UNCERTAIN RISK, CAUSATION AND PRECAUTION IN TOXIC TORT LITIGATION

by

BRENDA HEELAN POWELL

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Department of Law

The University of British Columbia
Vancouver, Canada

Date August 18, 1999
Abstract

The requirements for proof of causation determine the extent to which the general public will be exposed to risks associated with technological and scientific processes. If the requirements for proving causation are set too high, individuals will be less successful in protecting their rights to personal integrity and property. As such, the general public will be exposed to greater risk of harm by toxic substances associated with industrial activities. Conversely, technological and scientific advancement will be stifled by overly lax causation requirements which place an excessive burden on the producers and users of toxic substances.

Due to the limits of scientific knowledge, the traditional requirements for proof of causation present an almost insurmountable barrier to success in toxic tort litigation. In particular, the risk associated with a particular industrial process may be unknowable in light of current scientific knowledge. The traditional causation requirements are unsuited to the situation in which scientific evidence can demonstrate a significantly increased risk of harm but cannot establish a conclusive causal link.

The courts should expressly acknowledge the scientific uncertainty surrounding the risk associated with many industrial activities, and explicitly adopt a policy approach to dealing with this uncertainty. At one extreme, the courts may allow these processes to proceed until there has been clear demonstration of harm. At the other extreme, the courts may disallow these processes to proceed until there has been clear demonstration of safety. Falling between these
extremes, the courts may allow cautious progress with these processes until there has been clear
demonstration of harm or safety.

The latter approach allows a balance between the social benefit of technological and scientific
advancement and the individual rights to personal integrity and property. In the context of toxic
tort litigation, this approach can be adopted by moving from a formulaic conception of
causation to a flexible, policy sensitive conception which is guided by the notion of precaution.
Ultimately, the courts' selection of an approach to dealing with scientific uncertainty is a matter
of policy which should be resolved by consideration of the values in conflict in toxic tort
litigation.
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Chapter One: An Introduction to Toxic Tort Litigation & Causation

Introduction

Unfortunately, the immense social benefits of technological and scientific advances have been accompanied by an increased release of persistent, toxic substances into our environment which may have devastating effects on human health and the environment. A legal theory that provides a specific, justiciable right to be free of the harmful effects of toxic substances has not yet been developed in Canadian jurisprudence.\(^1\) However, several long-standing common law actions have been used to protect individual rights to physical integrity and property from the harmful effects of toxic substances.\(^2\) Common law actions used for these purposes are referred to as “toxic torts”. The common law actions most often used as toxic torts are:

1. nuisance, both public and private;

2. trespass, to land and to the person;

3. the rule in *Rylands v. Fletcher*;

4. riparian rights; and

5. negligence.

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2 E. Hughes, A Lucas & W. Tilleman, *supra* note 1 at 90.
By pursuing toxic tort litigation, individuals can assert and protect their rights to physical integrity and property. In addition, toxic torts serve as a mechanism of general environmental protection by controlling the use of land.\(^3\)

Environmental decision-making, including the resolution of toxic tort litigation, requires a balance of conflicting values. In toxic tort litigation, the courts are called upon to achieve a balance between the social benefit of technological and scientific progress, and the individual rights to physical integrity and property. The courts must promote technological and scientific progress without subjecting the general public to an unacceptable level of risk of harm from toxic exposure.

The requirements for proof of causation set by the courts determine the extent to which the general public will be exposed to risks associated with technological and scientific progress. If the requirements for proving causation are set too high, individuals will be less successful in protecting their rights to physical integrity and property. As a result, the general public will be exposed to greater risk of harm by toxic substances associated with technological and scientific activities. In addition, the true cost of such activities, including adverse environmental effects, will not be considered in valuing technological and scientific activities. Conversely, technological and scientific development will be stifled by overly lax causation requirements which place an excessive burden on the producers and users of toxic substances.

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The Causation Problem

The traditional requirements for proving causation are generally regarded as the primary barrier to success in toxic tort cases. The notion of causation in tort law determines the limits of liability of a defendant by linking the plaintiff’s injury to an act of the defendant. That is, the general principles of tort law require a plaintiff to demonstrate that the defendant has caused the injury of which the plaintiff complains. In the context of a toxic tort claim, this means a plaintiff must demonstrate that:

1. the defendant caused the plaintiff’s exposure to a toxic substance; and
2. this exposure caused the injury of which the plaintiff complains.

To be successful, a plaintiff must prove both elements on a balance of probabilities.

Practically, proof of both these elements of cause-in-fact can be difficult. Little is known about the toxicity of many substances which are in common use. The movement of substances through the air, soil and water is often unknown or very difficult to trace. Accordingly, the pathway between a suspected source and exposure point may be difficult to demonstrate. Hence, it is difficult to prove that the defendant caused the plaintiff’s exposure to a toxic substance.

It is also difficult to demonstrate that toxic exposure caused the injury of which the plaintiff complains. The synergistic interactions of substances may be unknown. Accordingly, the

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injury may be the result of the impugned substance, or the impugned substance interacting with other factors, or several factors other than the impugned substance. Scientific technology often cannot distinguish between injury caused by a toxic exposure and injury caused by other environmental or hereditary factors. In other words, it is difficult to distinguish those whose injuries were caused by the defendant's actions from those who would have suffered the same injury without the defendant's involvement. Where the causal link between exposure and injury cannot be established with a high degree of certainty as required by traditional tort law, the victim will not recover.

In addition, the etiology of a particular disease may be unknown. Even where there is scientific proof of the etiology of a particular disease, the courts may be reluctant to accept this as proof of legal causation. The effects of toxic substances are generally understood in terms of the association of a substance with the probability of harm to a population. In other words, toxicological causation is expressed as probability of an individual in a population contracting a disease. It appears that the courts may be reluctant to rely on such statistical evidence to establish legal causation. A finding of legal causation demands demonstration of an actual causal link between the particular exposure and the particular injury.

Given the necessary reliance on scientific evidence and the limits of scientific knowledge, the traditional requirements for proof of causation create an almost insurmountable barrier to the

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6 J.S. Forstrom, supra. note 5 at 156.
success of toxic tort plaintiffs. Scientific evidence can often establish a significantly increased risk of harm but cannot establish a conclusive causal link. The traditional causation requirements are not suited to this situation. In addition, scientific evidence cannot determine the appropriate level of risk from toxic exposure to which the general public should be exposed. This issue is a matter of policy which can be addressed only by explicitly balancing the social benefit of technological and scientific development with the individual rights to personal integrity and property. Ultimately, the balancing of these values must be explicitly addressed in toxic tort litigation.

The traditional requirements for proving causation create injustice by allowing industrial defendants to hide behind a barrier of scientific uncertainty thereby escaping liability for the damages they have caused. As such, several reforms to the tort system have been proposed to overcome the causation problem in toxic tort litigation. These proposals include the imposition of liability pursuant to novel theories of liability, the expansion of the categories of compensable damages, and the alteration of procedural requirements.

It has also been proposed that the risks associated with toxic substances cannot be addressed within the confines of the tort system. Rather, it is argued that comprehensive statutory regimes should be developed to deal with toxic substances. Admittedly, the environmental and human health impacts caused by the release of toxic substances cannot be addressed by resort to toxic tort litigation alone. However, a comprehensive statutory regime cannot possibly contemplate all toxic substances and possible effects. In this event, a victim of toxic exposure must turn to tort law as a backup to the comprehensive statutory regime. As such, the causation problem
associated with toxic substances must be addressed by a mechanism operating within the context of tort law.

The difficulties associated with the traditional requirements for proving causation in toxic tort litigation have been recognized by the Supreme Court of Canada. In *Snell v. Farrell*, the Court restated the nature and extent of the onus borne by a plaintiff to prove the cause of an injury. The Court stated that the dissatisfaction with the traditional causation approach stems largely from its too rigid application in many cases. Causation is a flexible concept which need not be demonstrated with scientific precision. Further, in the absence of contradicting evidence, the evidence adduced by the plaintiff may result in an inference being drawn adverse to the defendant. Thus, while declining to expressly rewrite traditional causation requirements in tort law, the Court restated the nature and extent of the onus borne by a plaintiff to prove the cause of his injury. The Court also indicated that overt attempts to shift the burden of proof from the plaintiff to the defendant or attempts by the plaintiff to satisfy the onus placed upon him solely by establishing that the defendant's conduct created risk of injury will not be well received.

The Supreme Court of Canada's decision in *Snell v. Farrell* has begun a movement away from a formulaic conception of causation to a more flexible, policy sensitive conception. By using the notion of causation as expressed in *Snell v. Farrell*, the traditional requirements for proving causation can be eased in toxic tort litigation. The courts may draw inferences adverse to the defendant even though the plaintiff may not be able to establish causation on a strict balance of

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probabilities. That is, a toxic tort plaintiff may succeed even in the face of limited scientific knowledge regarding the risk associated with a particular technological or scientific process.

To effectively address the causation issue in toxic tort litigation, the courts must expressly acknowledge the scientific uncertainty which surrounds the risk associated with many industrial processes. Further, the courts must explicitly adopt an appropriate policy approach to deal with this uncertainty. Essentially, the courts may adopt one of three approaches to deal with the scientific uncertainty surrounding the risk associated with scientific and technological processes. At one extreme, the courts may allow these processes to proceed until there has been clear demonstration of harm. At the other extreme, the courts may disallow these processes to proceed until there has been clear demonstration of safety. Falling between these extremes, the courts may allow cautious progress with these processes until there has been clear demonstration of harm or safety. Ultimately, the courts’ selection of an approach dealing with this uncertainty is a matter of policy which must be resolved by explicit consideration of the values in conflict in toxic tort litigation.

The ability of the courts to draw inferences of causation ought to be guided by the notion of precaution. That is, when the risks associated with a particular technological or scientific process are uncertain, the courts should allow only cautious progress with such processes. In the face of scientific uncertainty, the courts should err on the side of caution. As such, once a toxic tort plaintiff has demonstrated a rational connection between his injury and an act of the defendant, the courts should draw an inference of causation unless the defendant adduces contradicting evidence. A rational connection can be established by evidence that the
defendant did release the substance which the plaintiff alleges caused his harm. In addition, the plaintiff would have to establish that there is at least some scientific evidence that the substance can cause harm to living organisms.

In contrast to the traditional approach, this approach encourages the courts to explicitly weigh the social value of technological and scientific development with the individual rights to personal integrity and property. The courts can determine, as a matter of policy, the extent of risk from toxic substances to which the general public should be exposed. This approach moves from the traditional requirements for proof of causation which effectively presume that new technological and scientific development are harmless until proven otherwise. In contrast, by being guided by the notion of precaution, the courts do not presume scientific and technological developments to be harmless and do not require a plaintiff to prove otherwise. Rather, the courts will explicitly consider the appropriate level of risk from toxic substances to which the general public will be exposed. In the light of evidential uncertainty, the courts will make the decision designed to prevent further harm.

**Outline of Thesis**

This thesis consists of five chapters, including the introductory chapter. Given its pivotal role, chapter two reviews the type of scientific evidence typically adduced as proof of causation in toxic tort litigation. The limits of scientific knowledge contribute to the barrier to success in toxic tort litigation created by the traditional causation requirements. In addition, the courts appear reluctant to accept all but the most persuasive scientific evidence as proof of causation.
Finally, the fundamental conflicts between legal and scientific methodologies make incorporation of scientific evidence into toxic tort litigation difficult.

The notion of causation as a concept is explored in chapter three. Although conventionally treated as a purely factual and objective investigation, the traditional requirements for causation are influenced by policy concerns. As the evidence regarding causation becomes more uncertain, policy concerns become more important. In particular, the courts should move from seeking the scientific truth regarding causation to seeking the most appropriate policy solution.

The many reforms which have been proposed to overcome the causation problem are reviewed in chapter four. In addition, the courts’ experiments with techniques designed to alleviate the causation problem in toxic tort litigation are reviewed.

Finally, chapter five establishes that the notion of causation as expressed in Snell v. Farrell can be exploited by toxic tort plaintiffs to overcome the causation problem. The ability of the courts to draw an inference of cause-in-fact, even though there may not be conclusive evidence of such, will be greatly benefit toxic tort plaintiffs. The notion of precaution should guide the ability of the courts to draw inferences of causation. That is, if the extent of risk associated with a particular scientific or technological process is uncertain, the courts should allow only cautious progress with such processes to avoid further harm. This means that once a toxic tort plaintiff has demonstrated a rational connection between his injury and an act of the defendant, the courts should draw an inference of causation unless the defendant adduces contradicting evidence.
Conclusion

A strict application of the traditional requirements for proof of causation effectively presumes that technological and scientific development is harmless until proven otherwise. The burden of such development falls upon the innocent victims of toxic exposure rather than upon those who have benefited from the production and use of toxic substances. By strictly applying the traditional causation requirements, the courts do not explicitly consider the appropriate level of risk from toxic substance to which the general public will be exposed. In other words, the appropriate balance between the social benefit of technological and scientific development, and the individual rights to personal integrity and property is not addressed by the courts.

