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Comment

***1289** OPENING THE DOOR TO THE INDETERMINATE PLAINTIFF: AN ANALYSIS OF THE CAUSATION BARRIERS FACING ENVIRONMENTAL TOXIC TORT PLAINTIFFS

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More and more individuals living near large industrial and manufacturing plants are being diagnosed with serious and often devastating diseases. In many instances, these individuals unknowingly have been exposed to silent and invisible hazardous substances as a result of the improper disposal practices of large industrial and manufacturing plants. The exposure typically does not cause immediate harm to the nearby residents, but can result in serious illness several decades later when the disease manifests itself.

In this Comment, Shelly Brinker explains how traditional causation rules make it difficult for these individuals to overcome the indeterminate-plaintiff problem by proving that the industrial and manufacturing plants were the cause of their injuries. This Comment describes and critiques a variety of approaches, including the preponderance rule, the proportionality rule, burden shifting, and legislation, that courts and commentators have developed to deal with the causation barriers that inevitably exist in the environmental toxic tort context. Finally, this Comment concludes that courts should employ a substantial-factor approach to establish causation in the toxic tort context. This approach would dispense with the burdensome limitations present in current causation standards and proposals, and would also enable more plaintiffs to recover fully for their injuries while also deterring defendant companies from acting unreasonably and negligently in the future.

***1290** Introduction

In recent decades, it has become devastatingly apparent that average Americans living near large industrial and manufacturing plants may be risking their lives and their health. The emergence of the now familiar leukemia cluster in Woburn, Massachusetts in the 1970s is a telling example of how truly serious the threat to health may be. During the late 1960s and throughout the 1970s, children growing up in Woburn, a small town thirteen miles outside of Boston, suffered from an unusually high number of colds, sore throats, and other infections. But even more alarming was the increase in leukemia and cancer cases among young children and adults living within blocks of three large industrial plants. Anne Anderson, whose youngest child was diagnosed with leukemia in 1971, began to wonder whether it was a coincidence that so many children in the neighborhood were suffering from leukemia or whether some other factor in the community had induced the diseases. In 1979, Woburn citizens learned that two of Woburn's wells were contaminated with the toxic industrial solvents trichloroethylene and tetrachloroethylene--two suspected carcinogens. Subsequent studies by the Center for Disease Control and the Massachusetts Department of Public Health confirmed that the leukemia incidence rate in Woburn was significantly higher than expected. Anderson and the other families in Woburn affected by leukemia suspected that the increased leukemia rate in Woburn centered around the two contaminated wells. [FN1]

This Comment explores the difficulties that plaintiffs, like the Woburn citizens affected by leukemia, face when they attempt to hold large ***1291** industrial and manufacturing plants liable for causing their illnesses. In particular, this Comment focuses on the indeterminate-plaintiff problem in environmental toxic tort lawsuits. Given the characteristics of environmental toxic tort cases, how can any given plaintiff demonstrate that the alleged defendant company's negligent activities [FN2] were responsible for the development of the plaintiff's injury--in many instances, cancer? Part I begins by introducing the rise of the environmental toxic tort lawsuit and by investigating the characteristics inherent in environmental toxic torts. It then describes how those characteristics affect the traditional application of common-law causation principles to determining fault in toxic tort cases. Part II examines the preponderance rule--the causation standard that most courts apply to deal with the inapplicability of common-law causation rules in the environmental toxic tort context. It then explains the justifications for the preponderance rule as well as the obstacles that plaintiffs would face even if the preponderance rule were universally accepted. Part III then discusses and analyzes proposals that some courts and legal commentators have suggested should replace the preponderance rule for determining whether a defendant's activities were the cause-in-fact of plaintiff's injuries, including the proportionality rule, a burden-shifting approach, and legislation. Finally, Part IV proposes an additional alternative to the majority preponderance rule for evaluating causation in the indeterminate environmental toxic tort plaintiff context.

This Comment concludes that the preponderance rule, as well as its suggested replacements--the proportionality rule, burden shifting, and legislation--unjustly favor defendants by creating sometimes impossible roadblocks for plaintiffs attempting to recover fully for their injuries. Given the intrinsic uncertainties surrounding environmental toxic torts and the devastating consequences that they can have on human lives, courts should employ a more flexible substantial-factor approach in which a plaintiff would be permitted to bring forward whatever evidence he or she can--statistical or individualistic--to prove that the defendant's negligent activities were the cause-in-fact of plaintiff's injury. Under this substantial-factor approach, a plaintiff

would not have to satisfy the unreasonably strict ***1292** threshold requirements that current causation rules and proposals require. In addition, a substantial-factor approach, unlike current rules and proposals, would enable plaintiffs to recover in full for their injuries after proving that the defendant's activities were a substantial factor in harming the plaintiff. In each individual case, this approach would better ensure both that the burdens of uncertainty do not unjustly fall on plaintiffs and that the traditional goals that underlie the tort system--deterrence and victim compensation--are more effectively achieved. [FN3]

I. Background

A. Characteristics of Environmental Toxic Waste

The production of hazardous wastes [FN4] is an unavoidable by-product of the modern industrial era. [FN5] Everyday industries produce and dispose of a significant amount of hazardous waste. [FN6] The production of these chemicals is, of course, necessary and socially advantageous for the United States because it furnishes the nation with useful products and creates employment. [FN7] Nevertheless, hazardous-waste production and disposal is virtually certain to "pose a significant threat to human health." [FN8] This threat is even ***1293** more profound if the owners of these production facilities improperly, or negligently, produce and dispose of their hazardous wastes. [FN9] The actual threats to humans living near industrial and chemical plants depends on a variety of factors, including "the nature, quantity, and condition of the material deposited, the geological and hydrological conditions at the site, and the proximity of populated areas." [FN10] Even if wastes are disposed of properly, they may still reach the environment. For instance, one method of properly disposing of hazardous waste is to deposit it into containers that are then stored in the ground. If the containers corrode while the chemicals are still harmful, however, these chemical wastes may escape and migrate to surface waters or groundwater, or into the air in the form of gases and vapors. [FN11] Improper production and disposal of wastes--by dumping them directly into landfills or by storing them in containers ill suited to the particular waste's characteristics--only hastens the migration of toxic wastes into the environment.

If nearby residents are exposed to toxic substances as a result of industrial disposal and chemical migration, they often do not know it because most toxic chemicals are "silent" and "invisible." [FN12] Therefore, individuals already prone to increased risk of disease by their exposure to these potentially fatal substances may enhance their chance of developing disease from toxic exposure by unknowingly living their lives as they always have--by breathing the same air and by drinking the same water. In addition, given the characteristics of most diseases that develop from exposure to toxic substances, an individual who was exposed to hazardous waste in 1970 may not realize the devastating effects of such exposure until twenty years later when the injury finally arises. This is because cancer, one of the most prevalent injuries that results from exposure to toxic substances, [FN13] remains latent for ***1294** fifteen to forty years between exposure to the toxic chemical and onset of the disease. [FN14] The actual latency period in any given case depends on a variety of factors, including the type of carcinogen to which an individual was exposed, the length of an individual's exposure, and the age, sex, socioeconomic status, nutrition level, and hormonal balance of the individual. [FN15]

B. The Rise of the Environmental Toxic Tort

Over the past twenty years, environmental disasters involving hazardous-waste disposal, such as the Woburn case, [FN16] have dramatically increased; [FN17] they are "a concomitant of our industrial era." [FN18] Discovery that improper hazardous-waste disposal sites existed was not enough to caution individuals about their potentially disastrous effects, especially to human health and the environment. Rather, it was not until individuals personally witnessed and experienced hazardous-waste disposal disasters, through incidents such as Love Canal [FN19] and the Woburn case, that the government, and everyday citizens, began to realize that the problem is "'a public health nightmare of ***1295** extraordinary dimensions.'" [FN20] The health dangers posed by hazardous-waste contamination are even more striking because the often "invisible, tasteless, and odorless" character of hazardous substances makes nearby residents unknowing victims to exposure that often results in devastating illnesses and, sometimes, death. [FN21]

Congress has responded to the growing environmental problems caused by hazardous-waste contamination sites through the implementation of several federal statutes designed to alleviate much of the "environmental degradation problem." [FN22] Such statutes include: the Resource Conservation and Recovery Act; [FN23] the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund); [FN24] the Federal Insecticide, Fungicide, and Rodenticide Act; [FN25] the Safe Drinking Water Act; [FN26] the Federal Water Pollution Act; [FN27] and the Toxic Substances Control Act. [FN28] Although these environmental statutes respond to and attempt to eliminate specific harms caused by environmental pollution,

none of them provides a scheme to compensate human victims of hazardous-waste contamination. [FN29] As a ***1296** result, individuals who have been harmed by exposure to hazardous and toxic substances are forced to resort to the common-law tort system if they desire monetary recovery for their injuries. The common-law tort system, however, is not particularly amenable to plaintiffs in their efforts to recover for the devastating personal injuries that often result from exposure to environmental toxic substances. Specifically, environmental toxic tort plaintiffs' efforts to obtain tort remedies are often frustrated by statute-of-limitations requirements, [FN30] by the tremendous burden and expense involved in hiring experts and gathering data to prove their cases, by causation rules requiring plaintiffs to identify the responsible defendants, [FN31] and by causation standards designed to demonstrate that the defendant's wrongful activity really was the cause-in-fact of plaintiffs' injuries. [FN32]

***1297** C. Traditional Causation Rules

To recover in tort under any cause of action, a plaintiff has the burden of establishing a causal relationship between the defendant's tortious conduct and the plaintiff's injury. [FN33] To prove a prima facie case, the relationship must indicate that the defendant's activity both factually and proximately caused the plaintiff's injury. [FN34] Proximate causation is essentially a policy determination decided by the court about how far along the chain of cause-in-fact liability should extend. [FN35] Determination of factual causation, however, is objective and is generally decided by the jury. [FN36] Traditionally, the cause-in-fact inquiry requires the plaintiff to demonstrate a direct and linear cause-and-effect relationship between the defendant's activity and the plaintiff's injury. [FN37] If any other act by a third party or by the plaintiff breaks the linear chain of events from the defendant's act to the plaintiff's injury, then it is said to be intervening, and the plaintiff's burden of proving cause-in-fact fails. A factual causal relationship can be demonstrated using either the but-for test or the substantial-factor test. [FN38] To establish cause-in-fact using the but- for test, a plaintiff must show that the injury would not have occurred in the absence of the defendant's allegedly wrongful act. [FN39] The substantial- factor test, sometimes called the "material and contributing factor test," recognizes that "'[a]n event without millions of causes is simply inconceivable.'" [FN40] According to the Restatement (Second) of Torts, the substantial-factor test applies and is satisfied when "two forces are actively operating, one because of the defendant's [activity], the other not because of any misconduct on his part, and each of itself is sufficient to bring about harm to another." [FN41]

***1298** D. Traditional Cause-in-Fact Rules Would Bar the Environmental Toxic Tort Plaintiff

To satisfy the causation burden in the environmental toxic tort context, a plaintiff must prove that: (1) the plaintiff was exposed to an identified harmful substance; (2) the harmful substance was capable of causing the type of injury for which the plaintiff seeks redress and did, in fact, cause the injury; and (3) the defendant was responsible for manufacturing or disposing of the toxic substance that resulted in the plaintiff's injury. [FN42] Given the traditional rules requiring a direct and linear cause-in-fact relationship with no intervening causes, an environmental toxic tort plain-tiff attempting to prove the above in court would almost certainly fail. [FN43] In fact, according to one legal commentator, applying traditional causation rules "is analogous to placing a square peg into a round hole--it just will not fit." [FN44]

First, the plaintiff's attempts to prove a direct cause-and-effect relationship would likely be blocked by efforts to identify the actual substance that allegedly caused the plaintiff's injury. When chemical and manufacturing plants dispose of hazardous waste, they generally dispose of many different substances simultaneously over a long period of time. [FN45] These substances subsequently intermingle and, depending upon their characteristics individually or once combined, may migrate together to the same waters or evaporate together into the air. [FN46] Therefore, although a plaintiff may be able to demonstrate that he or she was exposed to this group of toxic substances, the intermingling effect of the substances can make it virtually ***1299** impossible for the plaintiff to identify a particular substance as having caused the plaintiff's injury. [FN47]

Second, assuming that a plaintiff can identify the alleged harm-causing substance disposed of by the defendant, a plaintiff may still have difficulty proving that the substance directly and immediately caused the plaintiff's injury. Medical and scientific experts poorly understand the etiology of many diseases. In fact, scientists are still trying to discover the molecular basis of cancer-causing agents. [FN48] Until they do, it will be impossible to establish conclusively that any given hazardous substance caused a plaintiff's cancer, [FN49] especially because the cancers associated with exposure to most environmental toxic substances have more than one possible cause. [FN50] Until carcinogenesis is completely understood, "any given statement about the role of any agent as a carcinogen is hedged with assumptions and hypotheses." [FN51] Therefore, in a system that requires a direct and conclusive ***1300** relationship between exposure to a hazardous substance and a plaintiff's injury, these assumptions and hypotheses open the door to the defendant to raise a myriad of defenses about other possible causes of the plaintiff's injury. [FN52] The defendant could argue that the plaintiff's cancer appeared because the plaintiff

smokes, or because the plaintiff lives (or once lived) in a large and polluted city, or because the plaintiff works (or used to work) in a job at which he or she could have been exposed to hazardous substances, or because the plaintiff's family has a genetic history of developing cancer. These other causal factors make it virtually impossible for a plaintiff to prove that the defendant's negligent activity caused the plain-tiff's cancer.

