanced-injury cases, when only the extent of the harm that has been caused by a given defendant is uncertain.[294] In such cases, the plaintiff need only establish that the tortfeasor's conduct was a substantial factor in the enhanced harm.[295]

The Third Restatement repudiated a wider scope for the application of the substantial-factor test,[296] which some courts employ in cases involving

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284. *Id.*
285. Green, *supra* note 88, at 371.
286 RESTATEMENT (THIRD) OF TORTS § 28.
287. Gold, *supra* note 105, at 401.
288. RESTATEMENT (THIRD) OF TORTS § 26.
289. *Id.* § 28.
290. STEEL, *supra* note 31, at 16.
291. *Id.* at 16–17 (surveying the tort law systems of Germany, France, and the United Kingdom).
292. RESTATEMENT (THIRD) OF TORTS § 26.
293. KUNDIS CRAIG ET AL., *supra* note 96, at 370.
294. RESTATEMENT (THIRD) OF TORTS § 26.
295. *Id.*
296. *Id.*

dose-sensitive exposures (e.g., asbestos when causing asbestosis).[297] This will be addressed below.

3. Problems and Solutions in Cases Involving Multiple Causal Agents

Perhaps the most pervasive problem in toxic exposure cases is that the same injury might have been caused by numerous possible causal agents. The causal relevance of each agent should be assessed scientifically and then evaluated legally. However, sometimes it is impossible to identify the actual cause, a situation that is called the defendant-indeterminacy problem.[298] In other instances, the tortfeasors are identifiable but their contributions cannot be measured precisely—only estimated based on disease-development models. Further complications arise when multiple causal agents have synergistic effects. The legal methods to cope with these scenarios are addressed below.

a. Defendant Indeterminacy: Alternative Liability, Market-Share Liability

In cases where it is not possible to prove which one of the defendants' identical conducts was the actual cause of injury,[299] tort law applies alternative liability.[300] This test has been recognized in United States tort law ever since the two hunters' dilemma entertained in *Summers v. Tice*.[301] In the toxic tort context, the textbook example of defendant indeterminacy is the flood of litigation related to a miscarriage-prevention drug containing diethylstilbestrol (DES), the harmful effects of which were only manifested in the daughters of the women who took the drug during pregnancy.[302]

In *Sindell v. Abbott Laboratories*, the California Supreme Court applied alternative liability and reversed the burden of proof so that plaintiffs did not need to prove which specific defendant's drug they had taken because

297. It is to be noted, however, that only asbestosis is described with the threshold model among asbestos-related diseases, while mechanisms of mesothelioma and lung cancer are more explained with the one-hit exposure model. *See infra* Part IV.B.3.b.

298. *See* M. Stuart Madden & Jamie Holian, *Defendant Indeterminacy: New Wine into Old Skins*, 67 LA. L. REV. 785, 785 (2007) (discussing the issue of causal indeterminacy in environmental tort litigation).

299. Ken Oliphant, *Uncertain Factual Causation in the Third Restatement: Some Comparative Notes*, 37 WM. MITCHELL L. REV. 1599, 1600 (2011).

300. *See* STEEL, *supra* note 31, at 161–64 (overviewing alternative liability).

301. Summers v. Tice, 199 P.2d 1, 1 (Cal. 1948). The California Supreme Court reversed the burden of proof so that the defendants had to bear the burden of the virtually impossible task of proving which one of them caused the actual health impairment to the plaintiff, given that both used the same type of gun and the same bullets. *Id.*

302. *See generally* Note, *Market Share Liability: An Answer to the DES Causation Problem*, 94 HARV. L. REV. 668 (1981) (examining the difficulty of proving causation in DES cases).

adducing such evidence on specific causation would have been virtually impossible due to the lapse of time.[303] As there were hundreds of manufacturers who produced drugs containing DES, the California Supreme Court had to devise a new rule in order to allocate liability and not allow exculpation for the manufacturers.[304] The method it used became known as "market-share liability" because the court imposed liability on the defendants according to their respective market shares.[305]