Rather than treating the causal inquiry as a purely factual investigation, the courts should recognize and address the policy concerns in issue. In particular, the courts should explicitly acknowledge the scientific uncertainty which surrounds the risk associated with many technological and scientific processes. The courts may adopt one of three policy approaches to deal with this uncertainty. At one extreme, the courts may allow these processes to proceed until there has been clear demonstration of harm. At the other extreme, the courts may disallow these processes to proceed until there has been clear demonstration of safety. Falling between these extremes, the courts may allow cautious progress with these processes until there has been clear demonstration of harm or safety.
Ultimately, the courts’ selection of an approach dealing with this uncertainty is a matter of policy which should be resolved by explicit consideration of the values in conflict in toxic tort litigation. In the context of toxic tort litigation, there is conflict between the social value of technological and scientific development, and the individual rights to personal integrity and property. The courts must make decisions that promote technological and scientific development while protecting individual rights to personal integrity and property. Given the significant and irreparable nature of the harm caused by toxic substances, the progress with technological and scientific processes should proceed cautiously until the associated risks are certain.
Introduction

Inevitably, toxic tort litigants must rely upon scientific evidence to establish toxic causation. As with other areas of environmental decision-making, toxic tort litigation often pushes the boundary of scientific knowledge.\(^8\) There is limited scientific knowledge regarding the toxicity of many substances in common use. The movement of substances through the air, soil and water is often unknown or very difficult to trace. Accordingly, the pathway between a suspected source and exposure point may be difficult to demonstrate. Hence, it is difficult to prove that the defendant caused the plaintiff's exposure to a toxic substance.

The state of scientific knowledge may be inadequate to demonstrate accurately the harmful effects of a defendant's act other than on the basis of epidemiological studies and statistical probabilities.\(^9\) As such, even if a factual link between the plaintiff and the defendant can be established, it is difficult to distinguish those whose injuries were caused by the defendant's actions from those who would have suffered the same injury without the defendant's involvement.

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\(^9\) M. Boodman, supra. note 4 at 242.
It is also difficult to demonstrate that exposure caused the injury of which the plaintiff complains. The synergistic interactions of substances may be unknown. Accordingly, the injury may be the result of the impugned substance, or the impugned substance interacting with other factors, or several factors other than the impugned substance. Medical technology often cannot distinguish between injury caused by a toxic exposure and injury caused by other environmental or hereditary factors.\(^\text{10}\) Where the causal link between exposure and injury cannot be established with a high degree of certainty as required by traditional tort law, the victim will not recover.

In addition, the etiology of a particular disease may be unknown. Even where there is scientific proof of the etiology of a particular disease, the courts may be reluctant to accept this as proof of cause-in-fact. The effects of toxic substances are generally understood in terms of the association of a substance with the probability of harm to a population. In other words, toxicological causation is expressed as the probability of an individual in a population contracting a disease.\(^\text{11}\) The courts may be reluctant to rely on such statistical evidence to establish legal cause-in-fact.

In addition to the limits of scientific knowledge, the conflict between legal and scientific methodologies contributes to the causation barrier in toxic tort litigation. In contrast to the legal community’s quest for certainty, uncertainty is considered an important aspect of the scientific

\(^{10}\) J.S. Forstrom, supra. note 5 at 153.

\(^{11}\) J.S. Forstrom, supra. note 5 at 156.
process. Another conflict arises from the scientific search for truth which includes a strong aversion to adding false knowledge to the existing body of scientific information. As a result of this aspect of scientific methodology, scientists have a very high standard for proof of a causal relationship between a substance and an injury.

**Toxicological Evidence of Causation**

As mentioned, a toxic tort plaintiff must rely upon scientific evidence to establish that the plaintiff was exposed to a toxic substance as a result of the defendant's actions, and that such exposure caused the injury for which compensation is sought. Generally, a toxic tort plaintiff will adduce toxicological evidence as proof of causation. In order to effectively use toxicological evidence in the toxic tort litigation process, an understanding of such evidence is essential.

Toxicology is the study of the capacity of chemicals and other environmental agents to produce harmful effects in living organisms. Toxicologists study the interactions between chemicals and biological systems, and attempt to identify the mechanism of action of toxic substances. In addition, toxicologists attempt to assess quantitatively the relationship between doses of toxic substances and the biological responses. The most common toxicological studies are *in vitro* studies, animal bioassay studies and epidemiological studies. Other scientific evidence of toxicity includes structural activity analysis and adverse case reports.

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12 M.D. Green, "Expert Witnesses and Sufficiency of Evidence in Toxic Substances Litigation: The Legacy of *Agent Orange* and *Bendectin* Litigation" (1992) 86 NW. Univ. L. Rev. 643 at 214 to 218.
In vitro Studies

In vitro studies are test tube experiments which are usually based on well-elucidated mechanisms of action. Several in vitro tests have been developed to measure toxicity of substances. Examples of in vitro studies include:

1. Competitive Ligand Binding Assays which measure the ability of a particular substance to bind to a defined molecular receptor;

2. Inductions of Protein Expression or Enzyme Activity which measure the ability of a substance to induce the production of proteins or enzyme activities;

3. Recombinant Receptor or Reporter Gene Assays; and

4. Yeast Based Assays which have been used to investigate receptor structure and function, as well as the activity of selected substances.

Since they are relatively inexpensive and less labor intensive, in vitro tests are suitable for large-scale screening of potentially toxic substances. In vitro studies are also advantageous because they use fairly definitive end points. The major drawback of using in vitro tests is the difficulty of extrapolating results to assess risk to human health and environmental quality.

14 T. Zacharewski, supra, note 13 at 614.
15 T. Zacharewski, supra, note 13 at 614.
Animal Bioassay Studies

Animal bioassay studies are tests in which the toxicity of a substance is determined by measuring the reaction of a living organism to it. The toxicity of a substance is usually reported in terms of the median lethal concentration. The conventional standard for expressing the acute lethal toxicity of a given substance is the concentration at which half of the exposed individuals die. This is referred to as the LC50. The safe concentration of a substance - which permits reproduction, growth and other normal life processes - is usually much lower than the LC50.

As with in vitro studies, the main concern with animal bioassay studies is extrapolating the toxic effects from animals to humans. Variations between species, including size, life span and metabolism, create concerns regarding the validity of making such extrapolations. In particular, there are species related differences in the metabolism and disposition of substances. The balance of bioactivation and detoxification mechanisms, the dose actually delivered to the target organs and general biological processes differ from species to species.

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17 M.D. Green, supra, note 12 at 654 to 656.
Extrapolations from animals to humans are further complicated by the possible difference in the dose-response relationship for different species. Moreover, substances may exert no effect below a threshold level of concentration. At low doses the shape of the dose-response relationship cannot be established with statistical confidence. As such, it is conventional to assume a linear dose-response relationship without a threshold level. Thus, because of scientific uncertainty, the results from an animal bioassay test may not reflect a threshold effect despite the actual existence of such an effect. In addition, the effects of a substance at low doses may not be accurately predicted.

Animal bioassay studies are often criticized on the basis that the dose received by the test animals is much higher than typical environmental exposures experienced by humans. It is important to note that dose is not synonymous with exposure. Exposure is merely the opportunity to receive a dose of a particular substance. The ultimate dose may be affected by several variables, including the source of the substance, the proximity to the substance and the concentration of the substance.

Recognizing the uncertainty surrounding animal bioassay studies and acting in the spirit of caution, regulators make conservative assumptions when extrapolating the toxic effects of a

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19 M.D. Green, supra. note 12 at 654 to 656.
21 M.D. Green, supra. note 12 at 216 to 217.
For example, the assumptions adopted by the American Environmental Protection Agency are:

1. when human data are not adequate, adverse effects in experimental animals are regarded as indicative of adverse effects in humans;

2. results obtained with dose-response models can be extrapolated outside the range of experimental observations to yield estimated bounds on low-dose risk;

3. when an appropriate standardized dosage scale is used, observed experimental results can be extrapolated across species;

4. there is no threshold for the production of cancer, but threshold effects may apply for other toxicological outcomes;

5. when dose rates are not constant, average doses give a reasonable measure of exposure;

6. in the absence of pharmacokinetic data, the effective or target dose is assumed to be proportional to the administered dose;

7. risks from many exposures and from many sources of exposure to the same chemical are usually assumed to be additive;

8. in the absence of evidence to the contrary and regardless of the route of exposure, 100% absorption across species is assumed; and

9. results associated with a specific route of exposure are potentially relevant for other routes of exposure.

If a court adopts the conclusions of regulators regarding safe human exposure levels based on animal studies, the underlying assumptions should be considered by the court. In particular, the court should determine, as a matter of policy, whether these assumptions are appropriate.

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Epidemiological Studies

Epidemiology is the study of the causes, occurrence and prevention of disease in human populations.\(^{23}\) The science of epidemiology uses statistics generated from population based studies to quantify the association between exposure to a substance and the harm suffered.

There are four major epidemiological study designs:\(^{24}\)

1. **Cohort Studies**
   A cohort study compares people who were exposed to a substance with people drawn from the general population. Members of the exposed group have had, or will have, a range of similar exposures. The major strength of cohort studies is the ability to detect a wide range of possible harmful effects from exposure. However, since these studies analyze populations over a long period of time, cohort studies are expensive and cumbersome. In addition, there is some tendency toward scientific bias.\(^{25}\)

2. **Case Control Studies**
   Case control studies compare a group of people who have the disease to those people who do not have the disease to determine the difference, if any, in exposure between the two groups. These studies focus on a particular type of harm and consider information on a wide range of exposures. These studies are smaller and more efficient than cohort studies. However, case control studies have greater tendency to scientific bias than cohort studies.

3. **Prospective Experimental Studies**
   Prospective experimental studies include clinical trials, field trials and community intervention studies. The experimental group is deliberately exposed to a particular substance whereas the control group is not. Both groups are then tracked for the occurrence of a particular harm. These studies offer a high degree of control and decreased scientific bias. However, the use of these studies is

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\(^{25}\) As defined in A.A. Marino and L.E. Marino, *The Scientific Basis of Causality in Toxic Tort Cases* (1995) 21 Univ. Dayton L. Rev. 2, scientific bias is an undisclosed or unappreciated factor that was, in fact, partly or wholly responsible for a particular observation.
limited due to ethical constraints which require exposures to be protective rather than harmful.

4. Cross-sectional Studies
Cross-sectional studies are essentially "polls" which ask research subjects their level of exposure and disease status. These studies provide a snapshot in time. Cross-sectional studies usually are used to determine whether further research is required, and should not be relied upon exclusively to demonstrate causation. The major concern with such studies is the occurrence of bias.

While epidemiological studies can demonstrate an association between a particular substance and a particular disease, they do not establish a causal relationship. To determine whether a causal relationship does exist, epidemiologists consider the Henle-Koch-Evans Postulates as guidelines: 26

1. the incidence of the disease should be significantly higher in those exposed to the hypothesized cause than in those not exposed;

2. when all other risk factors are constant, exposure to the hypothesized cause should be more frequent among those with the disease than those without the disease;

3. temporally, the development of the disease should follow exposure to the hypothesized cause;

4. a spectrum of host responses should follow exposure to the hypothetical cause along a biological gradient from mild to severe;

5. a measurable host response following exposure to the hypothesized cause should have a high probability of appearing in those lacking this response before exposure, or there should be an increase in magnitude of those responses present before exposure; in either event, this response should occur less frequently in those not exposed to hypothesized cause;

6. experimental reproduction of the disease should occur more frequently in those exposed to the hypothetical cause than those not exposed;

7. elimination or modification of the hypothesized cause or its vector should decrease the incidence of disease;

8. prevention or modification of the host’s response, for example by immunization, on exposure to the hypothesized cause should decrease or eliminate the disease; and

9. all relationships should make biological and epidemiological sense.

In order to make biological and epidemiological sense, there should be compatibility with current biological knowledge including animal bioassays, geneotoxicity, pharmacokinetics and in vitro studies. As well, the associational data should not seriously conflict with the natural history and biology of the disease.

Epidemiologists may consider other factors in determining whether an association between an exposure and a disease is a causal relationship. An important factor is the existence of repeated consistent observations over different observation periods, under different study designs and under different circumstances. Another factor which strongly points to a causal relationship is the correspondence of exposure to a particular substance with the occurrence of a particular disease.