The latency period of cancer [FN53] also serves as a barrier to a plaintiff trying to satisfy traditional causation requirements. [FN54] The fifteen- to forty-year latency period between exposure and injury strengthens the likelihood that other causes--lifestyle and natural background causes such as those discussed above--contributed to the plaintiff's injury, [FN55] or entirely inter-vened to constitute the sole cause of the plaintiff's injury. [FN56] The existence or occurrence of these intervening or contributing factors may prevent a plaintiff from establishing causation with the level of certainty that traditional causation rules require. The latency period also adversely affects a plaintiff's ability to bring forward the kind of individualistic proof of causation that courts traditionally require. Because most hazardous substances are invisible, tasteless, and odorless, direct observation of a ***1301** plaintiff's exposure to the substance often is impossible. [FN57] This is unlike the typical tort case in which injury to the victim is immediately observable: "A's vehicle strikes B, injuring him; a bottle of A's product explodes, injuring B; water impounded on A's property flows onto B's land, causing immediate damage." [FN58]

In addition, the latency period and general characteristics of hazardous substances make it difficult for a plaintiff to establish the extent of exposure to the toxic substance as well as the duration of the exposure. [FN59] When an individual is unknowingly exposed to a hazardous substance that eventually migrates [FN60] into the environment, a plaintiff is unable to pinpoint when exposure occurred, the amount of exposure, or whether the exposure was isolated or recurring. [FN61] Given the limited individualistic proof available to show that exposure to a hazardous substance caused a plaintiff's injury, most plaintiffs are unable to satisfy their burden of proving a direct and linear cause-in-fact relationship between exposure and injury.

Given these barriers to recovery, plaintiffs are out of luck if traditional causation principles are applied in the environmental toxic tort context because proof of causation fails in virtually every case. Consequently, plaintiffs suffering from horrible and devastating diseases that could have been caused by a defendant's negligent activities are left completely uncompensated, while the defendant who could have caused a plaintiff's injury is permitted to continue its negligent manufacturing and disposal activities. If a defendant is not held liable for the wrongful production and disposal activities that have already caused injuries to nearby residents, then the defendant will have no incentive to make its activities safer to prevent similar injuries in the future. Thus, individuals unknowingly exposed to the defendant's hazardous wastes today may find themselves suffering from devastating diseases such as cancer fifteen to forty years down the road.

***1302** II. The Preponderance Rule

A. The Rule

In recognition of the uncertainty that surrounds environmental toxic torts and the subsequent inability of a plaintiff to prove conclusively that a defendant's wrongful activities caused the plaintiff's injury, a majority of courts have modified traditional common-law causation rules in the toxic tort context. [FN62] This modified causation rule--called the "preponderance rule"--does not lessen a plaintiff's burden of proving cause-in-fact. Like traditional causation rules, a plaintiff still bears the burden of proving causation by a preponderance of the evidence. [FN63] Rather, the preponderance rule responds to a plaintiff's inability to prove that the defendant's activity directly and immediately caused the plaintiff's injury by allowing the plaintiff to bring forward both individualistic [FN64] and statistical evidence [FN65] to establish ***1303** that the defendant's activities caused the plaintiff's injury. [FN66] Essentially, it is a plaintiff's ability to rely on statistical evidence that makes the prepon- derance rule less burdensome on a plaintiff than the traditional causation rules, which rely almost exclusively on direct and individualistic evidence.

Like traditional causation rules, courts also apply the preponderance rule using either the but-for test or the substantial-factor test. [FN67] Applying the preponderance rule in a jurisdiction using the but-for test, a plaintiff must establish that it is more likely than not that the plaintiff's injury would not have occurred absent the defendant's conduct. [FN68] The but-for test is generally only applicable when one environmental factor (i.e., one toxic waste chemical) could have caused plaintiff's injury. In such a case, a plaintiff would have the burden of proving that but-for the defendant's improper disposal of the hazardous chemical, the plaintiff would not have developed cancer. Conversely, in a substantial-factor jurisdiction, a plaintiff has the burden of proving that the defendant's activity, more likely than not, was a substantial factor in bringing about the plaintiff's injury. [FN69] More and more, courts favor the substantial-factor test in the environmental toxic tort context because it better

deals with mixed causation-- when more than ***1304** one chemical or environmental factor could have independently caused the plaintiff's injury. [FN70] The preponderance rule's but-for and substantial-factor tests are somewhat different from their traditional common-law coun-terparts because a plaintiff does not have to prove causation with certainty, but is only required to prove that causation was more likely than not. Nevertheless, whether a jurisdiction applies the but-for test or the substantial-factor test, a plaintiff must still bring forward enough evidence to establish by a preponderance of the evidence that the plaintiff's injury more likely than not--or more probably than not--resulted from the defendant's activities. Generally, courts have equated the preponderance rule's more-likely-than-not component as requiring a level of certainty greater than 50%. [FN71] When a plaintiff establishes that the probability of cause-in-fact is greater than 50%, the plaintiff is entitled to full compensation. However, a plaintiff recovers nothing if the probability of causation is less than 50%. [FN72] Mere possibility that a defendant's conduct caused the plaintiff's injury is not sufficient to satisfy the preponderance rule. [FN73] In fact, even when the probability of causation is evenly balanced, a plaintiff's burden of proving cause-in-fact must fail. [FN74]

Jurisdictions have applied the preponderance rule to varying degrees. Some jurisdictions apply a stricter version of the rule and require that a plaintiff bring forward both individualistic proof and statistical proof of the cause-in-fact relationship. [FN75] In these jurisdictions, a plaintiff does not satisfy his or her burden of proving causation even if statistical evidence indicates an 80% likelihood that the defendant caused the plaintiff's injuries. [FN76] The ***1305** plaintiff must bring forward additional individualistic evidence linking the plaintiff to the defendant's wrongful activity. [FN77] Unlike more typical tort cases, however, a plaintiff does not have to rely exclusively on specific evidence. It is enough that a plaintiff presents at least some individual proof that a defendant caused the plaintiff's injury. [FN78]

In Sterling v. Velsicol Chemical Corp., [FN79] the Sixth Circuit employed a strict version of the preponderance rule. In Sterling, plaintiffs brought a class action lawsuit [FN80] against Velsicol Chemical Corporation for personal injuries and property damage that allegedly resulted after they were exposed to chemicals from Velsicol's chemical-waste burial site. [FN81] The Sixth Circuit upheld the district court's finding of generic causation [FN82] as determined in relation to the representative plaintiffs. However, it emphasized that an ultimate finding of causation cannot be based solely on the existence of generic causation--"generalized proofs will not suffice to prove individual damages." [FN83] Rather, the court required that each individual plaintiff bring forward individualized proof "to show that his or her specific injuries or damages were proximately caused by ingestion or otherwise using the contaminated [substance]." [FN84]

Jurisdictions that apply a weaker version of the preponderance rule are not as strict when it comes to showing individual damages. Recognizing the inherent difficulties of bringing forward individual proof of harm caused by environmental toxic substances, these courts permit plaintiffs to rely solely on general, or statistical, evidence to prove that a defendant's wrongful ***1306** activities were the cause-in-fact of the plaintiff's injuries. [FN85] Therefore, a plaintiff can recover for injuries suffered by exposure to hazardous substances emitted by the defendant simply by statistically proving that the likelihood of causation is greater than 50%. [FN86] In a weak-version jurisdiction, a plaintiff is not required to bring forward direct evidence linking the plaintiff's injury to the defendant's conduct. [FN87] It should be noted that, even in a strict-version jurisdiction, as soon as a plaintiff brings forward at least some individualistic proof that a defendant's negligent activity caused the plaintiff's injury, the strict version merges with the more lenient weak version of the preponderance rule. [FN88]

Recently, courts have begun to combine the strict and weak versions of the preponderance rule. In one asbestos exposure case, Landrigan v. Celotex Corp., [FN89] the plaintiff sued Owens-Corning Fiberglass Corporation and Owens Illinois, Inc. for the death of her husband, which she alleged was caused by his exposure to defendants' asbestos. The court noted that an expert witness may rely on both epidemiological studies and individualistic proof to testify about whether exposure to a hazardous substance caused the plaintiff's injury. [FN90] On its face, this method of proof resembles the strict version of the preponderance rule. Even with the admission of individualistic proof, however, the Landrigan court did not require that the statistical evidence alone indicate a greater than 50% likelihood that the decedent died as a result of exposure to defendants' asbestos. [FN91] According to the court, "a relative risk of 2.0 is not so much a password to a finding of causation as one piece of evidence, among others, for the court to consider in determining whether the expert has employed a sound methodology in reaching his or her conclusion." [FN92] Consequently, the Landrigan court was not concerned ***1307** whether the strict version of the preponderance rule was followed, as long as a combination of all of the evidence--individualistic and statistical--indicated that the defendant's tortious conduct more likely than not caused the plaintiff's injury.

Although Landrigan is an asbestos exposure case, it is likely that a similar weakening of the strict version of the preponderance rule could occur in a case involving exposure to hazardous substances. Of course, it should not be forgotten that individualistic proof is sometimes impossible to bring forward in a hazardous-waste exposure case because the

characteristics of most toxic substances make it difficult to ascertain the etiology of the disease and the extent and duration of exposure to the hazardous substance. [FN93] This problem is not as overwhelming in most asbestos expo-sure cases because the etiology of asbestos-related diseases--asbestosis and mesothelioma--is better understood and is more conclusively connected to asbestos exposure than any disease is connected to toxic waste exposure. [FN94] Therefore, depending on the jurisdiction, a court mindful of the difficulties inherent in toxic substance exposure cases might hesitate to apply even the Landrigan version of the preponderance rule, and might enable a plaintiff to establish cause-in-fact based exclusively on statistical evidence, i.e., the weak version of the preponderance rule.

B. Justifications for the Preponderance Rule

As has been discussed, courts created the preponderance rule, and manipulated it into three different versions, in order to deal with the barriers facing plaintiffs in their efforts to prove that exposure to a particular hazardous substance caused their injuries. [FN95] Courts and commentators almost unanimously agree that the preponderance rule was a fair compromise given that virtually no plaintiff could overcome the cause-in-fact hurdle under traditional common-law causation rules. [FN96] The preponderance rule strikes a balance between the plaintiff's rights and the defendant's rights. It allows causation to be established on the basis of probabilities rather than certainty. This gives a plaintiff attempting to prove that his or her injuries resulted from the defendant's wrongful discharge of hazardous wastes obvious advantages that would not exist if traditional causation rules ***1308** applied. Under the preponderance rule--whether it is the strong version, the weak version, or a combination of the two--a plaintiff does not have to meet the impossible burden of proving cause-in-fact with certainty in order to recover from a defendant for, in many cases, devastating injuries. Conversely, however, the balance struck by the preponderance rule does not permit a plaintiff to recover for all injuries that could have resulted from a defendant's conduct. In other words, the 50% threshold requirement--that can be achieved solely from statistical evidence (the weak version), from some individualistic proof and a greater than 50% statistical likelihood (the strict version), or from a combination of individualistic and statistical evidence (the Landrigan version)--avoids forcing defendants to pay damages to all individuals suffering from a disease in the exposed population when the likelihood that a defendant actually caused those diseases is only a mere possibility. [FN97] According to one commentator, "[t]his balance reflects a value judgment based on our society's intuitive sense of civil justice." [FN98]

C. Criticism of the Preponderance Rule

Despite its justifications, the all-or-nothing nature of the preponderance rule has been criticized for inadequately responding to the deterrence, [FN99] corrective justice, [FN100] and fairness principles [FN101] that form the basis of tort ***1309** law. [FN102] Under the preponderance rule--whether it is the strict version, the weak version, or a Landrigan version--all plaintiffs in the exposed pop-ulation suffering from cancer recover completely if they can demonstrate a greater than 50% likelihood that the defendant's activities caused their injuries. However, if the measured likelihood is 50% or lower, then none of these plaintiffs recover anything. This characteristic of the preponderance rule leads to a system in which plaintiffs are either overcompensated or undercompensated for their injuries.