Even though market-share liability was an innovative and exceptionally useful tool to solve the specific problems posed by the DES cases, the Third Restatement warns that it will be of limited use in the future because it is only applicable to cases where the manufacturers of the drug are unknown.[306] This is exceptionally rare under present-day circumstances. All pharmaceutical products are now protected by patents; thus, the manufacturers are known.[307] Moreover, market-share liability is only operational where all toxic products pose equivalent risks.[308]

### b. Multiple Exposures: Dose-Dependent (Threshold) Disease Development and One-Hit Exposure Theory

An ubiquitous challenge in toxic exposure cases is identifying which causal agent was *the* cause of injury when the victim was exposed to many agents, each of which is known to have been capable of causing the injury.[309] The toxic tort solution for this problem is to distinguish among the evidentiary requirements for different models of disease development.[310] Science differentiates between two main types of disease development: the threshold model, which describes dose-dependent diseases that manifest only above a certain threshold of exposure and whose severity is correlated with the exposure level (e.g., asbestosis),[311] and the one-hit exposure model, applicable for non-dose-dependent illnesses (e.g., certain forms of cancer).[312] Under the one-hit exposure theory, each exposure imposes distinct risks of developing the non-dose-dependent disease, and thus, each

303. *See* Sindell v. Abbott Labs., 607 P.2d 924, 924 (Cal. 1980) (holding that manufacturers of a drug are liable for a proportion of the share of the drug in the market).
304. *See id.* at 937 (describing the new market-share approach for allocating liability).
305. For more details on the market-share liability see STEEL, *supra* note 31, at 165–67.
306. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 (AM. LAW. INST. 2010).
307. *Id.*
308. *Id.*
309. *Id.*
310. *Id.*
311. *Id.*
312. *Id.*

exposure is a separate cause of the disease.[313] The threshold model implies that each dose of exposure creates a marginal additional harm.

For dose-dependent illnesses, the traditional rule of causation requires the plaintiff to show which of the multiple exposures was the actual cause of the disease (i.e., resulted in reaching the threshold).[314] However, to ease the evidentiary requirements for demonstrating the cause of such diseases, courts began applying the so-called Lohrmann test in asbestos litigation.[315] This text requires the plaintiff to adduce "evidence of exposure to a specific product on a regular basis over some extended period of time in proximity to where the plaintiff actually worked."[316] If the three-fold requirement of frequency, regularity, and proximity is met, courts are willing to regard the exposure as a "substantial cause" of the harm.[317]

Similarly, in *Rutherford v. Owens-Illinois, Inc.*, the plaintiff had to demonstrate that the defendant's product was "a substantial factor in causing or contributing to his risk of developing cancer,"[318] but he did not need to "prove . . . that fibers from a particular defendant's asbestos-containing products were those . . . that actually began the cellular process of malignancy."[319] This alternative causal test, thus, allows the plaintiff to prove that each of the multiple exposures was a cause in fact of the disease.[320] The Third Restatement promotes the adoption of this test in all cases when the exact disease-development mechanism is unknown; this is the best way of "adapting proof requirements to the available scientific knowledge."[321]

### c. Synergistic Effects of Multiple Causes

Causal agents can have synergistic effects in developing a harm. The Third Restatement provides that "[i]f the synergistic effect is sufficiently large, the excess incidence of disease due to synergistic effect will be greater than the excess incidence due to each of the agents separately."[322] In such cases, the factfinder is allowed to rule that the combined synergistic

313. *Id.*
314. *Id.*
315. Megan A. Ceder, Comment, *Dose of Reality: The Struggle with Causation in Toxic Tort Litigation*, 51 HOUS. L. REV. 1147, 1165 (2014).
316. Lohrmann v. Pittsburgh Corning Corp., 782 F.2d 1156, 1162–63 (4th Cir. 1986).
317. Rudlin et al., *supra* note 82, at 149.
318. Rutherford v. Owens-Ill., Inc., 941 P.2d 1203, 1206 (Cal. 1997).
319. *Id.*
320. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 (AM. LAW. INST. 2010).
321. *Id.*
322. *Id.*

exposure was the cause of the harm.[323] Courts usually allow harm to be apportioned in cases of synergistic effects between toxic exposure and causes inherent in lifestyle, such as smoking.[324] The plaintiff's genetic background risk of disease does not preclude the liability of a negligent actor if his conduct was a cause of the disease.[325]