Practically, the use of epidemiological studies in toxic tort litigation may be limited by several factors. Firstly, there is limited availability of epidemiological studies for many, if not most, substances in common use. Secondly, within a particular study it is often not possible to develop sufficient information regarding the magnitude of exposure of the individuals in the

\[27\] G.W. Boston, supra. note 18 at 241 to 248.
studies. Accordingly, there is limited evidence about the levels of substances necessary to cause the observed effects. Thirdly, the mixing or combining of effects other than from exposure, may distort the effect of exposure being investigated. Finally, rigorous scientific standards which require a stipulated research hypothesis, well specified cohort, analysis of attributable actions and avoidance of detection bias may be difficult to meet in a particular study. It is important to note that peer review of epidemiological studies does not guarantee scientific rigor.\textsuperscript{28}

\textit{Other Forms of Toxicological Evidence}

Structural activity models have been used to assess toxicity of substances.\textsuperscript{29} These models rely on the similarities in molecular structure of substances with unknown toxicity to substances with known toxicity. A substance with a molecular structure similar to a known toxin will be inferred to be toxic.

Another source of evidence used to demonstrate causation in toxic tort litigation is the existence of adverse case reports.\textsuperscript{30} Adverse case reports are anecdotal reports of adverse reactions following exposure to a particular substance.

\textsuperscript{28} G.W. Boston, \textit{supra}, note 18 at 241 to 248.
\textsuperscript{29} M.D. Green, \textit{supra}, note 12.
\textsuperscript{30} M.D. Green, \textit{supra}, note 12.
Regardless of the type of scientific evidence offered as proof of causation, the courts should consider that at least six factors may influence the reliability of evidence derived from a scientific principle. These factors include:

1. the validity of the underlying scientific principles;
2. the validity of the technique or process that applies the principle;
3. the condition of any instruments used in the process;
4. the adherence to proper procedures;
5. the qualifications of the person who performs the test; and
6. the qualifications of the person who interprets the results.

Especially when faced with conflicting scientific evidence, the courts should consider these factors as guidelines for assessing the reliability of the scientific evidence.

Treatment of Toxicological Evidence by the Courts

The consideration of toxicological evidence by Canadian courts has been quite limited. Of the various types of toxicological evidence, epidemiological evidence has been the most extensively considered. This is likely a reflection of the observation that “in most cases, epidemiological evidence is the best, if not the only, evidence to link the injury to the exposure.”

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31 G.W. Boston, supra. note 18 at 278.
32 J.S. Forstrom, supra. note 5 at 159.
The Ontario High Court commented generally on the use of epidemiological evidence in *Rothwell v. Raes*. In this case, the infant plaintiff was one of two twins, the other of whom was stillborn. At approximately three, four and five months of age, the infant plaintiff received immunization doses of a multipurpose vaccine known as quadrigen to protect against diphtheria, pertussis, tetanus and poliomyelitis. Shortly after receiving the third shot, it became apparent that the infant plaintiff was suffering from a developmental abnormality. The infant plaintiff was blind, almost deaf and severely disabled, both physically and mentally. The initial diagnosis of a pediatric neurologist was post-pertussis encephalitis. In other words, it seemed that the infant plaintiff had suffered severe brain damage as a result of the pertussis component of the vaccine he had received.

The plaintiffs' action against both defendants depended upon a finding that there was a causal relationship between the administration of the vaccine and the severe brain damage suffered by the infant plaintiff. If, on a balance of probabilities, it was found that the vaccine could cause encephalopathy, or permanent serious brain damage, the action would succeed.

Unfortunately, the scientific evidence was not clear as to the effects of the vaccine. As the Court stated:

> It is not too much to state that medical opinion about the effect of the pertussis component of DPTP vaccine has been in a state of ferment for at least the past decade.

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34 *Rothwell*, supra. note 33 at 457.
While there was no reference to evidence of in vitro studies or animal bioassay studies, the Court reviewed extensive epidemiological evidence in determining the issue of causation. The Court provided background information on epidemiological evidence as follows:35

Epidemiology may be described as the study, control and prevention of disease with respect to the population as a whole, or to defined groups thereof, as distinguished from disease in individuals. Clinical epidemiological studies can be carried out for the purpose of investigating the relationship between a particular condition existing in the environment, or population, and a particular disease or condition of health. A clinical epidemiological study cannot in itself prove causation but it may justify an inference that a statistical association reflects a causal link. ...[There are] nine guide-lines for drawing an inference about causality. These guide-lines are said to be widely respected and adopted, and are briefly listed here as strength of the association, consistency of the association, temporality of the association, biological gradients, plausibility, coherence, experiment, and analogy.

The Court provided a ranking of the evidentiary value of the various types of epidemiological study designs. From the least evidentiary value to the greatest evidentiary value are: anecdotal case reports, case control studies, cohort studies and prospective experimental studies.

In this case, five epidemiological studies were adduced as evidence of causation. Three of these studies were essentially collections of anecdotal case reports which demonstrated a temporal association between the vaccine and severe brain damage. The Court did not consider these studies to be sufficient evidence of causation. Rather, the anecdotal case reports merely raised a hypothesis of a causal relationship which required further research.

35 Rothwell, supra. note 33 at 446.
In addition to the case report studies, there were two case control epidemiological studies. One study, the Northwest Thames Study, did not establish an association between the vaccine and severe brain damage. This study was criticized by both the plaintiffs’ and the defendants’ experts.

Another case control study, the National Child Encephalopathy Study, was accepted by all experts and the Court as the most comprehensive study. The results of this study indicated a relative risk ranging from 2.4 to 4.7.\textsuperscript{36} In other words, there was evidence of an association between the vaccine and severe brain damage. The plaintiffs’ expert accepted this study as establishing a relative risk of 2.4. However, the defendant’s epidemiological experts, who had participated in the study or who had been concerned with an analysis of the results, were of the opinion that the published results must be treated with great reserve and did not establish a causal relationship. One of the defendants’ experts calculated that, accounting for study bias and control groups, the relative risk was 0.67.

Ultimately, the Court accepted the opinions of the defendants’ experts, and concluded that the epidemiological evidence did not provide convincing evidence of a causal relationship. Further, the Court’s view was that the risk of death or brain damage attributable to the vaccine is a rare event. Thus, the plaintiffs were unsuccessful in their action on the basis that they did not

\textsuperscript{36}Relative risk is calculated using the following formula:

\[
\frac{\text{exposed persons with disease}}{\text{exposed persons without disease}} + \frac{\text{unexposed persons with disease}}{\text{unexposed persons without disease}}
\]

Exposure is not associated with a disease when relative risk is 1.0 or less. At least some association between exposure and the disease is demonstrated by a relative risk greater than 1.0. Generally, any ratio less than 3.0 is considered a weak association. See L.N. Ellis and C.D. Case, \textit{supra}, note 23 at 113.
establish a causal relationship between the vaccine and the infant plaintiff's injuries on a balance of probabilities.

The Rothwell decision provides useful guidance on the use of epidemiological studies. While the courts are willing to accept such studies into evidence, it seems that only studies which involve control groups - that is, cohort studies or randomized prospective studies - will be afforded much weight. Further, the weight of such studies can easily be diminished by establishing the existence of scientific bias. It should be noted that scientific bias can often be easily established in epidemiological studies, especially in case control and cohort studies. On the basis of this decision, it seems that courts will accept epidemiological evidence but it must be very persuasive to establish causation.

As mentioned, the Court in Rothwell was reluctant to rely on anecdotal case reports as evidence of a causal relationship. This reluctance was also expressed in Trueman v. Ripley. In this case, the plaintiff claimed that the drug, Halcion, caused personality changes, caused episodes of memory loss, caused him to exhibit extreme and violent behavior leading to criminal convictions, and caused him to attempt suicide. The Court allowed the defendants' application for summary dismissal of the claims of the plaintiff. The Court concluded that the plaintiff had failed to prove that the drug caused the alleged behavior in general, or that the drug specifically caused the plaintiff's behavior.

The Court commented on the use of anecdotal case reports as evidence of causation as follows:  

[the defendants' expert] said that anecdotal reports show only a temporal relationship of the drug with a particular event, not a causal relationship, and can only form the hypothesis for clinical or epidemiological testing, which is then required to form a causal link. He said that it is generally accepted by the medical and scientific communities that anecdotal reports cannot be used to draw inferences about a causal link between an adverse medical event and a drug and that the Food and Drug Administration and the World Health Organization specifically caution against such conclusions.

Such reports, he said, are not considered by the medical and scientific communities to be reliable because of the uncontrolled nature of such reports and the possibility that an adverse medical event may be related to the patient’s underlying disease, another medication, significant events occurring in the patient’s life, or may be the result of chance.

The defendants’ experts were critical of the use of anecdotal case reports to establish a causal relationship between the use of Halcion and the type of behavior exhibited by the plaintiff. Further, the defendants’ experts stated that clinical studies of the generic compound triazolam, sold under the trade name Halcion, have produced little scientific evidence that it causes episodes of disinhibition as claimed by the plaintiff. Ultimately, the Court required evidence beyond anecdotal case reports to establish causation.

There is some authority for the proposition that specific evidence of causation is not necessary in light of strong epidemiological evidence. In Buchan v. Ortho Pharmaceutical (Canada) Ltd., the epidemiological evidence adduced to establish causation was very persuasive. In Buchan v. Ortho Pharmaceutical (Canada) Ltd. (1984), 46 O.R. (2d) 113 (H.C.), aff’d 54 O.R. (2d) 92 (C.A.), (hereafter, “Buchan”). On appeal, the appellant argued that the trial judge erred in finding a causal link between the defendant’s failure to warn and the plaintiff’s use of the oral contraceptive. The Court of Appeal dismissed the
this case, the plaintiff, a young women, suffered a stroke shortly after she started taking oral contraceptives manufactured and distributed by the defendant. The Ontario High Court found that the defendant had acted negligently by failing to warn of the risks of oral contraceptive use. The risks of oral contraceptive use, and particularly the association between oral contraceptive use and stroke, were known to the defendant at the time of the plaintiff’s stroke. The Court further held that the failure to warn caused or materially contributed to the plaintiff’s injuries.

In determining the issue of causation, the Court considered the Royal College of General Practitioners’ Oral Contraception Study which was generally acknowledged as the most reliable study conducted to date. The results of this study demonstrated a relative risk of stroke in users of oral contraceptives to be 19:1. That is, 95% of the strokes occurring among oral contraceptive users could be attributed to the oral contraceptive pill and would not have occurred had they not been taking the oral contraceptive pill. The Court commented that it is important to bear the absolute risk of stroke in mind, not just the relative risk of stroke. Specifically, the Court stated:

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[i]f there are one million women in Canada using oral contraception, this means that 180 women in Canada will suffer stroke as a result of using the pill each year, or 1,800 in 10 years. To bring it closer to home, if the greater Toronto area contains about 10% of Canada’s population this means that 18 women will suffer stroke each year in the Toronto area, and 180 in 10 years.

appeal on the basis there was no reversible error by the trial judge. The Court of Appeal made no comment on the trial judge’s use of the scientific evidence.

40 Buchan, supra. note 39 at 122.
In considering the epidemiological evidence, the Court highlighted the warning expressed in the 1974 Interim Report from the Oral Contraception Study of the Royal College:\textsuperscript{41}

PROOF OF CAUSATION

The results of this Study show that in a sample of the population of the United Kingdom there is an association between the frequency with which certain diseases are reported and the use of some oral contraceptives.

It must be clearly understood, however, that these results do not necessarily prove in the legal sense either that such an association exists between any of these diseases and a particular individual who has taken an oral contraceptive, or that a particular contraceptive has caused any of these diseases in any of the aforementioned sample of the population.

Four factors must always be borne in mind. First, all these diseases also occur in women who have never used an oral contraceptive. Secondly, in most instances the degree of risk can only be determined approximately, thus reducing the evidential value of the results. Thirdly, the risks described in the results vary considerably in degree from one disease to another, and fourthly the standard of proof required in litigation varies not only from one jurisdiction to another, but also within each jurisdiction depending on whether the litigation be civil or criminal.

In addition to the epidemiological studies, all the medical experts admitted that the risk of stroke, especially in young women, was increased by use of oral contraceptives. Ultimately, the Court concluded on the basis of the evidence of the haematologists, epidemiologists and neurologists, that the plaintiff's use of oral contraceptives probably caused or materially contributed to her stroke. The Court noted that although the exact mechanism by which the chemicals in oral contraceptives increase the tendency of blood to clot remains unknown, the fact of the matter is that there does appear to be this tendency, and a clear association between

\textsuperscript{41} Buchan, supra. note 39 at 120.
stroke and oral contraceptive use has been demonstrated. Thus, the Court found the defendant liable for the plaintiff’s injuries.

The Court in Buchan seemed impressed by the strong epidemiological evidence and did not require particularistic evidence of causation. The epidemiological evidence which demonstrated a high relative risk, and other supporting medical evidence, was accepted as sufficient evidence of a causal relationship between the plaintiff’s use of oral contraceptives and her stroke.