For instance, when the probability that a defendant caused a plaintiff's injuries is 65%, [FN103] all plaintiffs exposed to the toxic substance and suffering from cancer are compensated. [FN104] However, a 65% probability measurement does not indicate that a defendant caused each plaintiffs' injuries; rather, it reveals that a defendant is responsible for causing injury to 65% of the individuals in the exposed population. Consequently, 35% of the individuals in the exposed population that suffer from cancer developed their disease from other background factors (i.e., smoking, genetics, living in a polluted city, or some other unknown cause). [FN105] Therefore, compensating all individuals exposed and suffering from cancer creates a real potential for inflicting "a ***1310** crushing liability" on a defendant. [FN106] When a defendant is forced to pay 100% of the damages to a group of individuals suffering from cancer, even though the defendant only actually caused cancer in a substantially smaller percentage of the exposed population, the defendant is made liable for more than "the magnitude of its contribution to the risk of the plaintiff's injury." [FN107] This excess liability might distort a defendant's incentives to invest in safety and to act more carefully. [FN108] In other words, excess liability caused by a more- likely-than-not determination may encourage overdeterrence on the part of a defendant because it erroneously encourages a defendant to make unwarranted investments in safety in an effort to prevent future liability. [FN109] As a consequence:

> The market price would be higher than it should. Too little of [the defendant's product] "X" would be produced and used. Costly alternatives would become economically viable and be substituted for "X," thus raising the price of products which formerly incorporated this [product]. There might even be less economic incentive for cancer victims and researchers to look for other causes of this form of cancer. Since all victims would be entitled to full compensation from this single agent--even in cases where other factors actually caused [a percentage of the] disease--there would be less motivation to attempt to

identify other chemicals or environmental factors that can trigger the development of this cancer. [FN110]

Conversely, if a court determines that a defendant did not more likely than not cause the plaintiff's injury--because the probability of causation is less than 50%--plaintiffs exposed to the defendant's toxic substances and suffering from cancer will be undercompensated. [FN111] For instance, even if a court concludes that the probability that a defendant caused a plaintiff's injury is 49%, the preponderance rule requires the plaintiff's lawsuit to be dismissed for failing to meet the seemingly arbitrary more-likely-than-not ***1311** threshold. At this 49% probability level, and any lower level, tort law does not dispute that a defendant's activities actually caused injury in 49% of the exposed population. Rather, tort law deems it unfair to compensate all individuals in the exposed population when there is only a possibility (a 50% or less probability) that the defendant caused any one individual's injuries. [FN112] The result, however, is that 49% of individuals in the exposed population that were actually injured by the defendant are left completely uncompensated. Consequently, the tort system's corrective justice goals falter because these victims are left without redress and are forced both to suffer from their wrongfully caused injury and to incur the costs of the injury alone. From a fairness standpoint, the result is also questionable. When a defendant creates a risk of harm to a group of individuals, it is only fair for the defendant to compensate those individuals. The preponderance rule, however, would prevent compensation when a court determines that the defendant did not more likely than not cause injuries in the exposed population. [FN113]

In addition, the undercompensation that can result when the more-likely-than- not component of the preponderance rule is not satisfied may lead to underdeterrence of a defendant. [FN114] If a court finds that a plaintiff has not satisfied its burden of proving that a defendant more likely than not caused the plaintiff's injury, a defendant escapes liability altogether even though the defendant actually caused some of the injuries in the exposed population. [FN115] This determination creates a distorted vision of how the defendant should act in the future; it encourages the defendant to invest in too little safety. [FN116] As a result, the defendant industry continues manufacturing and disposing of the hazardous waste just as it always has. It has no incentive to curb production or to enhance safety and monitoring efforts during disposal. Thus, the price of the defendant's product is artificially low and consumption is artificially high. [FN117] The defendant's competitors are also ***1312** affected by a finding of no liability; they have no incentive to invent a comparable product that might be more expensive to manufacture but that would not emit a toxic by-product during production. Ultimately, and most devastating of all, the preponderance rule's failure to hold a defendant company liable when it actually caused injuries in the exposed population ensures that more individuals will fall victim to the defendant's tortious activities fifteen to forty years down the line. [FN118]

In addition to general criticisms about the preponderance rule's potential for overcompensation and undercompensation--or overdeterrence and underdeterrence--commentators specifically criticize the strict and Landrigan versions of the preponderance rule for placing too harsh a burden on plaintiffs to bring forward individualistic proof of causation. Given the characteristics of toxic exposure, specifically the long latency period and the poor understanding of disease etiology, individualistic proof is sometimes completely absent. [FN119] Although the weak version of the preponderance rule has adjusted for the absence of individualistic proof, a court applying either the strict version or the Landrigan version of the rule would determine that a defendant was not the cause-in-fact of plaintiffs' injuries simply because the plaintiff was unable to bring forward any particularistic evidence linking the plaintiff and the defendant. [FN120] Even if statistical evidence indicates that a defendant contributed greater than 50% to the risk that a plaintiff would develop cancer, both the strict and Landrigan versions of the preponderance rule would lead to dismissal of plaintiff's case. [FN121] This result seems unfair because it punishes a plaintiff simply because the characteristics of his or her disease make it impossible to connect the injury directly to the defendant's wrongful conduct.

Criticism, however, also exists for the weak version of the rule, precisely because it allows a plaintiff to recover solely on the basis of statistical evidence. Statistical evidence only indicates whether a defendant more likely than not caused a plaintiff's injury; it is not founded on a deter-mination of certainty. Nevertheless, statistical evidence alone, if it reveals a greater than 50% attributable risk, serves as a "legally absolute finding on ***1313** causation." [FN122] However, it might be dangerous to rely exclusively on statistical evidence when determining liability. Given that statistics are formulated based on assumptions in a population, it is unlikely that any statistical test is ever wholly accurate, especially when used to determine injury causation among a diverse group. Each injury is likely to be different in terms of the degree and extent of exposure. In addition, it is possible that some individuals are able to minimize risks of exposure better than others. [FN123] Therefore, critics argue that it might be unfair to make a legally absolute finding of causation based solely on statistical evidence when statistical studies do not accurately reflect individual differences in the exposed population. [FN124]

III. Proposals to Replace the Preponderance Rule

A. The Proportionality Rule

1. The Rule

In recognition of the drawbacks of the preponderance rule, several commentators have advanced the proportionality rule as a more pragmatic standard for courts to use in evaluating whether a defendant's activity was the cause-in-fact of a plaintiff's injury. The proportionality rule essentially dispenses with the traditional requirements for proving causation. Instead, causation is presumed as soon as a plaintiff brings forward statistical evidence indicating that a defendant caused injury to a proportion of the individuals in the exposed population. [FN125] Individualized proof is not required. [FN126] Courts then impose liability and distribute compensation to all plaintiffs in the exposed population in proportion to the risk that the defendant created by acting negligently. [FN127]

For instance, if there are 100 plaintiffs before the court, each alleging that the defendant's disposal of hazardous wastes caused them to develop cancer, and the attributable risk of developing cancer in the exposed population is 55%, then all 100 plaintiffs will be compensated for 55% of their ***1314** injuries. The rationale for the proportionality rule is that, in the aggregate, a defendant is liable for 100% of the damages it actually caused. Con-sequently, the proportionality rule operates irrespective of any required probability threshold level. [FN128] Even if statistical evidence reveals that a defendant only caused injury to 35% of the individuals in the exposed population--a level below the preponderance rule's 50% threshold requirement-- the proportionality rule would still compensate every plaintiff for 35% of his or her damages.

The proportionality rule is praised most often because it achieves optimal deterrence and encourages a defendant to invest most efficiently in care and safety. [FN129] In other words, because the proportionality rule imposes liability and awards compensation based on a pro rata share of the defendant's contribution to the plaintiff's risk of injury, the proportionality rule ensures that no defendant will ever have to pay more damages than it actually caused. [FN130] Consequently, faced with this liability, a defendant is encouraged to alter its conduct in order to avoid similar liability in the future. A defendant will, therefore, invest in safety and monitoring measures that prohibit toxic substances from reaching plaintiffs in the future only until one additional dollar spent on safety investments will save the defendant from paying an extra dollar in compensation to a plaintiff suffering from cancer. When a defendant company starts investing more in safety than it is saving in liability costs, the defendant is operating inefficiently. [FN131]

Judge Jack Weinstein proposed a proportionality approach in In re "Agent Orange" Product Liability Litigation. [FN132] In Agent Orange, Vietnam military ***1315** personnel and their families sued several manufacturers of Agent Orange for the diseases the military personnel suffered after they were allegedly exposed to Agent Orange, and other products containing dioxin, that were used as herbicides between 1962 and 1971 in Vietnam. Plaintiffs were unable to establish any clear connection between exposure to Agent Orange and the illnesses suffered by individual plaintiffs. There was virtually no individualistic proof to establish such a connection. As a result, plaintiffs relied almost exclusively on statistical studies to show that the risk of contracting cancer or other diseases had increased as a result of being exposed to Agent Orange.

Although the case ended in settlement, Judge Weinstein nevertheless analyzed the difficulties of proving causation in a mass exposure case. [FN133] Given the inadequacies of the preponderance rule, he proposed adopting a class action proportional approach in which all plaintiffs' claims would be tried together and would result in a single determination of liability. [FN134] The defendant, if found liable, would be required to pay each plaintiff a pro rata share of that plaintiff's injuries. [FN135]

Judge Weinstein's suggested approach to the causation problem in the toxic tort context is a clear indication that courts might soon depart from the majority preponderance rule. Following his lead, courts are likely to realize the inequities of the preponderance rule and are likely to search for a better solution that more closely conforms to societal and tort notions of fairness and efficiency. [FN136] Although the Agent Orange case is substantially different from the type of environmental toxic tort case discussed in this Comment, it would not be shocking for a court to adopt a proportional-liability approach in the hazardous-waste context, even when only one defendant is before the court. Similar rationales for application of pro-portional liability, like those discussed earlier, would apply equally well to both hazardous-waste cases and cases such as Agent Orange. This is because, ***1316** in both instances, plaintiffs actually harmed by the defendant's negligent activities are not conclusively identifiable, and individualistic proof clearly linking the defendant's activities to plaintiffs' injuries is difficult to find. In the environmental toxic tort context, then, a plaintiff would have only the burden of bringing forward statistical evidence indicating the defendant's attributable risk of causing the plaintiff's injury. Thus, a plaintiff would recover damages equal to the attributable risk that the defendant's improper disposal of hazardous wastes caused the plaintiff's injury.

2. Variations on the Proportionality Rule

Along with the flood of proportionality proposals in the last ten years, slight variations on these proposals have also emerged. Some commentators, for instance, have suggested that the proportionality rule should act as a variant, or a reverse, of the market share theory espoused in Sindell v. Abbott Laboratories. [FN137] This reverse-Sindell approach would allow both apportionment of damages and burden shifting. In Sindell, a woman who suffered from cancer allegedly caused by ingestion of diethylstilbesterol (DES) by her mother during pregnancy sued all of the major DES manufacturers because she was unable to present evidence connecting her injury to any particular drug manufacturer. [FN138] The California Supreme Court shifted the burden of proof to each of the DES manufacturers to bring forward proof that they did not cause the plaintiff's cancer. [FN139] When defendants were not able to exonerate themselves, the court apportioned liability among them in proportion to their share of the DES market. [FN140]

Using reverse-Sindell logic, some commentators have suggested that a burden- shifting approach with proportional liability could be similarly applied in the toxic tort context. [FN141] According to this approach, when a defendant has created an attributable risk that a certain percentage of the exposed population will develop cancer as a result of the defendant's activities, [FN142] the burden ***1317** should shift to the defendant company to prove that it did not, in fact, cause each injury. [FN143] The defendant can satisfy its burden either by showing that the probability that the defendant has caused injuries in the exposed population is lower than plaintiffs allege or by demonstrating that another human agent caused some of the injuries in the exposed population. [FN144] If the defendant fails to satisfy its burden of proof, damages will be apportioned among all plaintiffs according to the risk of harm that the defendant has created in the exposed population. [FN145]

Another variant of the more typical proportional-liability approach is the most-likely-victim approach. [FN146] This approach is predicated on the assumption that not all individuals in the exposed population are equally at risk for developing cancer. Because risk of developing an injury is related to the extent and duration of exposure, the timing of exposure during an individual's lifetime, and certain lifestyle characteristics of the exposed individual (such as smoking, family medical history, or living in a polluted city), it is unlikely that any two individuals will have an equal propensity for developing cancer as a result of a defendant's tortious conduct. [FN147] Therefore, the most-likely-victim approach operates to award full compensation to those individuals with the strongest claims and to award nothing to those plaintiffs with the weakest claims. It divides members of the exposed population into subgroups composed of individuals with similar risks of acquiring cancer from exposure to the defendant's toxic wastes. [FN148] Starting at the subgroup with the highest risk level, plaintiffs are compensated fully until a defendant has paid damages equal to the attributable risk that it created by negligently manufacturing or disposing of hazardous chemicals. ***1318** Consequently, those individuals classified into the lower- risk subgroups would likely receive no compensation for their injuries. [FN149]

Although the most-likely-victim approach appears to be a promising solution to the indeterminate-plaintiff problem in environmental toxic tort lawsuits because it operates to achieve optimal deterrence while also fully compensating those individuals most likely injured by a defendant's activities, it would be impossible to implement. It is unlikely that individuals in the exposed population can ever be accurately assigned to any risk-level subgroup. [FN150] The characteristics of environmental toxic torts that make it difficult for plaintiffs to bring forward individualistic proof [FN151] would also make it difficult to distinguish one plaintiff's likelihood of developing cancer from any other plaintiff's--the essence of the indeterminate- plaintiff problem.

3. Criticisms of Proportional Liability

Despite the proportionality rule's theoretical ability to achieve optimal deterrence and efficiency on the part of a defendant company that manufactures and disposes of hazardous wastes, [FN152] the proportionality rule falls short of fulfilling the tort system's other goals, namely, corrective justice and fairness. Because the proportionality rule bases plaintiff compensation on a pro rata share of the defendant's contribution to the plaintiff's harm, no plaintiff would ever recover fully even if the defendant company did actually cause the plaintiff's injury. In fact, in every instance, a plaintiff would be either overcompensated or undercompensated for his or her injuries. [FN153] Consequently, certain plaintiffs would receive windfalls when they recover a percentage of damages from a defendant who did not actually cause their injuries. The existence of windfalls to plaintiffs becomes even more pronounced when the probability that the defendant caused injuries in the exposed population is less than 50%. In such a case, the majority of plaintiffs were not injured by the defendant. Nevertheless, all plaintiffs would still recover some proportion of their damages from the defendant. But the larger danger is that plaintiffs actually harmed by the defendant ***1319** would recover only some damages for their wrongfully caused injuries-- an amount that would surely fail to make these plaintiffs whole again. [FN154] These wrongfully harmed plaintiffs would then have to internalize the remainder of their losses alone. [FN155] This result seems unfair in a system that seeks to

compensate victims who were wrongfully harmed. [FN156]

The proportionality rule is also criticized because it relies too heavily on statistical and epidemiological evidence. Proportional recovery is premised on the notion of proving only general causation--that the defendant created a risk that a certain percentage of individuals in the exposed population would develop cancer or some other disease. It, therefore, allows liability to be imposed in the air by dispensing with the more typical requirement in tort law that an individual demonstrate a specific injury before recovering. [FN157] As a result, "one unidentified group would be liable to another unidentified group because of an unidentified defect in an unidentified product, since identification of each element depends only on statistical proof of general causation and class injury." [FN158] Of course, reliance on statistical evidence is sometimes the only option for plaintiffs because, given the characteristics of environmental toxics, individualistic proof is often absent. When at least some individualistic proof is available to connect a plaintiff's injury to a defendant's activity, however, the proportionality rule should take advantage of it, especially when that evidence might provide a clearer indication of the cause-in-fact of the plaintiff's injury. In this instance, a burden-shifting proportionality rule, such as the reverse-Sindell approach, might be preferable to the more typical proportionality rule. [FN159] This is because when the burden shifts to defendants under the reverse-Sindell approach, defendants are encouraged to bring forward at least ***1320** some individualistic proof to demonstrate that another factor may have contributed to the plaintiff's injury.