The above developments show that multiple causal agents can fit well into the causal requirements of tort law and that tort law judges do not shy away from adjusting proof requirements to the available scientific knowledge. What is more, the ever-improving scientific models of disease developments help United States courts better understand the cause-and-effect relations of injurious exposures.

### *C. Proof of Uncertain Causation—Probabilistic Evidence, Probability of Causation*

Another striking difference between toxic tort law and the Strasbourg case law is the widespread acceptance of, and reliance on, probabilistic proof of causation. The Third Restatement is aware of the need for adapting traditional tort rules of proof "to a greater uncertainty inherent in agent-disease causation and the specialized types of evidence."[326] Tellingly, tort law scholars dub the evidence of causation "the holy grail of toxic torts."[327]

The Third Restatement is mindful that all causal inquiries presuppose inferential reasoning and only allow reasonable inferences, not impermissible speculations.[328] Within these confines, courts should make causal inferences on a case-by-case basis. The preponderance rule and the use of naked statistical evidence, along with the doubling of relative risk standard, are important United States toxic-tort-law tools that enable reliance on uncertain scientific evidence.

#### 1. Burden of Proof

The burden of proof is normally born by the plaintiff;[329] however, special rules accommodate the challenges of toxic tort cases. As one exception, in alternative-defendants situations, the burden of proof is

323. *Id.*
324. *Id.*
325. *Id.*
326. *Id.*
327. Joseph Sanders, *Apportionment and Proof in Toxic Injury Cases*, 10 KAN. J.L. & PUB. POL'Y 200, 202 (2000).
328. RESTATEMENT (THIRD) OF TORTS § 28.
329. *Id.*

reversed for the benefit of the plaintiff in certain jurisdictions.[330] There are no generally accepted rules on the burden of proof where preexisting conditions contribute to the harm as the nature of these conditions varies considerably and influences the imposition of the burden.[331] In this respect, courts generally consider whether the preexisting condition was a result of innocent forces (such as the plaintiff's genetic heritage) or involved a conscious choice (such as one of lifestyle) and whether the plaintiff was contributorily negligent.[332]

### 2. The "More Likely than Not" Standard—And Even Less Likely than 50 Percent?

The Third Restatement generally requires that the plaintiff prove the causal link by a preponderance of the evidence, meaning that the factor was more likely than not to be the cause of the injury.[333] The preponderance rule entails an "all-or-nothing" liability.[334] If the plaintiff can prove the causal link on the balance of probability, the defendant is held liable for the entirety of the harm.[335] The strong version of the preponderance rule allows for pure mathematical probabilities to meet the "more likely than not" standard; the weak version, as discussed earlier with reference to the *Rapid Transit* problem, requires an actual belief on the part of the factfinder to meet that standard.[336]

Some scholars suggest that the preponderance rule can be abandoned and replaced by proportional liability based on the probability of causation.[337] This would mean that a causal link could be established if there were less than a 50% probability of causation, and the defendant would be held liable to the extent of that probability.[338] Critics of proportional liability argue that it will result in excess damages due to the subjective judgments needed from scientists to interpret statistical data on probabilities.[339]

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330. Oliphant, *supra* note 299, at 1602.
331. RESTATEMENT (THIRD) OF TORTS § 28.
332. *Id.*
333. *Id.*
334. Rosenberg, *supra* note 79, at 857.
335. *Id.* at 858; *see supra* Part I.A.2
336. *Id.* at 857–58.
337. *Id.* at 859.
338. Green, *supra* note 88, at 359.
339. *Id.* at 388.