The Ontario High Court decision in Mozersky v. Cushman\(^\text{42}\) is an interesting contrast to Buchan. In this case, it was held that a causal relationship between the use of oral contraceptives and the plaintiff’s stroke was not established. The plaintiff commenced an action against her doctor for negligently prescribing oral contraceptives. While the plaintiff had suffered migraines for several years, the frequency but not the intensity of her migraines increased upon commencing oral contraceptives. Planned Parenthood, who had initially prescribed the oral contraceptives, recommended discontinuance of the use of oral contraceptives. The plaintiff continued the use, and obtained a prescription from the defendant for a lower dose oral contraceptive. Eighteen days later, the plaintiff suffered a stroke resulting in complete loss of mobility.

The Court concluded that the plaintiff failed to discharge her onus to show that migraines or the failure of the defendant to discontinue her use of oral contraceptives caused the stroke. There was no proof on a balance of probabilities that low dose oral contraceptives, increased migraines or the use of contraceptives by migraine sufferers could cause or materially contribute to the type of stroke suffered by the plaintiff.

With regard to the use of epidemiological evidence, the Court stated:

Our courts have for some time recognized the usefulness of epidemiological evidence: (Rothwell v. Raes (1988), 66 O.R. (2d) 449, aff'd (1990), 2 O.R. (3d) 332 (C.A.)) and indeed the Supreme Court of Canada in Laferriere v. Lawson (1991), 78 D.L.R. (4th) 609, explained the manner in which statistical evidence could be applied to questions of causation, namely, that causation in law must be established on a balance of probabilities, taking into account all of the evidence - factual, statistical and what the judge is entitled to presume. Although statistical evidence may be helpful, it is not determinative. In particular, where statistical evidence does not indicate causation on a balance of probabilities, causation in law may nonetheless exist where evidence in the case supports such a finding.

Both case control studies and cohort studies were adduced as epidemiological evidence of causation. The Court paid particular attention to the cohort studies because, with the exception of randomized clinical studies, it considered that such studies present the strongest evidence. The case control studies were considered less persuasive because they are retrospective and subject to considerable bias. On the basis of this evidence, the Court concluded that the oral contraceptives taken by the plaintiff created a very small increase in relative risk of stroke in young, healthy females.

43 Mozersky, supra. note 42 at 17.
On the issue of causation, the Court stated:\textsuperscript{44}

It is the plaintiff's onus to prove causation. It is not sufficient to show that a cause and effect is theoretically possible. For the plaintiffs to discharge this onus they must prove on a balance of probabilities that a cause and effect relationship does exist. Both the epidemiological and haematological evidence in this case, in my view, fails to demonstrate that the low dose oral contraceptive Judy was taking caused or materially contributed to this either by causing an arterial clot, by causing the dissection, or by causing increased clot in association with the dissection.

The result in this case is an interesting contrast to that in \textit{Buchan}. Both cases considered the existence of a causal relationship between the use of oral contraceptives and stroke, and reached opposite decisions. Unlike the Court in \textit{Buchan}, the Court in \textit{Mozersky} seemed very concerned about the biological mechanism by which oral contraceptives could cause the particular type of stroke suffered by the plaintiff. In other words, the \textit{Mozersky} Court sought clear evidence of the biological mechanism by which the specific injury was caused. In contrast, the \textit{Buchan} Court seemed unconcerned with this aspect of the causal relationship, and was sufficiently impressed by a strong association demonstrated by epidemiological evidence.

Since epidemiological evidence is statistical in nature, the comments of the Supreme Court of Canada in \textit{Laferriere v. Lawson}\textsuperscript{45} are helpful. In this case, the Court acknowledged that cases in which the evidence is scarce or seemingly inconclusive present the greatest difficulty in establishing causation. While a judge may be influenced by expert scientific opinions which

\textsuperscript{44} \textit{Mozersky, supra. note 42 at 66.}
\textsuperscript{45} \textit{Laferriere v. Lawson}, [1991] 1 S.C.R. 541 (hereafter, "\textit{Laferriere}").
are expressed in terms of statistical probabilities or test samplings, he is not bound by such evidence.

The use of statistical evidence is subject to several guidelines. Firstly, it is to be noted that causation in law is not identical to scientific causation. Secondly, legal causation must be established on the balance of probabilities, and take into account all the evidence - factual, statistical and that which the judge is entitled to presume. Thirdly, statistical evidence may be helpful to indicate cause but is not determinative of the causation issue. In particular, where statistical evidence does not indicate causation on the balance of probabilities, causation in law may nonetheless exist where evidence in the case supports such a finding. Fourthly, even when statistical evidence and factual evidence do not support a finding of causation on the balance of probabilities with respect to particular damage, such evidence may still justify a finding of causation with respect to lesser damage. Fifthly, the evidence must be carefully analyzed to determine the exact nature of the fault or breach of duty, its consequences and the particular character of the damages which have been suffered by the victim. Finally, if, after consideration of the foregoing factors, a judge is not satisfied that the fault has caused any real damages, then recovery should be denied.

These guidelines stress the distinction between scientific causation and legal causation. In particular, even though statistical evidence may not establish a strong association between the impugned substance and the harm suffered, legal causation may be found to exist. In other words, the goal of the courts is determine whether or not legal causation exists; the goal is not
to determine scientific truth. In any case involving toxicological evidence, these guidelines should be considered by the courts.

The British Columbia Supreme Court considered extensive toxicological evidence in Privest Properties Ltd. v. Foundation Co. of Canada. In this case, the plaintiffs owned a building in which an asbestos-containing spray fireproofing material was installed, allegedly without the knowledge or consent of the plaintiffs. The plaintiffs sought compensation for the costs incurred and revenue lost while having the asbestos-containing material removed from the building and replaced with another asbestos-free fireproofing material.

The Court considered expert evidence regarding epidemiological, animal bioassay and in vitro studies relating to the three principal diseases associated with exposure to asbestos fibres. With respect to asbestosis, the Court concluded that at all material times there was no risk of contracting asbestosis given the low levels of exposure to asbestos in the plaintiffs' building. The Court reached similar conclusions with respect to lung cancer and mesothelioma. That is, the levels of exposure to asbestos in the plaintiffs' building were too low to cause harm. As

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46Privest Properties Ltd. v. Foundation Co. of Canada (1995), 11 B.C.L.R. (3d) 1 (S.C.), aff'd (1997), 31 B.C.L.R. (3d) 114 (C.A.), leave ref'd [1997] 3 S.C.R. xiii, (hereafter, “Privest Properties”). On appeal, the plaintiffs submitted that the evidence at trial established a serious hazard to worker health and safety. The Court of Appeal held that the plaintiffs could not succeed on this contention. The plaintiffs chose to advance their case by an indirect approach. The plaintiffs relied on the actions taken by regulators - such as, the Environmental Protection Agency and the Workers' Compensation Board - regarding the use of asbestos-containing fireproofing to support the inference that the defendant’s product is dangerous to workers. The Court noted that air sampling during disturbance activities would have shown conclusively whether the exposure levels experienced by the workers was dangerous. The trial judge preferred the evidence provided by the defendant’s experts, and was not prepared to infer dangerousness from the indirect evidence offered by the plaintiffs. Ultimately, the Court of Appeal concluded that there was evidence on both sides of the issue, and the trial judge found that the plaintiffs did not prove their case. There was no palpable or overriding error in the trial judge's conclusion on the non-dangerous nature of the asbestos-containing product. As such, the Court of Appeal could not reverse his finding of fact.
such, no negligence, no breach of duty of care or duty to warn, and no misrepresentation on behalf of the defendants was found.

Rather than considering the question of whether asbestos has the general capacity to cause harm, the Court concentrated on the specific asbestos-containing material at issue. The Court stated:  

47 the fact that the Grace defendants were fully aware of the dangers associated with the use of asbestos has little legal significance in this case. They do not say that asbestos itself is never a health hazard, or that they did not know that it was a hazard in certain circumstances. Rather, they maintain that the asbestos fibres in Monokote MK-3 did not contaminate the Building and do not constitute a health hazard. {emphasis in original}

Ultimately, the Court found that given the low levels of possible exposure to asbestos, the product produced and applied by the defendant was safe. Interestingly, the Court commented that “after consideration of the testimonial and documentary evidence presented in this case, I do not agree with those American courts that have found Monokote MK-3 to be a dangerous product and thus awarded judgment against Grace-Conn.”  

48 The decision in Privest Properties is an illustration of the courts’ reluctance to accept toxicological evidence except in the most persuasive of cases. The Court found no causal relationship between the asbestos-containing product and the possibility of disease on the grounds that low levels of exposure would be experienced in the plaintiffs’ building. As

47 Privest Properties, supra. note 46 at 112.
48 Privest Properties, supra. note 46 at 174
previously noted, most epidemiological studies have significant problems with establishing the levels of exposure experienced by individuals in the studies. In other words, there is limited scientific knowledge regarding the levels of asbestos required to cause harm. In the face of such uncertainty, the Court refused to find a causal relationship despite an established increased risk of harm due to asbestos exposure.

In the case *Palmer et al. v. Stora Kopparbergs*, the Nova Scotia Trial Division considered extensive toxicological evidence. The plaintiffs in this matter sought an injunction to restrain the spraying of phenoxy herbicides by the defendant over lands adjacent to lands occupied by the plaintiffs. The action was framed in nuisance, trespass and strict liability. The matter was reduced to one question: whether the plaintiffs had adduced sufficient evidence that there was a serious health risk, and that such risk would occur if the spraying of the substance was permitted to take place.

The plaintiffs were concerned about the health effects associated with a constituent element of the phenoxy herbicide, known as T.C.D.D. Animal bioassay studies had demonstrated that the effects of T.C.D.D. included:

1. fetotoxic, teratogenic and carcinogenic effects;
2. the creation of immunological deficiencies;
3. enzymatic changes; and
4. liver disfunction.

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While the Court acknowledged that T.C.D.D. is one of the most toxic chemicals known to humankind, it was unable to conclude that the plaintiffs had proved a sufficient degree of probability of risk to health. The Court discounted the animal bioassay studies on the basis that the doses in such studies are several orders greater than those which could be received in Nova Scotia by spraying. Even so, the Court accepted, as a general proposition, that extrapolation from animal studies is a well-known and widely-accepted scientific approach. With regard to the epidemiological studies adduced by the plaintiffs, the Court concluded these were not probative. Any health risks found in epidemiological studies involved circumstances of massive exposure. The Court concluded that these studies lacked significant probative value in light of the low levels of possible exposure in the case at bar.

Like the decision in *Privest Properties*, this case demonstrates the courts' reluctance to accept toxicological evidence except in the most persuasive of cases. The plaintiffs' evidence was discounted on the basis that studies tended to involve high levels of exposure whereas the case at bar would potentially involve low levels of exposure. Essentially, in the face of limited scientific knowledge regarding the levels of T.C.D.D. required to cause harm, the Court refused to find a causal relationship. This is in spite of the Court's recognition that T.C.D.D. is one of the most toxic substances known to humankind.

Another interesting aspect of the *Palmer* decision is the Court's treatment of the scientific evidence. In considering the quality of the scientific evidence, the Court looked to the mannerisms of the experts rather than the scientific validity of the studies. In particular, the
Court commented on the plaintiffs' experts tendency to defend their opinions. In addition, the Court felt that the plaintiff's experts noticeably selected studies which supported their view. Finally, the plaintiffs' experts were criticized by the Court for asserting that studies done by scientists in industry can be subject to bias. These aspects of the plaintiffs' experts' testimony struck the Court as being unscientific, and in its view a "true scientific approach does not permit such self-serving selectivity, nor does it so readily decry a study on the basis of bias." In contrast, the mannerisms of the defendants' experts impressed the Court. The Court made no comment on the possibility of bias arising from these experts' association with the herbicide industry.

The Court's treatment of the scientific evidence raises a concern as to the level and evenhandedness of the scrutiny. The Court seemed to be primarily concerned with the manner in which the evidence was presented rather than with factors that may affect scientific validity. The plaintiffs' experts' concerns with bias due to funding from industrial sources is valid. It is not unusual for publications in scientific journals to indicate sources of funding to alert readers to possible external biases. In addition, the Court allowed its interpretation of the evidence to be coloured by its image of the ideal, objective scientist rather than addressing concerns of scientific validity. The Court should be aware that all science is subject to uncertainty and that, despite the uncertainties, scientists will defend the truth of proven facts and hypothesis. In

50 Palmer, supra. note 49 at 138.
51 A. A. Marino & L. E. Marino, supra. note 25 at 15.
addition, there may be conflicting explanations for such truths. Thus, a scientist is not being unscientific when he defends his opinion and points out possible bias in other studies.