Even further, however, the proportionality rule's reliance on statistical evidence and measurements of attributable risk to determine prorated lia-bility is misplaced. A measurement of attributable risk, or probability of causation, reveals the number of individuals in the exposed population who were actually injured by the defendant's negligent conduct. Attributable risk does not indicate, as is inferred from the proportionality approach, what percentage of each individual plaintiff's damages the defendant caused. It is precisely this misunderstanding that enables certain plaintiffs to receive undeserved windfalls, while prohibiting other plaintiffs from recovering fully for their wrongfully caused injuries.

Finally, the proportionality rule is criticized because it has the potential to open the door to endless litigation. When proof of causation is dependent solely on epidemiological studies and a determination of whether a defendant created a risk of harm in the exposed population--even if the risk is substantially less than 50%--more lawsuits may be filed because the potential for recovery is greater. [FN160] Furthermore, it is less likely that settle-ments will occur under a proportionality approach. Plaintiffs and defen-dants are likely to disagree more about the magnitude of liability because they each will rely on separate epidemiological studies that give drastically different estimates of the defendant's attributable risk level. [FN161] Therefore, compromise between the parties might be harder to achieve. [FN162] This is especially true when the defendant is risk averse and the probability of causation is greater than 50%. In such a case, a defendant is exposed to a substantially smaller amount of liability under the proportionality rule than under the preponderance rule. As a result, the defendant company might be more willing to tough it out in court. [FN163] Of course, because proportional liability leads to smaller damage awards, fewer attorneys may be willing to take cases on contingency. However, this effect might be counterbalanced by attor-neys who represent several plaintiffs. In the aggregate, these attorneys will still receive substantial contingent fees. [FN164]

***1321** B. Burden Shifting--Allen v. United States

In Allen v. United States, [FN165] 1200 plaintiffs brought a lawsuit against the U.S. government under the Federal Torts Claims Act. [FN166] Plaintiffs alleged various claims, including personal injury and the wrongful death of loved ones, as a result of radioactive fallout from open- air atomic-bomb tests during the 1950s and 1960s in Nevada. The district court held a full trial on twenty-four of the claims to determine how to manage the remainder of the 1200 claims.

In analyzing these claims, Judge Bruce Jenkins departed substantially from the majority preponderance rule. He judged each plaintiff's claims individually, requiring each of them to bring forward any evidence--statistical or individualistic--to indicate that the defendant's activities were a substantial factor in causing the plaintiff's injuries. [FN167] Judge Jenkins did not rigidly define "substantial factor" to mean more likely than not, more probably than not, or having a greater than 50% likelihood. Rather, the court delineated a list of factors that could be considered by the fact finder to determine whether the defendant's conduct was a substantial factor in bringing about harm to the plaintiff. These factors included
(1) the probability that plaintiff was exposed to ionizing radiation due to nuclear fallout from atmospheric testing at the Nevada Test Sites at rates in excess of natural background radiation; (2) that plaintiff's injury is of a type consistent with those known to be caused by exposure to radiation; and (3) that plaintiff resided in geographical proximity to the Nevada Test Site for some time between 1951 and 1962. [FN168]

In addition, the court listed other factors, such as the nature of exposure, age, latency period, disease etiology, and

attributable risk, that could also be important for a determination of cause-in-fact. The court instructed that, once a fact finder evaluates these relevant factual connec-tions and concludes that the defendant's conduct was a substantial factor [FN169] in bringing about the plaintiff's injury, the burden would shift to the defen-dant to bring forward evidence to prove noncausation. [FN170] If the defendant failed to dispute these factual connections with sufficient evidence, the court held that causation would be inferred and there would be a "rational basis for imposing liability" on the defendant. [FN171] In such a case, the defendant would be required to compensate the plaintiff for his or her full injuries. [FN172]

The burden-shifting approach advanced in Allen appears to address the problems of proof that plaintiffs face in the toxic tort context because it shifts the burden of proof to the defendant even if the plaintiff has not eliminated all other possible causes of physical harm. Although Allen involved injuries that occurred after plaintiffs were allegedly exposed to radiation fallout, a similar burden-shifting approach could be applied in the environmental toxic tort context to establish causation after plaintiffs are exposed to hazardous waste allegedly resulting from a defendant's negligent manufacturing and disposal activities. In both radiation and hazardous-waste exposure cases, it is often impossible to bring forward proof directly linking a plaintiff to a defendant's activities. [FN173] The burden-shifting approach lessens the degree of proof that a plaintiff is required to bring forward and provides a greater opportunity for an indeterminate plaintiff to overcome the causation hurdle, especially because Allen suggests that a less than 50%attributable risk could be enough to satisfy the substantial-factor inquiry. [FN174]

Judge Jenkin's burden-shifting approach in Allen has been criticized, however, because it does not seem applicable in the context of environmental toxic tort cases. In fact, in Agent Orange, Judge Weinstein refused to apply a burden-shifting approach in the indeterminate-plaintiff situation ***1323** because he feared that it "could result in liability far out of proportion to damage caused." [FN175] Ordinarily, the burden of proof is shifted to the defendant when the defendant has easier access to evidence that would determine cause-in-fact or when defendants are indistinguishable. [FN176] When only one defendant is before the court, neither of these justifications is necessarily present in the environmental toxic tort context. Plaintiffs and defendants have roughly equal access to causation evidence. It is true that a defendant might have easier access to records and documents regarding its hazardous-waste disposal. These records, however, are not particularly helpful when the etiology of diseases and the migration characteristics of chemicals are unknown. Therefore, when a plaintiff is unable to bring forward individualistic proof connecting his or her injury to a defendant's conduct, that does not necessarily mean that a defendant will be able to overcome this barrier. It is a settled and unfortunate fact that sometimes there is no way to link a plaintiff's injury to a defendant's tortious conduct. Sometimes, the only form of proof relating to a plaintiff's harm and a defen-dant's responsibility for it is statistical or epidemiological. Thus, no matter how sympathetic a court might be toward victims suffering from horrible and devastating diseases, it would be unfair to force the defendant to bear the burden of producing exonerating evidence that does not exist. [FN177]

C. Legislation

The varied proposals that commentators have advanced to replace the majority preponderance rule and the criticisms of those proposals all illustrate one thing: Tort law is not particularly amenable to environmental toxic tort plaintiffs. Some commentators have attempted to mold tort law to better respond to environmental toxic tort cases. Other commentators have proposed a much different approach: Toxic substance accidents that result in physical harm to nearby residents, they argue, should not be resolved in the courtroom. Rather, they argue that legislation should be passed that provides a compensation scheme for those individuals who are negligently injured by exposure to hazardous wastes. Most predominantly, these com-mentators propose legislation at the federal level because states likely would be reluctant to implement an administrative scheme that could potentially ***1324** ostracize local industries that would not necessarily have to incur the costs of such a scheme in another jurisdiction. [FN178]

The proposals, of course, are varied. But at the heart of all of them is a polluter-pays rationale--that victims of hazardous-waste exposure should be compensated at the expense of industries that have created those wastes. [FN179] The compensation scheme should be designed to spread the burden of paying for victims' injuries equally among industries producing hazardous wastes. [FN180] Of course, by imposing a tax on industries, the price of the goods produced will necessarily increase as industries spread their costs to consumers. [FN181] Such a result is appropriate, however, because when costs increase, consumers look for substitute products to purchase. Consequently, industries step up research and disposal techniques to create even better products and to ensure that hazardous-waste exposure injuries are minimized in the future. Overall, then, society will benefit.

Possible administrative schemes have been repeatedly proposed in Congress but have been consistently rejected. [FN182] One exception is the Radiation Exposure Compensation Act of 1990, [FN183] which provides a legislative solution for those

individuals exposed to radiation from the nuclear testings of the 1950s and 1960s and from uranium mining. [FN184] The act supports a $100 million trust fund and awards a $50,000 recovery award to any individual who suffers from an injury specified in the act as a result of being exposed to radiation and who meets certain age and residence requirements. [FN185]

Legislation might appear to be the perfect solution to the indeterminate- plaintiff problem in environmental toxic exposure cases. Administrative schemes, however, would not solve the causation problem. In order to determine the proper recipients of damage awards, the schemes would still be required to identify actual victims. This, then, "involves another form of ***1325** the same causation problem." [FN186] In addition, if a scheme is devised to offer compensation to a larger class of potential victims, it is unlikely that actual victims would ever be compensated for the full costs of their injuries. For instance, the Radiation Exposure Compensation Act only awards victims $50,000 for injuries such as childhood leukemia and breast cancer--an amount that is likely substantially less than the true costs that a victim would incur for his or her disease. Like proportional liability, then, an administrative scheme that fails to award actual victims full compensation would result in substantial undercompensation for victims' injuries. [FN187] Furthermore, legislative solutions are not the most favorable for plaintiffs. The judge and jury system is often alluring to plaintiffs because it provides them with certain opportunities and advantages that would be unavailable in an administrative context. For instance, the judicial system enables judicial independence and can promote the parties' adversary posture and a plaintiff's retributionist attitude. [FN188] In addition, a court is more likely to respond to individual claims as they arise, while an agency is likely to be overwhelmed by the prospects of screening tens of thousands of toxic practices every year. [FN189] Finally, courts are able to divide their resources more efficiently than agencies because the courts are not required to maintain a full-time staff of experts and administrators; instead, courts can hire experts on an as-needed basis. [FN190] On a whole, courts might be able to respond better to victims' complaints than would an administrative scheme.

IV. Proposing an Alternative--A Case-by-Case Substantial-Factor Approach

The majority preponderance rule and several other proposed solutions to the indeterminate-plaintiff problem in the environmental toxic tort context mandate strict threshold requirements before a plaintiff is able to prove causation. These strict requirements ultimately infringe on a plaintiff's efforts to obtain a remedy for the devastating injuries resulting from a defendant's negligent activities and enable a defendant to continue its negligent activity with no threat of liability. For instance, the preponderance rule imposes a more-likely-than-not or greater-than-50%-probability-of-causation threshold requirement before any plaintiff can recover in full for his or her injuries. If, under the weak version of the preponderance rule, ***1326** a plaintiff can only establish a 45% attributable risk level for the defen-dant's activities, then a plaintiff is unable to prove causation. Even if a plaintiff can bring forward at least some individualistic proof in addition to epidemiological evidence showing a 45% attributable risk level, a plain-tiff may still fail to carry the burden of proving causation if a fact finder judges the combination of evidence to fall short of the more-likely-than-not threshold required by the Landrigan preponderance rule. [FN191]

Furthermore, the strict version and the Landrigan version of the prepon-derance rule demand that plaintiffs bring forward at least some particu- laristic proof before they can prove that a defendant was the cause-in-fact of a plaintiff's injury. [FN192] If the characteristics of a plaintiff's injury and a defendant's hazardous waste make it practically impossible for a plaintiff to bring forward any direct proof that the defendant's negligent activities caused the plaintiff's injury, then the plaintiff is again out of luck.

Finally, several of the proposed alternatives to the majority prepon-derance rule, such as the proportionality rule and legislation, make proving causation less difficult, which ultimately benefits plaintiffs. These proposals, however, inhibit a plaintiff who was actually injured by a defendant's neg- ligent activity from ever being fully compensated for his or her injuries. For instance, the proportionality rule, by prorating compensation depending on a defendant's contribution to the risk that the plaintiff would be injured, ensures that no plaintiff is ever compensated for more than a defendant's attributable risk of causing the plaintiff's injury.

To ensure that the burdens of uncertainty do not unjustly fall on plaintiffs and that the traditional goals that underlie the tort system--deterrence and victim compensation--are more effectively achieved in the environ-mental toxic tort context, courts should employ a substantial-factor causation standard that dispenses with all of the current rigid threshold hurdles. This standard would enable a plaintiff to recover fully as soon as he or she has established that a defendant's negligent activities were a substantial factor in causing the plaintiff's injury. Furthermore, a substantial-factor test would not require a plaintiff to bring forward individualistic proof, especially if none existed. Instead, a substantial-factor test would be a more liberal and flexible standard for plaintiffs attempting to prove cause-in-fact, allowing plaintiffs to present whatever evidence there is

available--statistical, indi-vidualistic, or both--to establish a negligent defendant's liability. In fact, the substantial-factor approach would encourage a plaintiff to bring forward as much evidence as possible to assist a fact finder's determination of causation. ***1327** This is unlike the preponderance rule, for instance, under which a plaintiff only has the incentive to bring forward enough evidence to pass the more-likely-than-not threshold level. Because a substantial-factor approach would not mandate threshold levels, however, a plaintiff would have the incentive to bring forward as much evidence as is practically available to persuade the fact finder that the defendant's negligent activities were a substantial factor in causing the plaintiff's injuries.