### 3. Relying on Statistical Evidence

In order to use group-based, statistical epidemiological evidence for proving general causation, courts must ascertain whether the association of data indeed reflects causal connection and not just spurious association.[340] For this purpose, courts rely on the Bradford Hill criteria, which were developed and originally used by scientists.[341] A legion of case law demonstrates courts' willingness to accept epidemiological data as proof of general causation.[342] However, statistical evidence alone is not always treated as adequate proof of specific causation.[343] In certain cases, biological-mechanism evidence combined with differential diagnosis may also be regarded as persuasive proof of causation if the differential diagnosis rules out all other known causes, if general causation is established, and if there is a short latency period or an acute disease development.[344]

### 4. Doubling the Relative Risk: An Evidentiary Rule for Both General and Specific Causation?

A certain type of statistical data gained special importance in United States toxic torts, namely, epidemiological data showing the "doubling of relative risk" (RR>2) as proof of causation.[345] The computation of the doubling of relative risk is illustrated by Professor Gold through the following example: "[I]f 5% of smokers get lung cancer, but only 1% of non-smokers do, the relative risk of smokers for lung cancer would be five, implying that smoking explains four of every five cases of lung cancer in smokers."[346]

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340. Gold, *supra* note 105, at 373. Epidemiological studies either compare the rate of disease occurrence in populations exposed to the causal agent to those populations not exposed or they examine the rate of exposure to the causal agent in populations where the disease is manifest to those populations which do not manifest the disease. *Id.*

341. *See generally* Hill, *supra* note 102, at 32–37 (proposing criteria for evaluating whether data association reflects causal connection); *In re* Lipitor Mktg., 174 F. Supp. 3d 911, 921 (D.S.C. 2016).

342. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 (AM. LAW. INST. 2010).

343. *Id.* In such cases, case reports on instances of an individual's disease and biological mechanism evidence can serve as additional proof. *Id.*

344. *Id.*

345. *Id.*

346. Gold, *supra* note 105, at 373. Professor Gold suggests that the threshold of more than doubling the relative risk reflects the preponderance test because a relative risk of two describes a case when the incidence of the disease in the exposed population is exactly double than that in the exposed population where the disease is attributable to background risks. *Id.* at 376. In such a case, a randomly

Toxic tort jurisprudence is split over whether courts should regard the doubling of relative risk as a proof of general[347]or specific causation.[348] Understandably, many courts find it troublesome to infer specific causation from group-based data that, in fact, provide no proof of an actual causal link to a specific individual's disease.[349] The Third Restatement allows for the use of RR>2 as a proof of specific causation as well.[350] However, it stresses that it is "usually inappropriate" to require demonstrating RR>2 when other types of evidence are available and general causation is established.[351] Nevertheless, the use of the RR>2 standard shows courts' willingness to accept naked statistical evidence to establish causation in toxic torts.[352]

Importantly, RR>2 is not a general panacea for every problem that arises in the "black-box" of uncertain causation.[353] It is blind to the distinction of whether but for the exposure, the disease would not have occurred at all or would have occurred only later in the plaintiff's life.[354] Hence, the RR>2 standard can be misused as it systematically underestimates the probability of causation in cases when the exposure only accelerates the disease.[355] Another possible misinterpretation of the RR>2 standard is that relative risk might vary depending on the genetic heritage of a given individual.[356]

By and large, the judicial use of the RR>2 standard stands as a laudable example of accepting irreducible uncertainty in scientific results. As the court noted in *Merrell Dow Pharmaceuticals, Inc. v. Havner*, "[t]he use of scientifically reliable epidemiological studies and the requirement of more than a doubling of the risk strikes a balance between the needs of our legal system and the limits of science."[357] Indeed, the standard appears to be a

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selected individual from the exposed group of the population who manifests the disease is equally likely to be either harmed *due to the exposure* or having developed the disease *due to background* causes. *Id.*

347. RESTATEMENT (THIRD) OF TORTS § 28.

348. *See generally* Russellyn S. Carruth & Bernard D. Goldstein, *Relative Risk Greater than Two in Proof of Causation in Toxic Tort Litigation*, 41 JURIMETRICS 195 (2001) (discussing causation in toxic tort lawsuits).