It is interesting to note the following comment made by the Court in *Palmer et al. v. Stora Kopparebergs*:

As to the wider issues relating to the dioxin issue, it hardly seems necessary to state that a Court of law is no forum for the determination of matters of science. Those are for science to determine, as facts, following the traditionally accepted methods of scientific inquiry. A substance neither does nor does not create a risk to health by Court decree and it would be foolhardy for a Court to enter such an inquiry. If science itself is not certain, a Court cannot resolve the conflict and make the thing certain.

With respect, the Court seems to be confused about the purpose of determining causation in the context of a toxic tort case. It is true that a substance neither does nor does not create a risk to health by court decree. It is also true that a determination made by a court regarding scientific evidence will not add to the body of scientific knowledge. However, in the context of toxic tort litigation, as in other litigation, this is not the purpose of the courts. The purpose of the courts is to resolve the issues between the parties on the basis of the evidence before it. In particular, the courts must determine whether the evidence justifies one party being held liable for the harm suffered by another. It is not the role of the courts to determine scientific truth. However, it is not “foolhardy” for a court to enter into an inquiry regarding scientific evidence. Further, since science is inherently uncertain, the courts cannot refuse to act in the absence of scientific certainty. By refusing to act in the face of scientific uncertainty, courts would never be able to

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53 *Palmer, supra.* note 49 at 130.
resolve issues involving questions of science. The courts should explicitly acknowledge the
scientific uncertainty surrounding the risk associated with technological and scientific
processes, and adopt a policy approach to deal with this uncertainty. In other words, the courts
should not become preoccupied with obtaining the scientific truth in a particular case but rather
adopt the most appropriate policy approach in the light of scientific uncertainty.

The aftermath of the *Palmer* decision is very interesting. Despite the favourable decision in
*Palmer*, political and regulatory decision-makers, forestry companies and other users of the
herbicide containing T.C.D.D. decided against its use in Nova Scotia.\(^5^4\) In addition, the major
supplier of T.C.D.D. products, Dow Chemical, announced that it would no longer market
products containing T.C.D.D. Further, shortly after the *Palmer* decision, the American
Environmental Protection Agency banned the use of T.C.D.D. for any purpose in the United
States.

Although there has been little judicial consideration of toxicological evidence in Canada, some
general conclusions may be drawn. In general, the courts appear reluctant to accept all but the
most persuasive of toxicological evidence as proof of causation.

There has been little consideration of *in vitro* studies and animal bioassay studies by the
Canadian courts. Based upon the limited consideration, it seems that the courts are reluctant to
accept such evidence as establishing causation. This evidence is often discounted as being

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unreliable due to differences in experimental doses as compared to environmental exposures experienced by humans. Similarly, anecdotal case reports have been uniformly rejected by the courts as not being evidence that establishes causation. Rather, such evidence creates a hypothesis of causation which requires further investigation.

The judicial consideration of epidemiological evidence by the Canadian courts is also rather limited. The courts have demonstrated a clear willingness to consider such evidence. However, it is not clear that evidence of an association will be sufficient to establish causation. It may be that particularistic evidence will also be required. In either event, it seems that epidemiological evidence must demonstrate a very strong association in order to be accepted even as proof of general causation.

Science and Law in Conflict

As can be seen from the foregoing caselaw, causation often presents a great barrier to toxic tort litigants. Given the primacy of scientific evidence in toxic tort litigation, the participants in the legal decision-making process must be familiar with fundamental scientific principles. In addition, the participants should be alert to the fundamental conflicts between scientific and legal methodologies.

The issue of causation highlights the conflicts between scientific and legal methodologies. Contrary to common misconceptions, science does not generate exact knowledge with logical
certainty. Science depends upon criticism, testing, experimentation, and review to determine the validity of hypotheses. Consensus within the scientific community is the greatest degree of certainty regarding the validity of theories and reasoning in any given context. The scientific community is quick to abandon consensus in the light of new evidence. Uncertainty is considered an important aspect of the scientific investigative process. This contrasts strongly with the legal community’s quest for certainty.

Another fundamental conflict arises from the scientific concern with the search for truth. In its search for truth, the scientific community is continually prepared to discard old views in the light of new evidence. In contrast, the legal system’s main focus is the conclusive and final resolution of the particular issue before it. The legal system avoids revisiting the same issues whereas the scientific community is continually questioning issues.

Finally, scientific endeavors are concerned with describing physical phenomena, and deriving inferences about unobserved events from observed events. Scientists must always be concerned with the limitations in predicting future events from present observations. In contrast, the legal system is generally not concerned with what actually did happen or might occur but rather is interested in the circumstances in which it is legitimate to treat an event as

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56 L.A. Reynolds, supra, note 8 at 85 to 93.
57 L.A. Reynolds, supra. note 8 at 85 to 93
having happened or likely to occur.\textsuperscript{59} The scientific community has an extremely strong aversion to adding false knowledge to the existing body of scientific information. In contrast, the legal system is primarily concerned with determining which particular legal result is desirable.

The scientific meaning of causation as compared to the legal meaning of causation illustrates the contrast between the scientific and legal methodologies. As expressed by one commentator, Callahan:\textsuperscript{60}

The fundamental difficulty encountered by the plaintiff in establishing causation, however, arises from the difference between scientific and legal methodologies. As previously discussed, in the scientific community, the concept of causation implies nothing more than the fact that exposure to a given substance increases the overall risk of disease or injury among persons exposed to that substance. The scientific inquiry is not concerned with the existence of causation in an individual case. The legal inquiry, in contrast, involves precisely such an individualistic determination. The coalescence of scientific and legal methodologies is the key to resolving the causation problems in toxic tort litigation. In order to assess the prospects from such a coalescence, it is essential to understand the various types of proof available to show causation in the typical toxic tort case.

In other words:\textsuperscript{61}

The legalistic belief in determinate causes stands in stark contrast to the nature of scientific inquiry. While the legal analysis of causation assumes that a harm has, in fact, occurred and seeks to ascertain what has prompted the harm, scientific cause refers to the general propensity of a given substance to cause harm. This divergence between legal and scientific methodologies has been emphasized by the recent spate of litigation involving toxic torts.

\textsuperscript{59} M.R. Gelpe and A.D. Tarlock, \textit{supra} note 58.
\textsuperscript{60} C.L. Callahan, \textit{"Establishment of Causation in Toxic Tort Litigation"} (1991) 23 Arizona St. L. J. 605 at 618.
\textsuperscript{61} C.L. Callahan, \textit{supra} note 60 at 605.
These distinctions between scientific and legal methodologies must be addressed when using scientific evidence in the legal decision-making process. In the context of toxic tort litigation, the differences in the concept of causation must be recognized. Science is not concerned with an individualistic determination of causation but rather speaks in terms of probabilities. This contrasts with the legal system's necessary concern with individualistic causation.

In addition, given the reluctance to add false knowledge to the body of scientific information, scientific standards for establishing a causal relationship are extremely high. Participants in the toxic tort litigation process must be acutely aware of this aspect of scientific evidence. To require a high degree of scientific certainty would, effectively, hold a toxic tort plaintiff to a higher standard of proof than other tort plaintiffs. Participants in toxic tort litigation must focus on the goal of reaching a legal decision, and not become preoccupied with achieving scientific truth.

Conclusion

The traditional requirements for proving causation are generally regarded as the primary barrier to success in toxic tort litigation. In large part, this barrier has arisen as a result of the necessary reliance on scientific evidence to establish toxic causation. Unfortunately, current scientific knowledge regarding the effects of many substances is limited. In addition, the etiology of many diseases is unknown. The problem created by limited scientific knowledge is compounded by the courts' discomfort with the inherently uncertain and probabilistic nature of scientific evidence.
Aside from the problems associated with limited scientific knowledge, fundamental conflicts between scientific and legal methodologies contribute to the causation problem. Rather than attempting to achieve the scientific truth regarding causation, the courts should focus on achieving the most desirable policy outcome. In the context of toxic tort litigation, the courts should consider scientific evidence but not expect a definitive answer regarding the causal relationship between the defendant's act and the plaintiff's injury.

Ultimately, the courts should explicitly acknowledge the scientific uncertainty surrounding the risks associated with technological and scientific processes and adopt a policy approach to deal with this uncertainty. The courts' selection of an approach to dealing with this uncertainty is a matter of policy which should be resolved by consideration of the values in conflict in toxic tort litigation. That is, the courts should explicitly balance the social value of scientific and technological development with the individual rights to personal integrity and property. The courts must make decisions that promote technological and scientific development without exposing the general public to excessive risk from toxic substances.
Chapter Three: Causation as a Concept and as a Creature of Policy

Introduction

The general principles of tort law require that a plaintiff prove that the defendant has caused the injury of which the plaintiff complains. In the context of a toxic tort claim, this means that a plaintiff must demonstrate that the plaintiff has suffered an injury, that the defendant has caused the plaintiff’s exposure to a toxic substance and that this exposure has caused the plaintiff’s injury. The burden lies with the plaintiff to establish each element on a balance of probabilities.

The requirement for a causal relationship between the injury of the plaintiff and the act of the defendant stems from the corrective justice underpinnings of tort law. Corrective justice requires that a defendant be liable to compensate a plaintiff only for those injuries which he caused. The traditional causation requirements also reflect the emphasis on individualism and freedom of action. Without a requirement to demonstrate a causal relationship, the rights and liberties of the individual would arguably be violated.

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Causation as a Concept

Conventionally, the notion of causation is divided into two elements, cause-in-fact and legal or proximate cause. Cause-in-fact refers primarily to scientific or objective cause. In other words, cause-in-fact is an attempt to determine whether the actions of the defendant in fact caused the injuries of the plaintiff. Legal causation involves consideration of the issues of foreseeability, duty and policy. This element of the notion of causation is explicitly a creature of policy. Despite the existence of cause-in-fact, legal causation may not exist due to overriding considerations of policy.

Although often treated as such, the determination of cause-in-fact is not a completely scientific or objective process but rather has probabilistic elements. Even if all events culminating in an injury are known, conclusions as to the primary cause of injury are inferential. As such, there is a probabilistic element in the notion of cause-in-fact. More likely than not, all events leading to injury will not be known and the story must be pieced together. Proof of causation will require evidence that the facts alleged and the conclusions as to causation are true on a balance of probabilities. This is another probabilistic element in the notion of cause-in-fact. As such, purely scientific and objective proof as to cause-in-fact is not possible.

63 M. Boodman, supra, note 4 at 245.
There has been extensive consideration of the precise nature of the causal inquiry. The validity of the distinction between cause-in-fact and legal cause has been examined. In particular, the extent to which the determination of cause-in-fact is influenced by policy concerns has been considered. Conceptualizations of the nature of the causal inquiry fall along a spectrum ranging from the idea that causation is a purely factual notion to the idea that causation is solely a matter of policy.

The causal maximalists, conceptualize the notion of causation as a primarily factual inquiry. Accordingly, there is a sharp distinction between cause-in-fact and legal causation. Cause-in-fact is an attempt to determine whether the defendant's act in fact caused the plaintiff's inquiry. In contrast, legal causation involves consideration of policy concerns. As stated by Rizzo:

\[ \text{[M]uch of what is discussed under the notion of legal cause is really a debate over policy goals and the best way to implement them. Cause-in-fact (descriptive cause) is independent of policy goals.} \]

This means that all policy concerns should be considered under the rubric of legal causation and not be mingled with the factual inquiry. The factual inquiry should be designed to determine cause-in-fact without reference to policy concerns. The necessary element of a sufficient set test has been designed to achieve this goal.

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A particular condition was a cause of a specific consequence if, and only if, it was a necessary element of a set of antecedent actual conditions that was sufficient for the occurrence of the consequence.

Arguably, the necessary element of a sufficient set test allows a purely factual inquiry to determine cause-in-fact. This test is designed to avoid any consideration of policy concerns in the determination of cause-in-fact. Policy concerns are addressed under the separate rubric of legal causation.

In contrast, causal minimalists conceptualize the causal inquiry as being heavily influenced by policy concerns. Causation is not purely a matter of fact in the sense that it can be established by testimony. While testimonial evidence does provide a basis for the ultimate causal determination, the trier of fact must arrange the evidence into a satisfactory pattern of cause and effect. As such, policy concerns sneak into both the factual causation and legal causation considerations. Since there is not a clear distinction between factual causation and legal causation, policy concerns cannot be entirely eliminated from the factual causation inquiry.