Similar to Judge Jenkins's approach in Allen, whether a defendant's conduct was a substantial factor in bringing about harm to a plaintiff should not be rigidly defined as more likely than not or greater than 50%. Rather, it should depend on a variety of relevant factors that can be established by using either statistical or individualistic proof. These factors should include those discussed in Allen, as well as any other potentially relevant factors. Some examples are: extent of exposure; duration of exposure and likely dates when exposure occurred; etiology of the plaintiff's disease and whether it is consistent with the type of exposure that occurred; the plaintiff's geographical proximity to the defendant's plant and the likelihood that hazardous wastes may have migrated to air and waters in the plaintiff's geographical location; the plaintiff's age; the average latency period of the plaintiff's disease; the defendant's attributable risk of causing the plaintiff's injury; evidence of the plaintiff's medical condition that might make the plaintiff more prone to injury; and other important traits of the plaintiff, such as smoking, family history of cancer, prior employ-ment in an industry producing hazardous waste, or prior residence in a polluted city. [FN193]

It is for the fact finder, then, to evaluate these factors and determine whether a defendant's negligent activities were a substantial factor in causing a plaintiff's injuries. Contrary to Allen, the burden of proof should not shift to the defendant to disprove the court's finding of causation. As has been explained, burden shifting is not always appropriate in the environ-mental toxic tort context. Even if defendants have access to records about disposal times and dates, they do not necessarily have better access to information pertaining to the migration characteristics of the hazardous wastes and to the etiology of a plaintiff's disease. Without this evidence, a defendant's records may be almost meaningless--at least in relation to proving that the defendant's activities did or did not directly cause the plaintiff's injury. [FN194] Therefore, as in traditional tort cases, the burden of ***1328** proof should remain with the plaintiff. [FN195] If the fact finder determines that a plaintiff has satisfied his or her burden of proving that the defendant's activities represented a substantial factor in bringing about the plaintiff's harm, a court should then impose full liability on the defendant for all of the plaintiff's injuries.

One of the biggest differences between the substantial-factor approach to proving causation in the environmental toxic tort context and current methods or proposals, such as the preponderance rule or the proportionality rule, is that the substantial-factor approach judges causation on an ad hoc basis depending on the totality of the circumstances. This is a divergence from current rules, which operate on a mainly per se basis. For instance, under any of the three versions of the preponderance rule, causation is only established when the evidence surpasses the more-likely-than-not hurdle. Also, under proportional liability, a plaintiff only receives compensation in accordance with the attributable risk that the defendant caused the plaintiff's injury. Perhaps it is feared that an ad hoc formula for determining causation in the environmental toxic tort context would lead to uncer-tainty for plaintiffs who desire to hold a defendant liable for its negligent activities. Because they would be unsure exactly how much evidence to bring forward to ensure that a fact finder determines substantiality, plaintiffs might give up altogether by refusing to invest in a lawsuit in which the outcome is so uncertain. In such a case, the ad hoc nature of a substantial-factor approach would lead to undercompensation of plaintiffs who were actually injured by a defendant's negligent activity.

This fear is not unreasonable. An ad hoc approach, such as a substantial- factor test, however, will probably still be more favorable to plaintiffs than a per se preponderance rule approach. If a plaintiff is unsure that the evidence that he or she brings forward is enough to win a substantial-factor determination, it most certainly is not enough to surpass the preponderance rule's more-likely-than-not hurdle. Therefore, under-compensation can be no worse under a substantial-factor approach than it already is under the preponderance rule. In fact, undercompensation ***1329** probably occurs less often under a substantial-factor approach because a defendant's negligent activities can be deemed a substantial factor even when the evidence of causation is less than 50%.

The ad hoc nature of the substantial-factor approach might also be criticized because it leaves too much discretion in the hands of the fact finder and may theoretically permit a determination of substantiality even when there is no individualistic evidence and attributable risk is significantly less than 50%. This concern is more acute given the nature of most environmental toxic tort lawsuits. Generally, a plaintiff is suffering from a fatal, or at least a debilitating, disease, and the

defendant is a large manufacturing or industrial corporation whose resources seem insurmountable against the plaintiff's. A fact finder, then, has the potential to be sympathetic to the plaintiff's plight. Nevertheless, in such a case, if there are 100 individuals in the exposed population suffering from cancer, the defendant likely only caused injury to less than half of them.

Again, this fear of the substantial-factor approach is credible. However, in the environmental toxic tort context, in which a defendant has negligently disposed of hazardous and toxic substances, it would be appropriate for a fact finder to determine that the defendant was the cause-in-fact of the plaintiffs' injuries even when the evidence relating to causation is less than more likely than not. Given the uncertainty surrounding environ-mental toxic torts, a mandated 50% threshold level leaves many plaintiffs unable to establish causation and permits defendants to continue acting negligently. This is an inappropriate balance. The goal of the tort system is to deter negligent behavior. For this reason, if a court has determined that a defendant acted negligently, a plaintiff should be able to recover even if the evidence of causation is somewhat attenuated, in that it is less than more likely than not. For instance, assume that a plaintiff can only prove that he or she lived in close proximity to the defendant's industry when the defendant negligently disposed of hazardous wastes, but that the plaintiff cannot prove that the wastes migrated to an area in which the plaintiff would be exposed or that the plaintiff's cancer was necessarily caused by exposure to hazardous wastes. Also, assume that statistical evidence indicates that the defendant's activities created a 35% likelihood that the plaintiff would develop cancer. Most likely, a preponderance rule, or even the Landrigan approach, would not determine that this evidence surpasses the more-likely-than-not hurdle. However, it would be enough to lead to a substantial-factor determination. In such a case, a defendant would be fully liable for all of a plaintiff's injuries. As a result, the defendant com-pany has an incentive to act more carefully in the future so as to prevent the unreasonable or negligent disposal of hazardous wastes. Unlike the ***1330** preponderance rule's more-likely- than-not requirement, this approach would lead to a more appropriate balance between the tort system's deterrence goals and the tort system's belief that losses should remain unless a plaintiff can establish that a negligent defendant caused his or her injury.

A final concern is that the substantial-factor approach, by allowing recovery when the evidence of causation is less than 50%, would lead to substantial overcompensation for plaintiffs and would create a distorted incentive to a defendant company about its need to act more carefully. First, when a defendant has acted negligently, overcompensation provides a defendant company with an even stronger incentive to curb unreasonable and negligent practices to escape hefty liability in the future for negligently disposing of hazardous wastes. The rationale for substantial damage awards for a negligent defendant is even more acute when, in the environmental toxic tort context, the defendant's negligence has the potential to cause innocent individuals to develop devastating diseases that may lead to death. Arguably, when a negligent defendant's activities are killing innocent people, deterrence incentives should be drastic. Second, the potential for over-compensation of plaintiffs in the environmental toxic tort context is unlikely to be as severe as some commentators may fear. In all likelihood, not all of the individuals that were harmed by a defendant's tortious conduct will seek recovery through the judicial system. Perhaps some of these victims have already died; perhaps some have moved away and never learned that they were exposed to hazardous substances; and perhaps others simply do not want to get involved in a legal battle.

Conclusion

In recent decades, it has become more and more apparent that one of the by- products of modern industrial development has come at a high human cost. People living near large industrial and manufacturing plants are unknowingly exposed to silent and invisible hazardous chemicals when defendant companies improperly dispose of their hazardous wastes. In addition to other injuries, many of these individuals develop cancer, which often does not manifest itself until decades after the initial exposure or series of exposures to the hazardous substances. Because of the long latency period before injuries manifest themselves, the lack of understanding of the etiology of most forms of cancer, and the difficulty in ascertaining the migration of chemicals after they have been disposed, plaintiffs are unable to satisfy traditional causation rules that require a direct relationship between a defendant's negligent activities and the onset of a plaintiff's illness.

***1331** Consequently, courts have devised and employed other causation standards--with several versions of the preponderance rule in the lead--that enable plaintiffs to establish causation without certainty and without purely individualistic proof of causation. Nevertheless, the preponderance rule creates rigid threshold hurdles that are difficult for plaintiffs to overcome. Proposed alternatives to the preponderance rule, such as proportional liability or legislation, may make proving causation substantially easier. These methods, however, do not allow plaintiffs actually injured by a defendant's wrongful conduct to recover fully for their injuries. Thus, courts should employ a substantial-factor approach similar to the one used by Judge Jenkins in Allen. A substantial-factor approach would permit more plaintiffs to recover for injuries caused by a defendant's negligent disposal of hazardous wastes and would, therefore, deter defendant companies from acting unreasonably and negligently in the future. Furthermore, a substantial-factor approach would fully compensate

individuals actually injured by defendants' activities.

When uncertainty plagues plaintiffs' efforts to recover in tort for injuries caused by exposure to hazardous wastes, a perfect solution to the indeterminate-plaintiff problem is unlikely because doubt will always exist as to whether a defendant actually caused injury to a particular plaintiff. But a balance is necessary. Defendant companies should not be allowed to continue behaving negligently simply because circumstances make it impossible to establish direct causation or to satisfy strict threshold require-ments. Further, more plaintiffs wrongly injured by a defendant's negligent conduct deserve full compensation. The substantial-factor approach cre-ates such a balance because, in each individual case, it better ensures that the burdens of uncertainty do not unjustly fall on plaintiffs and that the traditional goals that underlie the tort system--deterrence and victim compensation--are more effectively achieved.

[FNa1]. Comments Editor, UCLA Law Review, Volume 46. J.D. candidate, UCLA School of Law, 1999; B.S., University of California, San Diego, 1996. Special thanks to Professor Jody Freeman for her helpful comments and suggestions in developing this work. All errors are mine.

[FN1]. See Jan Richard Schlichtmann, Eight Families Sue W.R. Grace and Beatrice Foods for Poisoning City Wells with Solvents and Causing Leukemia, Disease, and Death, in Proof of Causation and Damages in Toxic Chemical, Hazardous Waste, and Drug Cases, at 209 (PLI Litig. & Admin. Practice Course Handbook Series No. H4-5035, 1987). For a comprehensive and illustrative account of the Woburn case, see generally Jonathan Harr, A Civil Action (Vintage Books 1996).

[FN2]. For purposes of this Comment, I presume that the defendant's activities were negligent. In other words, I assume that the defendant's conduct falls below the standard established to protect others against an unreasonable risk of harm; the defendant did not act as a careful and prudent individual would have in the defendant's situation. See Restatement (Second) of Torts §282, at 9 (1965); see also William R. Ginsberg & Lois Weiss, Common Law Liability for Toxic Torts: A Phantom Remedy, 9 Hofstra L. Rev. 859, 886 (1981). From a deterrence standpoint, a negligence standard is the most appropriate. When a defendant is held liable for negligent activity, liability gives the defendant an incentive to act with care to avoid unreasonable accidents in the future.

[FN3]. For a discussion of the deterrence and corrective justice theories underlying tort law, see generally Gary T. Schwartz, Mixed Theories of Tort Law: Affirming Both Deterrence and Corrective Justice, 75 Tex. L. Rev. 1801 (1997).

[FN4]. Hazardous waste, as defined by Congress in the Resource Conservation and Recovery Act (RCRA), is
waste, ... which because of its quantity, concentration, or physical, chemical, or infectious characteristics may--(A) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.
42 U.S.C. §6903(5) (1994).

[FN5]. See Norman J. Landau, An Overview of Toxic Torts, in Toxic Torts: Tort Actions for Cancer and Lung Disease Due to Environmental Pollution 42, 42 (Paul D. Rheingold et al. eds., 1977) [hereinafter Toxic Torts] (describing that individuals working in or living near chemical plants often unknowingly ingest toxic and hazardous chemicals).

[FN6]. In 1991, the production of hazardous wastes "was between 29 and 54 million tons less than the 198 millions tons reported in 1989." Lynn Persson, EPA Publishes 1991 Biennial Report, 6 WDNR Waste-Less-News (Mar. 1995) (visited Mar. 19, 1999) <http://earth2.epa.gov/new/ contacts/newsltrs/wsteless/wln0395.html#report>. According to the Environmental Protection Agency's (EPA) National Biennial RCRA Hazardous Waste Report (based on 1993 data), the volume of hazardous waste produced in 1993 decreased by 15%, or 47 million tons, from 1991. See EPA Info. That Reveals the Falling Volume of RCRA Hazardous Waste, Envirosense (last modified Nov. 27, 1996) <http://es.epa.gov/new/contacts/newswires/rcra. html>.

[FN7]. See Ora Fred Harris, Jr., Toxic Tort Litigation and the Causation Element: Is There Any Hope of Reconciliation?, 40 Sw. L.J. 909, 913 (1986).

[FN8]. Id.

[FN9]. See id.

[FN10]. Ginsberg & Weiss, supra note 2, at 867.

[FN11]. See id. This result is unlikely, or at least alleviated, if "the waste is contained in soils and clays of low permeability and covered with similar materials capable of diverting surface water." Id.

[FN12]. Landau, supra note 5, at 42.

[FN13]. See Allan Kanner, Environmental and Toxic Tort Issues, SC24 ALI-ABA 713, 765 (June 22, 1998) (describing that cancer is the second leading cause of death in the United States, responsible for the deaths of 500,000 Americans every year, and asserting that "many Americans have come to believe that industrial chemicals and pollutants are chiefly to blame"). Although cancer is the most prevalent injury that results from exposure to toxic substances and other forms of environmental pollution, other possible injuries include pneumoconioses (i.e., "a diseased condition of the lungs characterized by a fibrous hardening of the soft tissues"), genetic mutations, miscarriages, mental retardation, eye damage, hearing damage, heart and vascular disease, and emphysema. Many of these injuries also have long latency periods. See Paul D. Rheingold & Norma Jacobson, The Toxic Tort Cause of Action: Law and Procedure, in Toxic Torts, supra note 5, at 1, 2-4.

[FN14]. See Council on Environmental Quality, Carcinogens in the Environment, in Toxic Torts, supra note 5, at 69, 87.

[FN15]. See id.

[FN16]. See Schlichtmann, supra note 1 and accompanying text.