349. Gold, *supra* note 105, at 374.

350. RESTATEMENT (THIRD) OF TORTS § 28.

351. *Id.*

352. Richard W. Wright, *Proving Causation: Probability Versus Belief*, *in* PERSPECTIVES ON CAUSATION 195, 215 (Richard Goldberg ed., 2011).

353. Grodsky, *supra* note 279, at 1687–88.

354. Greenland, *supra* note 25, at 1166.

355. Sander Greenland & James M. Robins, *Epidemiology, Justice, and the Probability of Causation*, 40 JURIMETRICS 321, 327, 329 (2000).

356. Gold, *supra* note 105, at 390. Gold drew attention to some studies showing dramatic changes in relative risk of developing breast cancer among smoking women depending on whether they carried the protective allele. *Id.*

357. Merrell Dow Pharm., Inc. v. Havner, 953 S.W.2d 706, 718 (Tex. 1997).

useful tool for establishing causation when the evidence inevitably falls short of the traditional requirement of certainty. Being able to measure the doubling of relative risk and then attaching probative force to it undoubtedly marks a great leap forward in bridging the gap between uncertain science and society's legitimate need for a tort law system based on the theory of corrective justice.

## V. LESSONS FOR THE STRASBOURG COURT FROM THE U.S. TOXIC TORT APPROACH

As evidenced by the above discussion, toxic tort case law has successfully adapted to the various challenges posed by the proof of uncertain causation. United States courts increasingly accept naked statistical evidence produced by epidemiology when the circumstances of the case make it impossible to obtain particularized evidence. This trend represents considerable progress compared to the 1980s, when a number of tort law scholars condemned United States courts for being too dismissive toward probabilistic evidence.[358] By now, United States courts have developed a thorough approach to evaluating the probative force of scientific evidence and have become quite successful in integrating uncertain scientific results into legal theories of causation.

United States toxic tort case law offers an alternative approach for the Strasbourg Court's avoidance of "science-intensive" evidentiary proceedings and detailed causal inquires. The judicial practices employed in toxic tort litigation clearly show that uncertainty does not constitute an insurmountable obstacle to a thorough judicial assessment. United States courts deal with expert evidence proactively and adapt legal theories of causation to ensure that probabilistic scientific evidence meets the applicable standard. Certain practices are particularly important for handling uncertain causation in toxic tort cases.

On the one hand, United States courts adopt a nuanced approach to evaluating expert evidence in toxic tort cases. Judges make considerable efforts to translate scientific results into legally relevant standards. The use of the Hill criteria and the diverse pieces of scientific evidence, which range from differential diagnosis to biological-mechanism models, exemplify these efforts.[359]

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358. *Cf.* Cranor, *supra* note 1, at 261 (criticizing courts for struggling to recognize the scientific and legal relevance of scientific studies); Brennan, *supra* note 37, at 493–94.

359. *See generally* Hill, *supra* note 102, at 32–37 (proposing criteria for evaluating whether data association reflects causal connection).

On the other hand, United States courts employ innovative tools, such as imposing market-share liability, that signal the courts' willingness to abandon traditional tort law causation requirements when those would prevent the plaintiffs' claims from recovery.[360] Finally, the Third Restatement mirrors United States courts' flexible approach to accepting statistical evidence.[361] The standard of RR>2 as proof of causation constitutes a reasonable compromise between the law's need for certainty in allocating liability and the inherent limitations of scientific method in identifying causal links.[362] Further, the preponderance standard renders it possible to establish causation based on the probabilistic results provided by the relative-risk standard.

From the above toxic tort practices, three appear to be readily transferable to the Strasbourg system as there are no procedural obstacles to their application and they are compatible with the Strasbourg Court's role. These include: (1) taking a closer look at scientific evidence and openly evaluating its probative force; (2) accepting probabilistic evidence as proof of uncertain causation; and (3) applying the balance of probability as the standard of proof of uncertain causation. Embracing these proposals would help the Strasbourg Court apply a more objective and consistent approach to decide the alleged violations in toxic exposure cases.