At the extreme, causal minimalists assert that the causal inquiry can be described solely in terms of policy concerns. For instance, Landes and Posner describe the causal inquiry in terms of economic goals:

[T]he causation cases in tort law, whether classified under the cause-in-fact rubric or the proximate-cause rubric, can be explained in unified economic terms without our having to worry about causal concepts, because the only causal

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concepts necessary to the economic analysis are completely obvious. The key factors in the economic analysis are not cause but the probability of accident and the costs of legal administration. In so analyzing the causation cases we are admittedly far from the language and concepts in which the courts analyze these cases. The concept of "foreseeability", so salient in the courts' discussion of proximate cause cases, plays only a small role in our analysis; nor does the fundamental distinction between cause in fact and proximate or legal cause play any role. The language of foresight and causation has not proved illuminating in the legal analysis, yet on the evidence presented in this paper the courts have groped their way to (or at least toward) rules and results that capture the essential economic elements of the causation question.

In their analysis, Landes and Posner avoid the traditional conceptions of the causal inquiry. Rather than basing liability on the notion of causation, a consideration of economic goals determine whether there is a sufficient connection between the defendant's act and the plaintiff's harm to establish liability. Essentially, the issue of factual causation is avoided and the determination of liability is solely a matter of policy.

Other commentators describe the nature of the causal inquiry in law as a middle ground between the extremes of causal maximalism and causal minimalism. In their seminal work, *Causation in the Law*, Hart and Honore assert that there is a distinction between factual causation and legal causation. The factual causation inquiry is a matter of common sense:

But causal judgments, though the law may have to systematize them, are not superficially legal. They appeal to a notion which is part of everyday life and which ordinary people, including jurymen, can handle with a minimum of guidance. There is no gain, and much danger, in seeking to assimilate them to policy judgments which are specifically legal, whether they concern particular rules of law or branches of the law or represent aims of the legal system as a whole.

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According to Hart and Honore, the courts are not merely giving effect to their conceptions of justice, expediency or chosen policy in using the language of causation. Rather, causal language is used to apply a group of notions embedded in common sense and the ordinary person's ordinary use of language.

In an attempt to refine the conventional view, Calabresi divided the notion of causation into causal link, but-for cause, and proximate cause.\textsuperscript{72} When available evidence leads to the conclusion that recurrence of a particular activity will increase the chance that a particular injury will occur, a causal link exists between that act and that injury. The causal link element of causation serves an entirely predictive and empirical function. For every particular injury, an infinite number of acts will be causally linked. Some of these acts will be considered desirable, some neutral and some undesirable. But-for cause refers to any one of many acts without which a particular injury would not have occurred. Although there is frequently overlap between causal link and but-for cause, these two concepts often diverge. Finally, proximate cause embraces those causally linked acts, and often but-for causes, to which the legal system assigns responsibility for an accident.

Calabresi's division of the causation notion into causal link, but-for cause, and proximate cause is a refinement of the conventional view. Essentially, the element of factual causation is divided into causal linkage and but-for cause. Both elements are treated as purely factual inquiries.

which do not involve consideration of policy concerns. Policy concerns are addressed under the rubric of proximate cause.

Accompanying the conventional distinction between cause-in-fact and legal causation, is the tendency to view causation as a linear notion. That is, the defendant's act and the plaintiff's injury are connected by a causal chain of events. An act of defendant initiates the chain of events which culminates in the plaintiff's injury. The chain consists of a series of events, each dependent upon the existence of the previous event. Once the causal chain has been initiated, the defendant is liable for the ultimate result unless policy concerns dictate otherwise. The image of a causal chain is overly simplistic because at any point in the chain, several factors and events may be required to create the next link. The causal relationship between a defendant's act and the plaintiff's injury cannot be viewed as a series of discrete, dependent events.

The linear analysis of the causal inquiry has been rejected by Pincus.73 Rather, a linguistic model is proposed as a descriptive account of the manner in which causal decisions are made by triers of fact. Causal reality, discourse about reality, and our perception and understanding of reality are described as a web within which language is used to place particular causal relationships. The causal webs consist of three layers: a perceptual scheme for absorbing data

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73 S.N. Pincus, supra. note 65. Pincus has not been the only commentator to propose the image of interrelated causal webs, rather than simple mutually exclusive causal chains, as a description of the nature of the causal inquiry. See for instance C. Kestor, “The Language of Law, the Sociology of Science and the Troubles of Translation: Defining the Proper Role for Scientific Evidence of Causation” (1995) 74 Nebraska L. Rev. 529. The single effect of the plaintiff's injury may be the result of numerous causes along the various strands of the web. The web generates a large number of possible causes for a particular injury. Thus, policy concerns are used to limit and exclude distant causes.
from physical and intellectual experiences, a linguistic layer which creates a framework for using language, and an ontological layer which provides a view of reality. All layers of the web are embedded with political, social, economic, cultural and philosophical perceptions and prejudices. While the metaphor of the web does not allow for absolute truths, all cases can be determined insofar as every statement has meaning in the context of a particular web. As the centre of the causal web is approached, experience becomes more fundamental.

Although grounded in fact, the determination of cause-in-fact is not a purely factual inquiry. In many cases, if not most, a causal link between the defendant’s act and the plaintiff’s injury can be determined by reference to intuition and to general knowledge and experience. However, as facts become more uncertain and removed from general knowledge and experience, policy concerns become more important. In the light of uncertain facts, the courts should move from the traditional requirements for proof of causation and explicitly consider the policy concerns in issue.

Reliance on scientific evidence is necessary to establish toxic causation. Since such evidence is uncertain, policy concerns are important in toxic tort litigation. In the context of toxic tort litigation, the courts are called upon to achieve a balance between the social benefit of technological and scientific progress, and the individual rights to physical integrity and property. Rather than strictly apply the traditional requirements for proof of causation, the courts should explicitly consider the conflicting values in toxic tort litigation. The ultimate goal is to promote technological and scientific progress without exposing the general public to an unacceptable level of risk from toxic exposure.
Traditional Requirements for Proof of Causation

In many cases, the question of whether a causal relationship exists does not create a contentious issue for the courts. The question of causation, if addressed at all, may be answered simply by reference to intuition based upon general knowledge and experience. Intuition suggests that a causal relationship exists if an act is followed closely temporally and spatially by an injury. The inference of a causal relationship is strengthened if general knowledge and experience tells us that the act committed can result in injury. In these cases, it seems that the question of causation can be decided merely as a matter of observation. In other words, an inference of a causal relationship can be made by reference to intuition and to general knowledge and experience.

There are cases, including toxic tort litigation, in which the question of causation cannot be resolved by an intuitive reference to general knowledge and experience. For instance, there may be a time lag between the act of the defendant and the plaintiff’s injury which lessens the intuitive sense of a causal relationship. In addition, gaps in knowledge and experience make the issue of causation more contentious. In these cases, the courts must undertake to examine the question of a causal relationship more closely.

The traditional test for determining whether there is a causal relationship between a particular act and a particular injury is the but-for test. This test was clearly enunciated by Lord Denning
in the *Cork v. Kirby Maclean, Ltd.* decision. This case involved an action for damages arising from the death of the plaintiff’s spouse. While employed by the defendant, the deceased fell from a platform approximately 20 feet above ground. In violation of statutory requirements, the platform did not have railings and guards. The defendant denied the existence of causation on the basis that the deceased was prone to epileptic fits and had been advised not to work above ground. The deceased had not informed the defendant of his condition. At trial, it was found that the defendant was indeed in breach of statute by failing to provide a working platform with adequate railings and guards. Further, the trial judge held that the defendant was liable for the whole of the damages since he did not establish that the deceased would have fallen even if the statutory precautions had been taken.

The trial decision was amended on appeal to the English Court of Appeal. Ultimately, the Court held that the injury was caused by both the defendant’s breach of statute and the deceased’s tendency to suffer epileptic fits. The damages were apportioned equally between the two causes of injury. The Court applied the but-for test to determine the cause of the injury:

If you can say that the damage would not have happened but for a particular fault, then that fault is in fact a cause of the damage; but if you can say that the damage would have happened just the same, fault or no fault, then the fault is not a cause of the damage.

The Court further stressed that it does not search for the effective or predominant cause of the damage.

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75 *Cork v. Kirby Maclean, Ltd.*, supra. note 74 at 407.
76 *Cork v. Kirby Maclean, Ltd.*, supra. note 74 at 406 to 407.
We recognize that there may be many causes of one damage, and we ask: What were the causes of it? What faults were there which caused the damage?"

That is, a particular injury may result from several causes. A plaintiff need not establish that the defendant’s act was the cause of the injury but rather that it was a cause of the injury. A particular act will be a cause once the but-for test has been satisfied.

The reliability of the but-for test as a mechanism to determine the existence of a causal relationship between an act of the defendant and the injury of the plaintiff has been questioned.

As stated by one commentator:77

Given the logical and legal infirmities in the use of the counterfactual hypotheses and the but-for test to “prove” cause-in-fact, it is surprising that courts have continued to employ the test for as long as they have. It is certainly not because the commentators have failed to call the problems to the courts’ attention.

The but-for test does not examine the events which in fact occurred. Rather, the situation which would exist had the defendant not acted as he did is hypothesized and examined. In other words, the but-for test takes the trier-of-fact’s “eye off the ball”.78

Further, the but-for test cannot establish that a particular action is not a cause. As Weinrib stated:79

The difficult cases arise when the but for test does not establish causation, and here the but for test is a treacherous guide. Its existence as a device to include tempts us into thinking that it can be used to exclude. This danger is aggravated

78 M.D. Green, supra, note 12.
by the tendency to view the but for test as normative and tests such as substantial
collection as exceptional.

The but-for test can establish that a particular act is a cause of a particular result. If a result
would not have occurred but-for the occurrence of a particular act, that act is a cause. However,
the converse is not true. Although an act may fail to meet the but-for test, that act may be a
cause of the result. An act may have contributed to the ultimate result but not be the but-for
cause of the result.

Finally, strict application of the but-for test creates unsatisfactory results in situations involving
an indeterminate plaintiff or an indeterminate defendant. The indeterminate plaintiff situation
arises when the evidence can establish that the defendant’s act has caused harm but cannot
demonstrate which particular person was harmed. In this situation, strict application of the but-
for test exculpates the defendant in all cases. Although the evidence establishes that the
defendant has caused harm, the defendant is not the but-for cause of any particular plaintiff’s
injury. The indeterminate defendant situation arises when the evidence has demonstrated that
one of several defendants caused the plaintiff’s harm but cannot demonstrate which one
defendant is responsible. Strict application of the but-for test in this situation exculpates all
defendants. Despite establishing that at least one defendant caused his injury, the plaintiff is not
compensated for his injury. The but-for test is not suited to the situation where a significantly
increased risk of harm is established but cannot be conclusively linked to a particular plaintiff or
defendant.
The reliability of the but-for test as a mechanism for determining whether a causal relationship exists has been criticized. The but-for test diverts the trier-of-fact's attention from an examination of the events which did occur to an examination of a hypothetical situation. By applying the but-for test, the trier-of-fact must engage in a more difficult and speculative inquiry. Further, the usefulness of the but-for test is limited to ascertaining that an event is a cause but cannot establish that an event is not a cause. Finally, a strict application of the but-for test can lead to unsatisfactory conclusions.

Recognizing the difficulties associated with the but-for test, the courts have also traditionally used the test of material contribution to answer the question of causation. The material contribution test was considered by the English House of Lords in *Bonnington Casting, Ltd. v. Wardlaw*. In this case, the plaintiff sought damages for pneumoconiosis caused by silica dust exposure throughout his eight years of employment with the defendant company. The main source of the dust was pneumatic hammers, one of which was operated by the plaintiff. Since there was no known mechanism to contain the dust created by the pneumatic hammers at the material time, the plaintiff did not base his claim on negligent exposure to silica dust from the pneumatic hammers. Rather, the claim was based on negligent exposure to silica dust from the swing grinders. In breach of statute, the dust extraction plant for the swing grinders was not kept free of obstruction which resulted in release of silica dust. The Court stated:

I cannot agree that the question is which was the more probable source of the respondent's disease, the dust from the pneumatic hammers or the dust from the

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81 *Bonnington Casting, Ltd. v. Wardlaw*, supra. note 80.
swing grinders. It appears to me that the real question is whether the dust from the swing hammers *materially contributed* to the disease. What is a material contribution must be a question of degree. A contribution which comes within the exception of de minimis non curat lex is not material, but I think that any contribution which does not fall within that exception must be material. I do not see how there can be something too large for the de minimis principle, but yet too small to be material. {emphasis added}

Ultimately, the Court held that the silica dust created by the swing grinders was a material contribution to the plaintiff's injury and, as such, the defendant was liable to compensate the plaintiff.

The Canadian courts have applied the material contribution test to answer the question of causation. For example, in *Athey v. Leonati*\(^{82}\) the plaintiff had minor back problems for several years. The plaintiff was involved in two motor vehicle accidents in 1991, each of which caused back injuries requiring physiotherapy and chiropractic treatments. On the advice of his doctor, the plaintiff undertook an exercise program, during the course this program (the first day!) the plaintiff suffered a severe disc herniation. At trial, the only issue was whether the disc herniation was caused by the injuries sustained in the accidents or whether it was attributable to the appellant’s pre-existing back problems. On appeal to the Supreme Court of Canada, the issue was whether the loss should be apportioned between tortious and non-tortious causes where both were necessary to create the injury.