[FN17]. See Harris, supra note 7, at 913 ("To assist in comprehending the magnitude of the danger involved, note that '[e]xperts estimate that of the approximately 50,000 hazardous waste disposal sites in the country, between 1300 and 34,000 sites contain substantial amounts of hazardous wastes which could damage human health or the environment.'" (quoting Note, Personal Injury Hazardous Waste Litigation: A Proposal for Tort Reform, 10 B.C. Envtl. Aff. L. Rev. 797, 798 (1982))).

[FN18]. Ginsberg & Weiss, supra note 2, at 868.

[FN19]. Between 1942 and 1953, the Hooker Electrochemical Company disposed of chemical wastes in a canal site located near the Niagara River. In 1953, Hooker sold the canal site to the Board of Education for the City of Niagara. The deed to the sale explicitly informed the buyer that the site had been "'filled, in whole or in part ... with waste products resulting from the manufacturing of chemicals.'" Id. at 869 (quoting Deed from Hooker Electrochemical Company to the Board of Education of the School District of the City of Niagara Falls, New York (Apr. 23, 1953)). Nevertheless, the board constructed an elementary school on the site. In the late 1950s, it came to the attention of city officials that many children who played in the schoolyard suffered injuries as a result of the chemicals buried on the site. In the 1980s, the seriousness of the health problems for residents near Love Canal became alarmingly apparent. The EPA identified 26 hazardous-waste compounds that had migrated from the school site to nearby homes. Seven of these were known to be carcinogenic in animals, while one was known as a human carcinogen. Studies emerged indicating that residents living near Love Canal had experienced above average rates of "'miscarriages, birth defects, nervous breakdowns, asthma and diseases of the urinary system.'" Id. at 874 (citation omitted). Most alarmingly, however, was an EPA report that concluded that for residents living near Love Canal, the probability of developing cancer was one in ten, while it was one in one thousand for residents living only a few blocks away. See id.

[FN20]. Myra Paiewonsky Mulcahy, Proving Causation in Toxic Torts Litigation, 11 Hofstra L. Rev. 1299, 1299 (1983) (quoting Health Effects of Hazardous Waste Disposal Practices, 1980: Joint Hearings Before the Subcomm. on Health and Scientific Research of the Senate Comm. on Labor and Human Resources and the Senate Comm. on the Judiciary, 96th Cong., 1 (1980) (statement of Sen. Edward Kennedy)).

[FN21]. Id. at 1300; see also id. at 1299-300.
Most victims never consciously choose to face the risks of exposure to hazardous waste. They select their living environment unaware of the danger that may lurk underground. Because many hazardous waste disposal sites still have not been discovered, there is a "chemical time bomb ticking beneath the earth" which could explode at any time causing devastation to

innocent people.
Id. at 1299-300 (citation omitted).

[FN22]. Harris, supra note 7, at 915.

[FN23]. 42 U.S.C. §§6901-6987 (1994) (preventing the discard of hazardous wastes that create an "imminent" and "substantial" endangerment to human health and the environment, and providing "cradle-to-grave" requirements for generating, transporting, treating, storing, or disposing of hazardous waste).

[FN24]. 42 U.S.C. §§9601-9657 (implementing a cost-recovery program, known as Superfund, to enable the government to clean up hazardous-waste sites and recover damages later from potentially responsible parties).

[FN25]. 7 U.S.C. §136 (requiring, among other things, the registration of pesticides with the EPA).

[FN26]. 42 U.S.C. §300f-j (prohibiting groundwater contamination that creates imminent endangerment to existent public water supplies).

[FN27]. 33 U.S.C. §§1251-1376 (forbidding the unauthorized disposal of hazardous wastes into surface waters).

[FN28]. 15 U.S.C. §§2601-2629 (prohibiting the use of toxic substances that create an unreasonable risk of injury to health and the environment); see Harris, supra note 7, at 915-22.

[FN29]. See Harris, supra note 7, at 915; see also Ginsberg & Weiss, supra note 2, at 929 (noting that the Comprehensive Environmental Response, Compensation, and Liability Act's (CERCLA) Superfund initially had a victim compensation plan, but that it was removed prior to passing).

[FN30]. For an explanation of the statute-of-limitations problems that environmental tort plaintiffs often confront, see Sheila L. Birnbaum, Statutes of Limitations Problems in Environmental Tort Suits, in Toxic Torts, supra note 5, at 412.

[FN31]. This is known as the indeterminate-defendant problem. When more than one defendant in a particular area produces and disposes of the same toxic substances, it is impossible to know which of them was actually responsible for the plaintiff's injury. Given the uncertainties surrounding toxic waste exposure, a plaintiff may be unable to trace his or her injury to any one particular defendant company. See Christopher L. Callahan, Establishment of Causation in Toxic Tort Litigation, 23 Ariz. St. L.J. 605, 612 (1991).
Theories have emerged to handle this indeterminate-defendant problem, which have their origin in a 1948 hunting accident case, Summers v. Tice, 199 P.2d 1 (Cal. 1948) (en banc). In Summers, because it was equally likely that each of the two defendants shot and injured the plaintiff, the California Supreme Court shifted the burden of proof to the two negligent defendants to prove that they did not cause the plaintiff's injury. When the two defendants could not satisfy the burden of proof, the court apportioned damages between them. See id. at 5.
Using the reasoning in Summers, several courts and commentators have suggested similar approaches for dealing with the indeterminate-defendant problem. These include: (1) alternative liability--the defendant carries the burden of causation; (2) concert of action--a plaintiff can sue one of a group of actors who implicitly agreed to carry on an activity jointly, in a "consciously parallel manner" (i.e., through a similar pattern of conduct in the manufacture and disposal of chemicals), and can hold that one actor liable for all damages; (3) market share liability--when the actual defendant cannot be identified, the plaintiff can sue all the possible defendants who represent a substantial share of the market, and those defendants have the burden of disproving that they were the cause-in-fact of the plaintiff's injuries; and (4) enterprise liability--when the actual defendant cannot be identified, the plaintiff can sue a limited group of defendants who acted under "'substantially similar industry-imposed safety standards.'" Harris, supra note 7, at 931-38 (quoting Collins v. Ely Lilly Co., 342 N.W.2d 37, 47 (Wis. 1984)). But see Hurt v. Philadelphia Hous. Auth., 806 F. Supp. 515, 536 (E.D. Pa. 1992) (rejecting concert of action, market share, enterprise liability, and alternative liability theories in the context of lead poisoning allegedly caused by certain manufacturers and sellers of lead pigment and lead-based paint).
Obviously, when more than one defendant company could be responsible for a plaintiff's injuries, the causation issue can become complicated. The indeterminate-defendant problem, however, goes beyond the scope of this Comment. For purposes of this Comment, I assume that only one defendant company can be identified as having manufactured or disposed of toxic substances that could have harmed the plaintiff.

[FN32]. This is the indeterminate-plaintiff problem and is the focus of this Comment. See Mulcahy, supra note 20, at 1301.

[FN33]. See David Rosenberg, The Causal Connection in Mass Exposure Cases: A "Public Law" Vision of the Tort System, 97 Harv. L. Rev. 849, 855 (1984).

[FN34]. See Nancy Lee Firak, Alternative Forms of Liability: Developing Policy Aspects of the Cause-in-Fact Requirement of Tort Law, 20 Ariz. St. L.J. 1041, 1041 (1988).

[FN35]. See id. at 1042.

[FN36]. See id. at 1041-42.

[FN37]. See William L. Prosser, Handbook of the Law of Torts §43, at 263-64 (4th ed. 1971).

[FN38]. Whether a court applies the but-for test or the substantial-factor test generally depends upon which test a particular jurisdiction embraces. The but-for test, however, is the most frequently employed test for proving cause- in-fact. See Richard Delgado, Beyond Sindell: Relaxation of Cause-in-Fact Rules for Indeterminate Plaintiffs, 70 Cal. L. Rev. 881, 886-87 (1982).

[FN39]. See id. at 887.

[FN40]. Elam v. Alcolac, Inc., 765 S.W.2d 42, 174 (Mo. Ct. App. 1988) (alteration in original) (quoting W. Page Keeton et al., Prosser & Keeton on the Law of Torts §41, at 266 (5th ed. 1984)).

[FN41]. Restatement (Second) of Torts §432(2) (1965). The substantial- factor approach was applied in Kingston v. Chicago & Northwestern Railway Co., 211 N.W. 913, 915 (Wis. 1927). In Kingston, a fire in the northeast caused by sparks from the defendant's railroad locomotive and a fire from the northwest caused from an unknown origin concurred, and were each independently capable of destroying the plaintiff's property. The but-for cause-in-fact test failed because the second fire from the northwest made it impossible to conjecture that but for the spark from the defendant's locomotive, the plaintiff's property would not have been destroyed. However, the court still held the defendant railroad liable because, despite the existence of the northwest fire, the spark by the railway locomotive would have been capable of producing the injury to the plaintiff's property and therefore was a substantial factor in bringing about harm to the plaintiff. See id.

[FN42]. See Elam, 765 S.W.2d at 178. Because this Comment does not address the indeterminate-defendant problem, this test is premised on the notion that a plaintiff can identify the party responsible for discharging the particular substance. Identification of the responsible party can further complicate proof of causation for a plaintiff. See supra note 31.

[FN43]. See Elam, 765 S.W.2d at 174 ("[T]he logical model of a single definable cause and a direct, immediate and observable [and, hence, determinate] effect that suffices to prove cause in fact in the traditional tort cause of action does not suit the toxic tort explanandum.").

[FN44]. Mulcahy, supra note 20, at 1326.

[FN45]. See Mary Carter Andrues, Note, Proof of Cancer Causation in Toxic Waste Litigation: The Case of Determinacy Versus Indeterminacy, 61 S. Cal. L. Rev. 2075, 2076 (1988).

[FN46]. See id.

[FN47]. See Orrin E. Tilevitz, Comment, Judicial Attitudes Towards Legal and Scientific Proof of Cancer Causation, 3 Colum. J. Envtl. L. 344, 348 (1977); see also Callahan, supra note 31, at 618 (describing that to prove causation a plaintiff must isolate the effects of a single hazardous-waste substance). Note that a plaintiff's inability to identify a particular hazardous substance among many substances is more harmful to a plaintiff's attempt to prove causation when more than one defendant is before the court. This is because if several defendants dispose of chemical waste into the same landfill, the intermingling effect of the toxic substances not only makes it difficult for a plaintiff to identify the particular injury-causing substance, but also makes it difficult for a plaintiff to identify which defendant, among many, was responsible for the disposal of the injury-causing substance.

[FN48]. See Rubanick v. Witco Chem. Corp., 593 A.2d 733, 740 (N.J. Sup. Ct. 1991). According to the National Toxicology Program, 44 agents, substances, mixtures, and medical treatments are known to be carcinogenic in humans. Approximately 250 additional agents are reasonably anti-cipated to be human carcinogens. See National Toxicology Program, The 8th Report on Carcinogens (1998) (last modified July 29, 1998) <http://ntp- server.niehs.nih.gov>.

[FN49]. See Schlictmann, supra note 1, at 244 (noting that the cause of 98% of all leukemia cases is unknown); Rosenberg, supra note 33, at 856 (describing that cancer has several causes and each cause, acting independently, could induce cancer in humans); see also Allen v. United States, 588 F. Supp. 247 (D. Utah 1984), rev'd on other grounds, 816 F.2d 1417 (10th Cir. 1987).
[I]t must be emphasized and reemphasized that when a cancer is induced by ionizing radiation, the structural and functional features of the cancer cells, and the gross cancer itself, show nothing specific to ionizing radiation. Once established, a radiation-induced cancer cannot be distinguished from a cancer of the same organ arising from the unknown causes we so commonly lump together as "spontaneous."
Allen, 588 F. Supp. at 406 (citation omitted).

[FN50]. In some toxic tort cases, however, the type of cancer caused is unique to the toxic substance to which individuals were exposed. In these cases, it is not as difficult for a plaintiff to determine whether exposure to the particular substance caused the plaintiff's injury. For instance, adenosis and clear-cell adenocarcinoma of the vagina and uterus are injuries unique to exposure to diethylstilbesterol (DES) and are "almost unknown among women whose mothers had not taken DES." In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 834 (E.D.N.Y. 1984). Also, asbestosis of the lungs is relatively unique to asbestos exposure. See id.

[FN51]. Id.

[FN52]. But see Allen, 588 F. Supp. at 406.
That the court cannot now peer into the damaged cells of a plaintiff to determine that the cancer or leukemia was radiation-induced does not mean (1) that the damage was not in fact caused by radiation; (2) that the radiation damage involved did not result from the defendant's conduct; or (3) that a satisfactory factual connection can never be established between plaintiff's injury and defendant's conduct for purposes of determining liability.
Id.

[FN53]. See id. at 405 ("Assuming that cancer originates in a single cell, or a few cells, in a particular organ or tissue, it may take years before those cells multiply into the millions or billions that comprise a detectable tumor.").

[FN54]. See Miller v. National Cabinet Co., 168 N.E.2d 811, 817 (N.Y. Ct. App. 1960) (noting that among other weaknesses in the plaintiff's attempt to prove causation "is a long lapse of time before leukemia was discovered [[[because] ... an immediately observable aggravation is the only proof of causation that exists in the legal cases that have been decided").

[FN55]. When an individual is exposed to a number of carcinogens, it is possible that several factors--environmental and lifestyle--combined to produce the injury. See Robert F. Blomquist, Emerging Themes and Dilemmas in American Toxic Tort Law, 1988-1991: A Legal-Historical and Philosophical Exegesis, 18 S. Ill. U. L.J. 1, 43 (1993).

[FN56]. See Ginsberg & Weiss, supra note 2, at 922-23.