### 1. Considering Scientific Proof of Causation

This article presents a plea for causal inquiry by the Strasbourg Court in claims that involve health injuries that are allegedly caused by severe environmental pollution. It is argued that in such cases, the Court should revisit the scientific evidence submitted to it and should base its decision on whether a violation had taken place on the causal assessment of the scientific aspects of the case.

Conducting a thorough causal analysis in toxic exposure cases does not mean that the Strasbourg Court should disregard its proxies entirely. Neither it is incompatible with granting a margin of appreciation to states in ensuring the effective enjoyment of the rights at hand. Proxies can be suitable tools for determining unlawful conduct that encroaches upon the broader sphere of private life, i.e., those adverse effects on wellbeing that do not cause health injuries (e.g., grave health risks imposed on the individual). Violations of the procedural aspects of states' environmental

360. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 (AM. LAW. INST. 2010).

361. *Id.*

362. Carruth & Goldstein, *supra* note 348.

obligations (e.g., conducting an EIA or providing access to environmental information) can also be assessed through proxies. However, once health injuries emerge in the context of a toxic exposure, consistent and predictable jurisprudence can only be achieved if the Court considers causation and evaluates the scientific evidence submitted when it decides whether the *López Ostra* test has been fulfilled.[363]

Basing decisions on causal inquiry would produce more accurate results, and that, in turn, would ensure a more efficient jurisprudence. Moreover, conducting a transparent evidentiary assessment would result in a procedurally fairer jurisprudence by revealing the evidentiary standards that parties need to meet.

The Court does have the necessary powers to deal with the scientific aspects of the toxic-exposure claims submitted. The procedural rules of the Strasbourg Court allow for more scrutiny of scientific facts than is currently done in the Court's practice. To surmount its lack of scientific expertise, the Court has the power to appoint experts.[364] Pursuant to the Rules of Court, the Strasbourg Court can "ask any person or institution of its choice to express an opinion or make a written report on any matter considered by it to be relevant to the case."[365] By the time the Strasbourg Court started to decide environmental cases on the merits, scholars expected the Court to use its evidentiary powers in environmental cases.[366] However, as shown above, judicial practice evolved in the opposite direction.

Irrespective of the reluctance to appoint experts, the Strasbourg Court could still have a closer look at the scientific evidence already in the casefile. Even though it relies primarily on the fact finding of domestic courts, this practice does not mean that it is bound by such findings.[367] "The Court's proceeding is governed by the . . . free admission and assessment of evidence";[368] therefore, it may reevaluate causal findings of domestic fora. The Court itself has stressed the need not to "rely blindly on the decisions of the domestic authorities, especially when they are obviously inconsistent or contradict each other. In such a situation it has to assess the evidence in its entirety."[369]

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363. *López Ostra*, 303-C Eur. Ct. H.R. (ser. A) at 15; *see supra* Part III.A.1.

364. HARRIS ET AL., *supra* note 249, at 144.

365. EUROPEAN COURT OF HUMAN RIGHTS, RULES OF COURT 49 (Nov. 14, 2016), http://www.echr.coe.int/Documents/Rules_Court_ENG.pdf [https://perma.cc/SJP5-7RKV] (quoting the Annex to Rule A1(2)); HARRIS ET AL., *supra* note 249, at 144.

366. *See* Sands, *supra* note 112, at 615 (observing that the Court would likely use its evidentiary powers to decide an increasing number of complex environmental cases).

367. Shelton, *supra* note 111, at 115.

368. HARRIS ET AL., *supra* note 249, at 147.

369. *Dubetska*, 2011 Eur. Ct. H.R. at 19; *Dzemyuk*, 2014 Eur. Ct. H.R. at 13.