The Court summarized the law of causation as follows:\(^{83}\)


\(^{83}\) *Athey v. Leonati*, supra. note 82 at 466.
Causation is established where the plaintiff proves to the civil standard on a balance of probabilities that the defendant caused or contributed to the injury. ...

The general, but not conclusive, test for causation is the 'but for' test, which requires the plaintiff to show that the injury would not have occurred but for the negligence of the defendant. ...

The 'but for' test is unworkable in some circumstances, so the courts have recognized that causation is established where the defendant's negligence 'materially contributed' to the occurrence of the injury.

The Court affirmed that the traditional test for resolving the issue of causation is the but-for test. Further, the material contribution test was affirmed as the traditional alternative in instances where the but-for test is unworkable.

The material contribution test was also used in Buchan v. Ortho Pharmaceutical (Canada) Ltd. In this case the plaintiff suffered a stroke shortly after she started taking oral contraceptives manufactured and distributed by the defendant. The Court concluded that epidemiological evidence demonstrated a clear association between stroke and oral contraceptive use. Ultimately, the defendant was held liable for the plaintiff's injury since their contraceptives caused, or materially contributed, to the plaintiff's stroke.

Seemingly, the courts are making a neutral and objective determination of causation by applying the material contribution test. It appears that the courts are merely making a mathematical assessment of the defendant's act and its effect on the plaintiff. However, the material contribution test is just a reflection that the defendant's act was of a type that can be associated with the type of injury suffered by the plaintiff. In effect, while not obvious, there is

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84 Buchan, supra. note 39.
some connection between the defendant’s act and the plaintiff’s injury. That is, the defendant’s act is of such a type and of such a connection to the plaintiff’s injury as to require that the defendant be held liable.

The appeal of the but-for and material contribution tests lie in their shroud of objectivity. The but-for test is treated as a scientific and objective tool for determining a matter of pure fact. Similarly, the material contribution test is treated as a mathematical inquiry into the purely factual question of causation. However, the causal inquiry, while grounded in fact, is not purely a matter of fact. Rather than adhering to the traditional but-for and material contribution tests, the courts should address the policy concerns which surround the question of causation in toxic tort litigation.

Causation as a Creature of Policy

Although grounded in fact, the notion of causation is influenced by concerns of policy. In those cases in which the causal inquiry cannot be resolved by an intuitive reference to general knowledge and experience, policy considerations become more important. Since any particular result is caused by a multitude of factors and events, policy concerns focus the causal inquiry made by the courts on a few discrete factors or events. The purpose of the causal inquiry is not to obtain the scientific truth regarding cause and effect but rather to obtain the most desirable policy judgment. As expressed by the Supreme Court of Canada in *Snell v. Farrell*.85

85 *Snell v. Farrell, supra.* note 7 at 326.
Causation is an expression of the relationship that must be found to exist between the tortious act of the wrongdoer and the injury to the victim in order to justify compensation of the latter out of the pocket of the former.

That is, the focus of the courts is not to determine, with scientific precision, the cause of the plaintiff's injury. Rather, the focus of the courts is the determination of whether there is a sufficient connection between the defendant's act and the plaintiff's injury to justify imposing liability on the defendant. In other words, the courts determine whether policy recommends imposing liability for the act of the defendant. In the context of toxic tort litigation, the courts must balance the social value of technological and scientific development with the individual rights to personal integrity and property.

Although the courts traditionally apply seemingly neutral, objective language to resolve the causation issue, there has been some recognition of the importance of explicit consideration of policy concerns. For example, the decision of Lord Wilberforce in McGhee v. National Coal Board\(^6\) was based upon a consideration of policy concerns. In this case, the plaintiff was exposed to abrasive brick dust in the course of his employment. Despite the hot and dirty working conditions, the defendant employer provided no washing facilities. As a consequence, the appellant had to cycle home after work caked with sweat and grime. Eventually, the plaintiff was diagnosed as suffering from dermatitis.

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Since it was found that the defendant breached its duty of care to the plaintiff by failing to provide adequate washing facilities, the issue on appeal to the House of Lords was whether there was a causal relationship between the breach of duty and the plaintiff's injury. The medical evidence could not conclusively link the occurrence of dermatitis with the plaintiff's exposure to abrasive brick dust. However, the medical evidence could establish an increased risk of dermatitis from exposure to abrasive brick dust. Lord Wilberforce resolved the evidential gap as follows:  

To merely show that a breach of duty increases the risk of harm is not, in abstracto, enough to enable the plaintiff to succeed. But the question remains whether a plaintiff must necessarily fail if, after he has shown a breach of duty, involving an increase of risk of disease, he cannot positively prove that this increase of risk caused or materially contributed to the disease while his employers cannot prove the contrary. It is a sound principle that where a person has, by breach of duty of care, created a risk, and injury occurs within that area of risk, the loss should be borne by him unless he shows that it has some other cause. In many cases of which the present is typical, it is impossible to prove that the risk caused the injury, just because honest medical opinion cannot segregate the causes of an illness between compound cases. And if one asks which one of the parties, the workman or the employers should suffer from this inherent evidential difficulty, the answer as a matter of policy or justice should be that it is the creator of the risk who, ex hypothesis, must be taken to have foreseen the possibility of damage, who should bear its consequences. A defendant is liable in negligence to the pursuer if the defender's breach of duty caused, or materially contributed to, the injury suffered by the plaintiff notwithstanding that there were other factors, for which the defendant was not responsible, which had contributed to the injury. (emphasis added)

Rather than strictly applying the traditional requirements for proof of causation, the evidential gap created by inadequate knowledge was resolved by a policy analysis. That is, Lord Wilberforce recognized that application of the traditional causal requirements would not result

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87 McGhee v. National Coal Board, supra. note 86 at 1012.
in the most desirable policy decision. Given the evidential gap, the traditional requirements for proof of causation would demand that the plaintiff's action fail. Rather than adopt the traditional approach, Lord Wilberforce framed the issue of causation in policy terms. Lord Wilberforce allocated the burden of proving causation according to policy concerns.\(^{88}\)

Similarly, in *Sindell v. Abbott Laboratories*,\(^ {89}\) the California Court addressed policy concerns rather than strictly applying the traditional requirements for proof of causation. This case was an action for damages arising from exposure to diethylstilbestrol ("D.E.S."). From the late 1940's to approximately 1970, D.E.S. was manufactured and marketed for the purpose of preventing miscarriages. Ultimately, it was discovered that the daughters of mothers who had ingested D.E.S. were prone to develop a rare form of cancer. Since D.E.S. was manufactured and marketed by hundreds of corporations in a generally nondescript form, the plaintiff was unable to identify the particular manufacturer of the D.E.S. ingested by her mother. That is, the plaintiff was faced by the problem of an indeterminate defendant due to limited knowledge.

Rather than applying the traditional approach to the causation issue, the Court considered matters of policy.\(^ {90}\)

In our contemporary complex industrialized society, advances in science and technology create fungible goods which may harm consumers and which cannot

\(^{88}\) This decision was revisited by the House of Lords in *Wilsher v. Essex AHA*, [1988] 1 All E.R. 871 (H.L.). In *Wilsher*, the House of Lords acknowledged that Lord Wilberforce's decision advocated a shift in the burden of proof but stated that this was a minority opinion. The majority of the *McGhee* Court had merely made a legitimate inference that the defendant's negligence had materially contributed to the plaintiff's injury. This interpretation of *McGhee* was adopted by the Supreme Court of Canada in *Snell v. Farrell*. See discussion infra. pages 103 to 107 of this thesis.

\(^{89}\) *Sindell v. Abbott Laboratories*, 607 P. 2d 924 (Cal. 1980).

\(^{90}\) *Sindell v. Abbott Laboratories*, supra. note 89 at 936.
be traced to any specific producer. The response of the courts can be either to adhere rigidly to prior doctrine, denying recovery to those injured by such products, or to fashion remedies to meet these changing needs. ... In an era of mass production and complex marketing methods the traditional standard of negligence was insufficient to govern the obligations of manufacturer to consumer, so should we acknowledge that some adaptation to the rules of causation and liability may be appropriate in these recurring circumstances.

That is, the Court recognized that application of the traditional requirements for proving causation would not achieve the most desirable outcome from a policy point of view. Given the problem of the indeterminate defendant, the traditional causation requirements would demand that the plaintiff's action fail. As such, the Court framed the issue of causation in policy terms. The burden of proof borne by the plaintiff was adjusted to accommodate the problem of the indeterminate plaintiff. The Court imposed liability pursuant to the novel market share theory of liability. Under this theory, each defendant manufacturer was held liable for the proportion of the judgment represented by its share of the market. A defendant manufacturer could exculpate itself from liability by establishing that it could not have produced the D.E.S. ingested by the plaintiff's mother. In this case, the Court addressed the policy concerns in issue and accordingly modified the burden of proof borne by the plaintiff.

There has been some recognition by Canadian courts that the traditional requirements for proof of causation can result in undesirable policy outcomes. That is, the Canadian courts have acknowledged that the traditional causation requirements can be adjusted to accommodate policy concerns. In its Snell v. Farrell decision, the Supreme Court of Canada recognized the concern surrounding the traditional causation requirements in toxic tort litigation. In this case, the defendant ophthalmologist noticed retrobulbar bleeding in the course of the plaintiff's eye
surgery but negligently continued with the procedure. Ultimately, it was discovered that the plaintiff's optic nerve had atrophied with resulting loss of sight in that eye. While one possible cause of optic nerve atrophy is pressure due to retrobulbar haemorrhage, expert witnesses could not state with certainty what caused the atrophy in this particular case. Ultimately, the Court affirmed the trial decision holding the defendant liable for the plaintiff's injuries.

In the course of its judgment, the Supreme Court of Canada provided guidance on the law of causation. The primarily American developments which have challenged the traditional requirements for proof of causation were reviewed by the Court. The Court concluded that: 91

Although to date these developments have had little impact in other common law countries, it has long been recognized that the allocation of the burden of proof is not immutable. The legal or ultimate burden of proof is determined by the substantive law upon broad reasons of experience and fairness. ...

In a civil case, the two broad principles are:

1. that the onus is on the party who asserts a proposition, usually the plaintiff;
2. that where the subject matter of the allegation lies particularly within the knowledge of one party, that party may be required to prove it.

This Court has not hesitated to alter the incidence of the ultimate burden of proof when the underlying rationale for its allocation is absent in a particular case. ...This flexibility extends to the issue of causation.

The Court stated that, properly applied, the traditional principles relating to causation are adequate to the task. It is not necessary to adopt the principle that the plaintiff simply prove

91 Snell v. Farrell, supra. note 7 at 320.
that the defendant created a risk that the injury would occur, or the principle that the defendant has the burden of disproving causation. Adoption of either principle would have the effect of compensating plaintiffs where a substantial connection between the injury and the defendant's conduct is absent. However, the Court stated that if defendants who have a substantial connection to the injury were escaping liability because plaintiffs cannot prove causation under currently applied principles, one of these alternate principles could be adopted.

While declining to expressly rewrite traditional causation requirements in tort law, the Supreme Court of Canada restated the nature and the extent of the onus borne by a plaintiff to prove the cause of his injury. The Court stated that causation need not be demonstrated with scientific precision. In the absence of contradicting evidence, the evidence adduced by the plaintiff may result in an adverse inference being drawn against the defendant.

In the course of its decision, the Supreme Court of Canada suggested that adjustment to the traditional causation requirements may be justified by reference to policy concerns. In particular, the Court acknowledged that the ultimate burden of proof may be adjusted when the underlying rationale for the traditional allocation is absent. Further, the courts will not allow defendants who have a substantial connection to the plaintiff's injury to escape liability because plaintiffs cannot prove causation under currently applied principles. Rather, the principle that the plaintiff simply prove that the defendant created a risk that the injury would occur, or the principle that the defendant has the burden of disproving causation may be applied by the courts. The ultimate burden of proof is determined by the substantive law upon broad reasons
of experience and fairness. In other words, the Supreme Court of Canada recognized that policy concerns may require adjustment to the traditional requirements for proof of causation.

In a later decision, the Supreme Court of Canada affirmed the approach taken in *Snell v. Farrell*. In *Stewart v. Pettie*, the defendant host served excessive alcohol to a guest who subsequently drove while impaired and injured the plaintiff. Although the Court found that the defendant did owe a duty of care to the users of the highway, including the plaintiff, the mere serving of excessive alcohol did not give rise to liability. The plaintiff had to establish a causal relationship between the serving of excessive alcohol and his injury. Ultimately, the Court found that causation had not been established since the defendant reasonably assumed that one of the non-drinking guests in the party would be driving home. In addition, the evidence did not clearly establish that had the defendant intervened different driving arrangements would have been made.