[FN57]. See Callahan, supra note 31, at 616-17; see also Cottle v. Superior Court, 5 Cal. Rptr. 2d 882, 895 (Ct. App. 1992) (Johnson, J., dissenting).
[T]here are no witnesses to the "events" linking the toxic to its victim--no one to say I saw this toxic invade this cell and chemically alter its composition so that a dozen cell generations later it mutated into a cancer that then grew larger and larger until it now threatens the plaintiff's life.
Cottle, 5 Cal. Rptr. 2d at 903 (Johnson, J., dissenting).

[FN58]. Allen, 588 F. Supp. at 405.

[FN59]. See Blomquist, supra note 55, at 42 ("[I]n most cases the precise measurement of routes and amounts of exposure is difficult because of the random and ad hoc nature of individual toxic tort injuries.").

[FN60]. The timing of migration can vary depending on environmental conditions and disposal methods. See supra notes 10-11 and accompanying text.

[FN61]. See supra notes 10-11 and accompanying text.

[FN62]. However, in Miller v. National Cabinet Co., the court declined to modify traditional causation rules and held that the plaintiff failed to prove a direct cause-in-fact relationship between the defendant's activities and the resulting injury. See 168 N.E.2d 811, 818 (N.Y. Ct. App. 1960). Specifically, the court noted that the evidence did not establish that exposure to benzol was the cause of leukemia because it did not occur until several years after employment ended. See id. at 817. According to the court, "[t] he law does not intend that the less that is known about a disease the greater shall be the opportunity of recovery in court." Id. at 818.

[FN63]. See Callahan, supra note 31, at 609.

[FN64]. Individualistic evidence is "proof that can provide direct and actual knowledge of the causal relationship between the defendant's tortious conduct and the plaintiff's injury." In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 835 (E.D.N.Y. 1984). Individualistic, or particularistic, evidence consists of: conclusive evidence of the etiology of the disease (e.g., most asbestosis is caused by exposure to asbestos); duration of the exposure to the hazardous substance; extent of exposure to the hazardous substance; expert testimony from the plaintiff's medical examiner or treating physician that "to a reasonable degree of medical certainty" the defendant's conduct caused the plaintiff's injury; and evidence about a plaintiff's personal and lifestyle history (e.g., past employers, family medical history, or personal habits such as smoking). See Blomquist, supra note 55, at 40 (discussing the type of evidence relied on in Elam v. Alcolac, Inc., 765 S.W.2d 42 (Mo. Ct. App. 1988)). But cf. Callahan, supra note 31, at 619; supra Part I.D (discussing that in the environmental toxic tort context much of this individualistic proof is impossible to ascertain).

[FN65]. Statistical evidence is generally determined through epidemiological studies. Epidemiological studies investigate "the movement of different diseases within human populations." Landrigan v. Celotex Corp., 605 A.2d 1079, 1083 (N.J. Sup. Ct. 1992). These studies indicate whether the incidence of a particular disease in the exposed population is higher than the incidence rate in the rest of the population. See David Kaye, The Limits of the Preponderance of the Evidence Standard: Justifiably Naked Statistical Evidence and Multiple Causation, 1982 Am. B. Found. Res. J. 487, 492. For a mathematical description of how statistical evidence is formulated, assume:
b = the base rate, or background rate, of cancer in the population. This is the rate of cancer that would occur naturally in the population.
a = the rate of cancer among individuals who were exposed to hazardous substances as a result of the defendant's activities.
a - b = the increment in the probability of contracting cancer due to exposure to hazardous substances from the defendant's tortious conduct. Out of every a individuals who develop cancer, a - b would not have been afflicted had they not been exposed to toxic substances.
Therefore, c = (a - b) / a, when c = the risk that an individual's cancer is attributable to exposure to the hazardous substance in question; or the probability that an individual will develop cancer after being exposed to the hazardous waste. See id.
When the attributable risk is greater than 50%, statistical evidence indicates that the defendant is responsible for causing cancer in greater than 50% of the exposed population. The problem with epidemiological studies is that they cannot prove individual causation. Rather, they can only create a presumption of general causation between the plaintiff's injury and the defendant's tortious conduct. See Callahan, supra note 31, at 626. Therefore, epidemiological studies cannot be used to determine exactly which members in the exposed population developed cancer because of exposure to a hazardous substance disposed of by the defendant, and which members developed cancer naturally. Furthermore, epidemiological studies are unable to discount a particular individual's likelihood of developing cancer from the defendant when that individual has certain idiosyncrasies that make it unlikely that the defendant caused his or her cancer (e.g., the individual smokes, lives in a polluted city, or has a genetic history of cancer). See id. Nevertheless, statistical associations may be so compelling that they raise a presumption of causation. See Bert Black & David E. Lilienfeld, Epidemiologic Proof in Toxic Tort Litigation, 52 Fordham L. Rev. 732, 758 (1984).

[FN66]. But see Paul Sherman, Agent Orange and the Problem of the Indeterminate Plaintiff, 52 Brook. L. Rev. 369, 383 (1986) (describing that traditional causation rules require the plaintiff to bring forward specific proof of causation rather than general proof).

[FN67]. See Callahan, supra note 31, at 610.

[FN68]. The plaintiff must prove "'that there was a greater likelihood or probability that the harm complained of was due to causes for which the defendant was responsible than from any other cause.'" Id. (quoting Lynch v. Merrell-Nat'l Lab., 830 F.2d 1190, 1197 (1st Cir. 1987)).

[FN69]. See William L. Prosser, Handbook of the Law of Torts 286 (3d ed. 1964).

[FN70]. See Delgado, supra note 38, at 887; see also Graham v. Canadian Nat'l Ry. Co., 749 F. Supp. 1300, 1318 (D. Vt. 1990) (affirming the court's conclusion in Elam that the substantial-factor test is particularly appropriate in the toxic tort context); Elam v. Alcolac, Inc., 765 S.W.2d 42, 174 (Mo. Ct. App. 1988) (noting that the substantial-factor test has been recognized as "particularly suited to injury from chronic exposure to toxic chemicals where the sequent man-ifestation of biological disease may be the result of a confluence of causes").

[FN71]. See Rosenberg, supra note 33, at 857.

[FN72]. See id.

[FN73]. See W. Noel Keyes & John L. Howarth, Approaches to Liability for Remote Causes: The Low-Level Radiation Example, 56 Iowa L. Rev. 531, 549 (1971); see also Miller v. National Cabinet Co., 168 N.E.2d 811 (N.Y. Ct. App. 1960).
[A possibility doctrine] would mean that wherever such a cause is possible, the burden rests on the opposite party to prove that the disease resulted from something else. Consequently, for so long as the causes of the disease are unknown to medical science, the claimant or plaintiff can always recover--if the trier of the fact is favorably disposed--since no one can prove that the disease had other causes.
Miller, 168 N.E.2d at 817-18.

[FN74]. See Keyes & Howarth, supra note 73, at 549.

[FN75]. See In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 835 (E.D.N.Y. 1984); Rosenberg, supra note 33, at 857.

[FN76]. See Rosenberg, supra note 33, at 857.

[FN77]. See Sherman, supra note 66, at 384 (noting that individualistic evidence is often difficult to bring forward in mass exposure cases); see also Ryan v. Eli Lilly & Co., 514 F. Supp. 1004 (D.S.C. 1981).

[FN78]. See Rosenberg, supra note 33, at 869.

[FN79]. 855 F.2d 1188 (6th Cir. 1988).

[FN80]. See generally Rosenberg, supra note 33, at 905-24 (favoring a public-law vision, or class action treatment, of toxic tort cases because the "'private law' process results in the tort system's exclusion of most mass exposure claims").

[FN81]. Velsicol Chemical Corporation used the waste burial site to deposit by-products from the production of chlorinated hydrocarbon pesticides. Before disposing of chemicals in the landfill, Velsicol neither conducted hydrological studies to assess the soil composition of the site nor determined whether the water flow from the soil would flow to the local water aquifer. In addition, Velsicol failed to drill a monitoring well to regulate any contamination in the soil. See Velsicol, 855 F.2d at 1192.

[FN82]. According to the Sixth Circuit, a determination of generic causation implies that the combination of the chemicals in the soil and the water aquifers and plaintiffs' exposure to them were statistically capable of causing the type of harm of which plaintiffs complained. See id. at 1200.

[FN83]. Id.

[FN84]. Id. (emphasizing that individual particularized damages must be determined as to each individual).

[FN85]. See In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 835 (E.D.N.Y. 1984); Rosenberg, supra note 33, at 857-58. But see Sherman, supra note 66, at 386-87 ("While courts traditionally have admitted statistical evidence on the issue

of causation, most jurisdictions have concluded that some additional evidence is necessary to tie the alleged injury to the alleged breach of duty.").

[FN86]. See supra note 65.

[FN87]. See Sherman, supra note 66, at 384.

[FN88]. See Rosenberg, supra note 33, at 869.

[FN89]. 605 A.2d 1079 (N.J. Sup. Ct. 1992).

[FN90]. See id. at 1086.

[FN91]. See id.

[FN92]. Id. at 1087. A relative risk of 2.0 correlates with an attributable risk of 50%. Relative risk measures the strength of a statistical association by comparing the ratio of the disease rate in individuals who were exposed to a toxic substance to the disease rate in individuals who were not exposed. See id. at 1085. The attributable risk, however, is the proportion of the disease that is statistically attributable to exposure to the toxic substance. It takes into account both the relative risk and the proportion of the population that was exposed. See id. at 1086.

[FN93]. See discussion supra Part I.D.

[FN94]. See In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 834 (E.D.N.Y. 1984).

[FN95]. See discussion supra Part II.A.

[FN96]. See Earl v. Cryovac, 772 P.2d 725 (Idaho Ct. App. 1989); Blomquist, supra note 55, at 57; Callahan, supra note 31, at 609.

[FN97]. See Callahan, supra note 31, at 609 ("'[T]he law believes it unfair to require an indi-vidual to pay for another's tragedy unless it is shown that it is more likely than not that he caused it.'" (quoting Agent Orange, 597 F. Supp. at 781)).

[FN98]. Blomquist, supra note 55, at 57 (citing Earl, 772 P.2d at 727).

[FN99]. Under a deterrence rationale, tort law is designed to influence societal actors to behave efficiently and to engage in tortious, or accident- causing conduct, only up to the point at which the cost of further accident prevention equals the injury losses they would prevent. See Richard A. Posner, A Theory of Negligence, 1 J. Legal Stud. 29, 33 (1972); see also Mario J. Rizzo & Frank S. Arnold, Causal Apportionment in the Law of Torts: An Economic Theory, 80 Colum. L. Rev. 1399, 1405 n.36 (1980); Rosenberg, supra note 33, at 862 ("Optimal deterrence of tortious conduct--of inefficient risk- taking--is the [tort] system's dominant utilitarian function.").

[FN100]. Corrective justice principles ensure that victims are made whole after the defendant's wrongful conduct. In other words, plaintiffs are compensated up to the point that they are returned to their pre-wronged state. But see Rosenberg, supra note 33, at 878. David Rosenberg notes that attempts to make a plaintiff whole are never completely satisfactory because
[c]ompensation is ... limited by juries' prejudices against racial minorities and the poor; by high litigation costs, which deter competent plaintiffs' attorneys--particularly in mass exposure cases--from investing in lawsuits ... and by the inability of some victims to reach the assets of wrongdoers, who may be insolvent or otherwise legally unaccountable by the time the victims bring suit.
Id.

[FN101]. Fairness rationales involve determining whether a defendant has acted unreasonably, not whether a defendant has actually injured someone. See Glen O. Robinson, Multiple Causation in Tort Law: Reflections on the DES Cases, 68 Va. L. Rev. 713, 739 (1982).

[FN102]. See Cottle v. Superior Court, 5 Cal. Rptr. 2d 882, 906 (Ct. App. 1992) (Johnson, J., dissenting) (noting that the preponderance rule does not perform the dual functions of compensating injured parties and encouraging efficiency in safety

investment).

[FN103]. Under a strong version of the preponderance rule, or even the Landrigan version, this measurement comes from a combination of both individualistic and statistical evidence. Under a weak version of the rule, this measurement comes exclusively from statistical studies. For instance, under a weak version of the rule, if the background rate of cancer is 100 and the rate of cancer among individuals in the exposed population is 250, the attributable risk--the probability that a particular disease is attributed to the defendant's activities--is (250-100) / 250, or 60%. See supra note 65.

[FN104]. This is because when the likelihood that a defendant caused an individual's cancer is more likely than not, the tort system has made a value judgment that all exposed individuals suffering from cancer should be compensated. See discussion supra Part II.B. When the characteristics of toxic exposure make it impossible to distinguish those individuals that were exposed to toxic substances from those individuals who developed cancer from some other natural or background cause, tort law deems it unfair to exclude recovery for everyone simply because plaintiffs are indistinguishable. See Cottle, 5 Cal. Rptr. 2d at 903 (Johnson, J., dissenting).

[FN105]. By requiring individualistic proof, the strong version of the preponderance rule hopefully weeds out some of these individuals who developed their disease from other causes. Epidemiological studies might reveal a greater than 50% likelihood that a defendant caused a plaintiff's injury. However, under a strong version of the rule, defendants can respond by bringing forward evidence that indicates that another factor intervened or contributed to the plaintiff's illness, such as the plaintiff smoked, the plaintiff previously worked in a chemical plant, and so forth. It is only when the natural causes of cancer are unknown, and other individualistic proof is impossible to ascertain, that all injured plaintiffs might recover from a defendant even though there is only a 65% probability that the defendant caused their cancer. Under a weak version of the rule, however, reliance on abstract data might completely prohibit a defendant from proving that certain individuals did not in fact suffer injury after being exposed to its product. See Sherman, supra note 66, at 386-87.

[FN106]. Rosenberg, supra note 33, at 859.

[FN107]. Robinson, supra note 101, at 752; see also Rosenberg, supra note 33, at 863 (explaining that a more-likely-than-not determination causes firms to "bear liability for losses attributable not only to excess risk, but also to background risk").