### 2. Accepting Probabilistic, Statistical Proof of Causation

The Strasbourg Court should use its existing evidentiary powers to engage in in-depth and meaningful evidentiary proceedings. A consistent and transparent methodology is essential to give future plaintiffs guidance as to the prospects for success of their claims. United States toxic tort case law proves that statistical evidence, such as epidemiological studies, can have probative force; therefore, the overly dismissive approach of the Strasbourg Court is hardly justifiable.

Examples from United States toxic tort law square with critiques that have long demanded that the Strasbourg Court be more open to probabilistic proof. They endorse the judicial acceptance of statistical evidence, arguing that in many cases, probabilities best approximate the fact pattern of the case. "So long as the statistical probability estimate takes into account enough features of the case at hand, it is not clear what complaint litigants (or others) could have."[370]

Acceptance of the RR>2 standard as a proof of causation would provide a valuable tool for the Strasbourg Court. It would affirm that uncertain scientific evidence can reach a level of legally appreciable (un)certainty on which the Court can rely. The widespread use of disease-development-mechanism models in adjusting causal proof requirements is another technique that could be useful for the Strasbourg Court when it faces multiple possible causes.[371]

The Strasbourg Court needs to abandon its avoidance of probabilistic statements on causation. Evaluating and accepting (uncertain) scientific facts will help Strasbourg judges make decisions that better approximate scientific standards of knowledge, which will always remain in the realm of statistical probabilities.

### 3. Lowering the Standard-of-Proof Requirement

In order to accept statistical proof of causation, the Strasbourg Court ought to be committed to lowering its beyond-a-reasonable-doubt standard in every toxic exposure case.[372] Such a judicial intent was articulated in *Fadeyeva*,[373] although subsequent practice remained dismissive toward uncertain evidence and continued to demand proof beyond a reasonable

370. STEEL, *supra* note 31, at 101.

371. RESTATEMENT (THIRD) OF TORTS: LIABILITY FOR PHYSICAL AND EMOTIONAL HARM § 28 (AM. LAW. INST. 2010).

372. HARRIS ET AL., *supra* note 249, at 148.

373. *Fadeyeva*, 2005-IV Eur. Ct. H.R. at 279.

doubt.[374] Probabilistic evidence could meet a lenient standard more easily, which would improve the Court's responsiveness to uncertainty.

The toxic tort example suggests that the balance of probability is a workable compromise between the law's need for certainty and the inescapably uncertain results of scientific research. Favoring the preponderance standard would enable the Strasbourg Court to find causal links established on the basis of uncertain proof when the circumstances of a case preclude achieving clearer results.

However, in several instances, the Strasbourg Court has refused to rely on statistical evidence that could have satisfied the preponderance standard. In *Tătar*, epidemiologic group-based evidence was submitted that could have provided a sufficient evidentiary basis for finding a causal link under Article 41 and awarding damages for the health injury.[375]

## CONCLUSION

This comparative study has highlighted the distinctive paths that courts can take in compensating health injuries when facing uncertainty. They can either regard uncertainty as a reason for not dealing with the evidence at hand, or they can try to bridge the gap between law and science by employing various evidentiary and causal methods. The task of deciding whether to allocate liability based on an uncertain causal link ultimately rests with judges because there is no universal causal principle that would "relieve the courts of the burden of discretion or creative choice."[376]

At a time when growing scientific knowledge allows us to better understand disease developments and to identify the causal mechanisms underlying health injuries, a legal regime that distances itself from the scientific aspects of causation runs the risk of being detached from reality and, in turn, of losing legitimacy. Fortunately, courts have the power to close the gap between law and science by embracing uncertain evidence to the extent possible and translating probabilistic proof into legal consequences with due regard to the true nature of the scientific facts of the case.

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374. In a judgment handed down in 2011, the Strasbourg Court noted that it "considers that there is insufficient evidence to prove all the applicant's allegations 'beyond reasonable doubt.'" *See Grimkovskaya*, 2011 Eur. Ct. H.R. at 15.

375. *Tătar*, 2009 Eur. Ct. H.R. at 49.

376. HART & HONORE, *supra* note 18, at 130.