[FN108]. See Rosenberg, supra note 33, at 864-65. "Firms threatened with liability for the total disease risk will overinvest in safety in an attempt to satisfy the courts' inflated perception of what constitutes optimal care." Id. at 864. This may continue "even when marginal investments yield no reduction in the chance of accidents, as long as marginal investments are lower than the marginal damages firms will avoid by conforming to the courts' standard of optimal care." Id. at 864-85.

[FN109]. See Cottle, 5 Cal. Rptr. 2d at 904-05 (Johnson, J., dissenting).

[FN110]. Id.; see also Rosenberg, supra note 33, at 880 ("Holding the firm responsible for losses attributable to other sources counts its wrong twice, for it has caused neither the wrongdoing nor the recklessness of others, nor even the conditions of indeterminacy that prevent courts from fixing responsibility on an individual basis.").

[FN111]. See Rosenberg, supra note 33, at 863.

[FN112]. See discussion supra Part II.B.

[FN113]. As previously discussed, the rationale for the preponderance rule's seeming arbitrariness is that some balance has to be struck when injured plaintiffs are indistinguishable. Plaintiff indeterminacy should not prevent plaintiffs from ever proving liability in court. However, a defendant company should not be held liable for all injuries when it is only possibly responsible. See discussion supra Part II.B.

[FN114]. See Robinson, supra note 101, at 751 (noting that underdeterrence of a defendant results when a defendant is considered not liable even though the defendant created an identifiable but unsubstantial risk of harm to a group of individuals).

[FN115]. See Rosenberg, supra note 33, at 879 ("Such a rule unjustly enriches the wrongdoer and thus encourages the wrongs that it fails to deter.").

[FN116]. See id. at 862.

[FN117]. See Ginsberg & Weiss, supra note 2, at 929 ("If the full societal cost of manufacture is not incorporated in the price of the waste producing products, such products will have an unwarranted advantage in the marketplace....[W]aste producing products will be subsidized by their unwitting and unwilling victims.").

[FN118]. See Cottle v. Superior Court, 5 Cal. Rptr. 2d 882, 904 (Ct. App. 1992) (Johnson, J., dissenting).

[FN119]. See Rosenberg, supra note 33, at 858.

[FN120]. See discussion supra Part II.A.

[FN121]. See Rosenberg, supra note 33, at 869 ("By rejecting statistical evidence, the strong version of the preponderance rule forces courts to disregard the best evidence available and thus creates a risk of error even greater than the one that would obtain if courts founded judgments explicitly upon such evidence.").

[FN122]. Sherman, supra note 66, at 384-85.

[FN123]. See id. at 385.

[FN124]. See id.

[FN125]. Essentially, the proportionality rule permits a finding of general causation, or negligence in the air, rather than the more typically required specific causation. But see Palsgraf v. Long Island R.R. Co., 162 N.E. 99, 99(N.Y. Ct. App. 1928) ("'Proof of negligence in the air, so to speak, will not do.'" (quoting Frederick Pollock, Torts 455 (11th ed. 1916))).

[FN126]. See Rosenberg, supra note 33, at 859.

[FN127]. See Callahan, supra note 31, at 669.

[FN128]. But see Kaye, supra note 65, at 495 n.34 (proposing a modified proportionality rule that would require some threshold probability level before granting any recovery); 2 American Law Institute, Reporters' Study: Enterprise Responsibility for Personal Injury 369-75 (1991) (proposing a 20% probability of causation threshold level before applying proportional liability).

[FN129]. See Kaye, supra note 65, at 493; Rosenberg, supra note 33, at 866.

[FN130]. See Rosenberg, supra note 33, at 875 ("Proportional liability exacts no more or less from the defendant than the loss the defendant has tortiously caused; the rule does not misappropriate the defendant's wealth.").

[FN131]. Efficiency and optimal deterrence arguments are especially important in any discussion of environmental toxic torts because they provide an important basis for determining how industrial and economic growth should be balanced with the health of individuals and the quality of the environment. See Harris, supra note 7, at 913. Perhaps the most favorable balance between economic growth and environmental health should be struck exactly when the marginal cost of safety measures equals the marginal cost of accident avoidance. At this point, economic theory proposes that a company cannot act any more optimally or efficiently. Although beyond the scope of this Comment, relying solely on economic efficiency arguments might be inappropriate in the environmental toxic tort context. Perhaps efficiency concerns should also take into account the severity of the injury and the morality of the defendant's conduct.

[FN132]. 597 F. Supp. 740 (E.D.N.Y. 1984).

[FN133]. See Sherman, supra note 66, at 374-75.

[FN134]. See Agent Orange, 597 F. Supp. at 837-38.

[FN135]. Judge Weinstein's method for apportioning damages is somewhat different from other legal commentators' methods. See, e.g., Rosenberg, supra note 33. In the Agent Orange case, plaintiffs faced both the problems of plaintiff

indeterminacy and defendant indeterminacy. See supra note 31. In such a case, Judge Weinstein suggested that the percentage of the award paid by each manufacturer could be measured by the product's toxicity. See Agent Orange, 597 F. Supp. at 838. For example, if 1100 people were exposed to a toxic substance, developed cancer, and subsequently sued 10 manufacturers responsible for producing the substance, total damages (if damages average $1,000,000 per cancer) would be $100,000,000. Consequently, if a company produced only 20% of the substance in question, but likely caused 60% of the damages because of the greater toxicity of the product, Judge Weinstein would hold that particular defendant liable for 60% of the total damages. See id.

[FN136]. See, e.g., Cottle v. Superior Court, 5 Cal. Rptr. 2d 882, 905- 06 (Ct. App. 1992) (Johnson, J., dissenting) (proposing a variant of the market share approach to replace the preponderance rule).

[FN137]. 607 P.2d 924, 937 (Cal. 1980).

[FN138]. See id. at 925-26.

[FN139]. See id. at 936-37.

[FN140]. See id. at 936-38.

[FN141]. See Delgado, supra note 38, at 899-901.

[FN142]. This approach would require a plaintiff to establish a prima facie case of causation before the burden of proof would shift to the defendant company. To satisfy this requirement, a plaintiff must demonstrate
(i) that plaintiffs have suffered an injury; (ii) that the injury be one that could have resulted from either natural or human causes, acting separately and without synergy; (iii) that the injuries be causally indeterminate--that is, not identifiable as humanly or naturally caused; (iv) that the defendant is the only possible human cause; and (v) that the population injured, mode of risk, and other variables be uniform and stable enough to permit calculation of the increased number of victims.
Id. at 899-900.

[FN143]. See id. at 899. But see In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 837 (E.D.N.Y. 1984).
[S]hifting the burden of proof in the indeterminate plaintiff situation could result in liability far out of proportion to damage caused. It is not helpful in most situations to say that the defendant will not be liable for "those harms which [he] can reasonably prove were not in fact a consequence of his risk-creating, negligent conduct," since, were such individualized proof available, there would have been no need to shift the burden.
Id. (quoting Allen v. United States, 588 F. Supp. 247, 415 (D. Utah 1984), rev'd on other grounds, 816 F.2d 1417 (10th Cir. 1987)).

[FN144]. See Delgado, supra note 38, at 900.

[FN145]. See id. at 901.

[FN146]. See Daniel A. Farber, Toxic Causation, 71 Minn. L. Rev. 1219, 1221 (1987).

[FN147]. See Callahan, supra note 31, at 669-70; Farber, supra note 146, at 1243-44.

[FN148]. See Farber, supra note 146, at 1244.

[FN149]. See Callahan, supra note 31, at 669-70.

[FN150]. See id. at 670.

[FN151]. See discussion supra Part I.D.

[FN152]. See supra notes 129-131 and accompanying text.

[FN153]. See Kaye, supra note 65, at 502 (noting that, under a proportionality rule, individual recovery would be wrong every time, even though on average it would be exactly right).

[FN154]. See Rosenberg, supra note 33, at 879-80 (arguing that when the probability of causation is greater than 50%, the proportionality rule, which allows victims prorated compensation, does not protect victims' entitlements as well as a rule allowing full recovery).

[FN155]. See id. at 880 ("If inequity is unavoidable--if either the defendant must pay too much or those the defendant has actually injured will receive too little--it might be appropriate for the burden to fall upon the wrongdoer rather than upon innocent victims.").

[FN156]. The most-likely-victim approach attempts to remedy this fault in proportional liability. Nevertheless, as already discussed, the most-likely- victim approach is helpful in theory, but likely is impossible to implement.

[FN157]. See supra note 125.

[FN158]. Sherman, supra note 66, at 391.

[FN159]. Professor Richard Delgado's reverse-Sindell approach does permit defendants to introduce individualistic proof to rebut causation. See supra notes 141-143 and accompanying text. The burden-shifting nature of the reverse-Sindell approach, however, might not be appropriate given the circumstances--a defendant is no more likely to have individualistic proof of causation than a plaintiff. See In re "Agent Orange" Prod. Liab. Litig., 597 F. Supp. 740, 837 (E.D.N.Y. 1984).

[FN160]. See Kaye, supra note 65, at 495 (noting that recovery will be allowed "even when the factual basis for liability is tenuous").

[FN161]. See Allen v. United States, 588 F. Supp. 247, 438, 439 n.197 (D. Utah 1984) (noting significant variation in experts' interpretation of statistical evidence relating to the likelihood that the plaintiff's cancer was caused by exposure to radiation), rev'd on other grounds, 816 F.2d 1417 (10th Cir. 1987).

[FN162]. See Rosenberg, supra note 33, at 897.

[FN163]. See Kaye, supra note 65, at 495.

[FN164]. See Rosenberg, supra note 33, at 894.

[FN165]. 588 F. Supp. at 247.

[FN166]. The Federal Torts Claims Act makes the government liable for tort claims by indi-viduals in the same manner and to the same extent as private companies. See 28 U.S.C. §1346(b) (1994).

[FN167]. See Allen, 588 F. Supp. at 415.

[FN168]. Id.

[FN169]. The court articulated a test on which a fact finder could rely to determine whether a defendant was a substantial factor in causing harm to a plaintiff:
Where a defendant who negligently creates a radiological hazard which puts an identifiable population group at increased risk, and a member of that group at risk develops a biological condition which is consistent with having been caused by the hazard to which he has been negligently subjected, such consistency having been demonstrated by substantial, appropriate, persuasive and connecting factors, a fact finder may reasonably conclude that the hazard caused the condition absent persuasive proof to the contrary offered by the defendant.
Id. (emphasis added). According to Judge Jenkins, this test satisfies the substantial-factor causation test of the Restatement (Second) of Torts §433 (1965). See supra note 41 and accompanying text.

[FN170]. See Allen, 588 F. Supp. at 415.

[FN171]. Id. at 428.

[FN172]. Although this burden-shifting approach appears to favor plaintiffs substantially more than the preponderance rule,

the practical results were not altogether favorable for plaintiffs in Allen. Out of 24 claims, the court granted recovery to only nine plaintiffs, denied recovery to 14 plaintiffs, and left one plaintiff's claim unresolved. See id. at 428-43.

[FN173]. See discussion supra Part I.D.

[FN174]. But see Mulcahy, supra note 20, at 1313 ("Lessening the plaintiff's burden may appear to be unjust to the defendant since the producer of a toxic substance may then be held liable for injuries suffered by the plaintiff despite the lack of direct proof that the defendant caused the harm.").

[FN175]. In re "Agent Orange" Product Liab. Litig., 597 F. Supp. 740, 837 (E.D.N.Y. 1984).

[FN176]. See, e.g., Sindell v. Abbott Lab., 607 P.2d 924, 936-37 (Cal. 1980); Summers v. Tice, 199 P.2d 1, 5 (Cal. 1948) (en banc); Ybarra v. Spangard, 154 P.2d 687, 689 (Cal. 1944).

[FN177]. See Robinson, supra note 101, at 731 n.71.

[FN178]. See Ginsberg & Weiss, supra note 2, at 930. See generally Stephen M. Soble, A Proposal for the Administrative Compensation of Victims of Toxic Substance Pollution: A Model Act, 14 Harv. J. Legis. 683 (1977) (proposing an administrative compensation scheme for victims of hazardous-waste pollution).

[FN179]. See Ginsberg & Weiss, supra note 2, at 929.

[FN180]. See id. at 929-30.

[FN181]. See id.

[FN182]. See, e.g., 126 Cong. Rec. 30,948 (1980) (sacrificing victim compensation in favor of Superfund in the CERCLA); 131 Cong. Rec. S12,004 (daily ed. Sept. 24, 1985) (rejecting for the second time a Victim Assistance Program provision to be included in the amended CERCLA that would, in part, compensate specific victims of toxic waste).

[FN183]. 42 U.S.C. §2210 (1994).

[FN184]. See id.

[FN185]. The act also requires that an individual has not engaged in certain lifestyle habits that could have substantially affected the likelihood that radiation caused the victim's injury (e.g., no heavy smoking). See id.

[FN186]. Farber, supra note 146, at 1242 (citation omitted).

[FN187]. See discussion supra Part III.A.3.

[FN188]. See Rosenberg, supra note 33, at 926-28.

[FN189]. See id. at 927.

[FN190]. See id.

[FN191]. See supra Part I.D.

[FN192]. See supra Part I.D.

[FN193]. See supra notes 168-169 and accompanying text.

[FN194]. See supra note 177 and accompanying text.

[FN195]. See Robinson, supra note 101, at 730.
Allocating the burden of production to the plaintiff follows Holmes' principle of social conservatism that requires special

justification for engaging the machinery of the law to effect a change in the status quo. In the field of torts, this means that losses from accidents should lie where they fall unless an affirmative case can be made for shifting them to others.
Id. (citing Oliver Wendell Holmes, The Common Law 96 (1881)).

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