In the course of its decision, the Court commented on the causation requirements as follows:

> There have progressively been developments in tort law which lessen the burden facing a plaintiff in trying to prove that the defendant’s actions actually caused the loss complained of: see *Snell v. Farrell* (1990), 72 D.L.R. (4th) 289, [1990] 2 S.C.R. 311, 4 C.C.L.T. (2d) 229. This makes the plaintiff's task less onerous where there is some inherent difficulty in proving causation with scientific accuracy, or where the facts surrounding causation lie uniquely within the knowledge of the defendant.

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93 *Stewart v. Pettie*, supra. note 92 at 238.
The Court acknowledged that the traditional requirements for proving causation should be adjusted in light of evidential difficulties. In other words, as a matter of policy, the Court recognized that a strict application the traditional causation requirements is not appropriate in all cases. This implies that matters of policy will be considered to determine the extent to which the traditional requirements for proof of causation need to be adjusted.

The Supreme Court of Canada eased the traditional requirements for proof of causation on explicit policy grounds in *Rainbow Industrial Caterers Ltd. v. Canadian National Railway Co.*[^94] In this case, the plaintiff entered a bid in a call for tenders advertised by the defendant. The defendant negligently misrepresented the extent of the contractual obligations. As a result of the misrepresentation, the plaintiff lost approximately $1,000,000 on the contract. Ultimately, the Court held that the defendant was liable for the damages incurred by the plaintiff.

In determining the proper assessment of damages arising from the negligent misrepresentation, the Court considered the appropriate burden of proof. Under traditional causation requirements, the plaintiff bore the burden of proving that his damages were caused by the negligent misrepresentation. In other words, the plaintiff bore the onus of demonstrating that no loss would have been incurred had the negligent misrepresentation not been made by the defendant.

The Court considered whether the traditional allocation of burden of proof was appropriate in this case:95

Although the legal burden generally rests with the plaintiff, it is not immutable. See National Trust Co. v. Wong Aviation Ltd., [1969] S.C.R. 481, and Snell v. Farrell, [1990] 2 S.C.R. 311. Valid policy reasons will be sufficient to reverse the ordinary incidence of proof. In my opinion, there is good reason for such reversal in this kind of case. The plaintiff is the innocent victim of a misrepresentation which has induced a change of position.

The Court determined, as a matter of policy, that the traditional requirements for proof of causation were inappropriate in this case. Given the hypothetical nature of the causal inquiry, it is usually impossible to adduce concrete evidence. The question of who bears the burden of non-persuasion was answered by reference to policy concerns rather than by strict application of the traditional causation requirements. In particular, the Court considered whether the plaintiff should be required to negate all speculative hypotheses about his position had the defendant not committed a negligent misrepresentation, or whether the defendant who created the situation should be required to establish a lack of causation. Ultimately, the Court determined that the more desirable policy outcome is that the innocent victim of a negligent misrepresentation not be required to bear this burden. The Court used reasons of policy to justify an adjustment to the traditional causation requirements.

A similar case was considered by the British Columbia Court of Appeal in Kripps v. Touche, Ross & Co.96 This case involved an action for damages arising from a misrepresentation

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95 Rainbow Industrial Caterers Ltd. v. Canadian National Railway Co., supra, note 94 at 15.
negligently made by the defendants. The plaintiffs allegedly relied upon audits which were
prepared by the defendants and published in the prospectus of a mortgage company.
Subsequently, the mortgage company failed and the plaintiffs lost their investments. The audits
prepared by the defendants did not disclose transactions with a related company, did not
disclose that a substantial portion of the loan portfolio was in arrears, and did not make
adequate provision for future losses.

At trial, it was held that the defendants owed a duty of care to all those who would read the
prospectus, including the plaintiffs. Since the defendants had conducted the audit in accordance
with generally accepted accounting principles, the requisite standard of care had been met
except with regard to the inadequate provision for future loss. However, since the plaintiffs did
not meet their burden to demonstrate reliance on the negligent misrepresentation, the action did
not succeed at trial. On appeal to the British Columbia Court of Appeal, the trial decision was
reversed on the basis that the trial judge had misdirected himself on the law regarding burden of
proof.

Contrary to the opinion of the trial judge, the Court of Appeal stated that the plaintiffs are not
required to prove the misrepresentation upon which they relied was fundamental to their
decision to invest in the mortgage company. Further, the plaintiffs need not adduce affirmative
evidence to allow a finding of actual reliance. Once a plaintiff has demonstrated a material
misrepresentation, the onus is shifted to the defendant to prove that the plaintiff did not rely
upon the misrepresentation. In other words, if a defendant has made a material
misrepresentation calculated to induce the plaintiff to enter the transaction and the loss is
consistent with the plaintiff having acted on the material misrepresentation, the burden shifts to
the defendant to prove that the plaintiff did not rely at all on that misrepresentation.

The traditional requirements for proof of causation demand that the plaintiff establish all
elements of a cause of action. However, as in *Rainbow Industrial Caterers Ltd. v. Canadian
National Railway Co.*, the Court adjusted the traditional causation requirements. Implicitly, the
Court recognized that the traditional approach would not achieve the most desirable outcome
from a policy point of view. Presumably, the Court concluded, as a matter of policy, that it is
more desirable that the innocent victim of a negligent misrepresentation not bear the burden of
non-persuasion.

Traditionally, the courts apply seemingly neutral, objective language to resolve the causation
issue. However, there has been some recognition that a strict application of the traditional
requirements for proof of causation may not achieve the most desirable policy outcome. In
these cases, the traditional causation requirements have been adjusted as a matter of policy.

These cases illustrate the policy aspects of the causal inquiry. The purpose of the causal
inquiry is not to obtain the scientific truth regarding cause and effect but rather to obtain the
most desirable policy judgment. There should be explicit recognition that the focus of the
courts is not to determine, with scientific precision, the cause of the plaintiff’s injury. Rather,
the focus of the courts is to determine whether a sufficient connection between the defendant’s
act and the plaintiff’s injury exists to justify imposing liability on the defendant. In other words,
the courts should explicitly consider whether policy requires the imposition of liability for the
act of the defendant. In the context of toxic tort litigation, this inquiry requires the courts to balance the social value of scientific and technological development with the individual rights to personal integrity and property.

**The Doctrine of Res Ipsa Loquitur**

The doctrine of *res ipsa loquitur* can be invoked to permit a reasonable inference of negligence based on circumstantial evidence. Arguably, the doctrine of *res ipsa loquitur* acts as a mechanism which eases the traditional proof requirements by shifting the burden for proving negligence to the defendant.97 In *Fontaine v. British Columbia (Official Administrator)*,98 the Supreme Court of Canada considered the meaning and application of the doctrine in Canada. In this case, the plaintiff sought damages for the wrongful death of her spouse pursuant to the British Columbia *Family Compensation Act*. There was no evidence regarding the cause of the single vehicle accident in which the plaintiff's spouse was killed. There were credible explanations for the accident which were consistent with the absence of negligence. Further,

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Recently, in *Fontaine v. British Columbia (Official Administrator)*, the Supreme Court of Canada took an arguably stricter approach to causation. The plaintiff's husband and a companion were killed when their truck left the highway and went into a river during a heavy storm. The plaintiff's husband was found in the passenger seat and his companion in the driver's seat. The plaintiff sought compensation from the companion's estate. Faced with the absence of evidence as to how the accident occurred, or even precisely when it occurred, the plaintiff invoked *res ipsa loquitur*. The Court held that *res ipsa loquitur* did not apply and the plaintiff, unable to prove negligence, was denied recovery. {emphasis added}

there was no circumstantial evidence from which an inference of negligence could be drawn. Ultimately, the plaintiff's action was dismissed at all levels of Court.

In the course of its decision, the Supreme Court of Canada defined the doctrine of *res ipsa loquitur* as follows:99

As in any negligence case, the plaintiff bears the burden of proving on a balance of probabilities that negligence on the part of the defendant caused the plaintiff's injuries. The invocation of *res ipsa loquitur* does not shift the burden of proof to the defendant. Rather, the effect of the application of *res ipsa loquitur* is as described in The Law of Evidence in Canada (1992), by John Sopinka, Sidney N. Lederman and Alan W. Bryant, at p. 81:

*Res ipsa loquitur*, correctly understood, means that circumstantial evidence constitutes reasonable evidence of negligence. Accordingly, the plaintiff is able to overcome a motion for a non-suit and the trial judge is required to instruct the jury on the issue of negligence. The jury may, but need not, find negligence: a permissible fact inference. If, at the conclusion of the case, it would be equally reasonable to infer negligence or no negligence, the plaintiff will lose since he or she bears the legal burden on the issue. Under this construction, the maxim is superfluous. It can be treated simply as a case of circumstantial evidence.

That is, the doctrine of *res ipsa loquitur* does not operate to shift the burden of proof to the defendant. However, the traditional proof requirements are eased slightly since the doctrine allows an inference of negligence to be drawn from circumstantial evidence. Ultimately, the plaintiff bears the burden of proof. An inference of negligence will not be made if the circumstantial evidence equally supports the existence of negligence and the lack of negligence.

99 *Fontaine, supra.* note 98 at paragraph 23.
According to the Supreme Court of Canada, the doctrine of *res ipsa loquitur* should be treated as expired in Canadian law:¹⁰⁰

Whatever value *res ipsa loquitur* may have once provided is gone. Various attempts to apply the so-called doctrine have been more confusing than helpful. Its use has been restricted to cases where the facts permitted an inference of negligence and there was no other reasonable explanation for the accident. Given its limited use it is somewhat meaningless to refer to that use as a doctrine of law.

It would appear that the law would be better served if the maxim was treated as expired and no longer used as a separate component in negligence actions. After all, it was nothing more than an attempt to deal with circumstantial evidence. That evidence is more sensibly dealt with by the trier of fact, who should weigh the circumstantial evidence with the direct evidence, if any, to determine whether the plaintiff has established on a balance of probabilities a prima facie case of negligence against the defendant. Once the plaintiff has done so, the defendant must present evidence negating that of the plaintiff or necessarily the plaintiff will succeed.

The doctrine is limited to those cases which permit an inference of negligence based on circumstantial evidence and in which there is no other reasonable explanation for the accident. Given its limited use, the Court concluded that the law would be better served to consider the doctrine expired. Importantly, the Court stressed that evidence is better dealt with by explicit weighing of circumstantial evidence with direct evidence rather than by reference to the doctrine of *res ipsa loquitur*. In other words, the Court stressed the importance of considering which reasonable inferences may be drawn from the evidence.

The Supreme Court of Canada’s decision in *Fontaine* echoes its decision in *Snell v. Farrell*. In *Snell* v. Farrell, the Court stated that the notion of causation is flexible and need not be

¹⁰⁰ *Fontaine, supra.* note 98 at paragraphs 26 to 27.
demonstrated with scientific precision. In the absence of contradicting evidence, the evidence adduced by the plaintiff may result in an inference being drawn adverse to the defendant. Both decisions move from the application of formulaic, rigid doctrines toward consideration of evidence in a flexible manner. In particular, the courts are allowed to draw reasonable inferences of negligence or causation based upon the evidence adduced by the plaintiff. Further, the defendant can be required to present evidence negating the inference based on the evidence of the plaintiff.

Conclusion

The traditional principles of tort law require that a plaintiff demonstrate, on a balance of probabilities, the existence of a causal relationship between an act of the defendant and the plaintiff's injury. The question of whether a causal relationship exists does not create a contentious issue for the court in many cases. If addressed at all, the question of causation may be answered simply by an intuitive reference to general knowledge and experience. In such cases, it seems that the issue of causation is merely a matter of observation.

However, there are cases in which the question of causation cannot be resolved by an intuitive reference to general knowledge and experience. For instance, the intuitive sense of a causal relationship may be lessened by a time lag between the act of the defendant and the plaintiff's injury. Further, gaps in knowledge and experience make the issue of causation more contentious. Policy concerns become more important as facts become more uncertain and removed from general knowledge and experience.
Although grounded in fact, the causal inquiry is not purely factual. The purpose of the causal inquiry is not to obtain the scientific truth regarding cause and effect but rather to obtain the most desirable policy judgment. The focus of the courts is not to determine, with scientific precision, the cause of the plaintiff's injury. Rather, the focus of the courts is to determine whether a sufficient connection exists between the defendant's act and the plaintiff's injury to justify imposing liability on the defendant. In other words, the courts are determining whether policy recommends imposing liability for the act of the defendant.

In the context of toxic tort litigation, the courts must balance the social value of scientific and technological development with the individual rights to personal integrity and property. Rather than strictly apply the traditional requirements for proof of causation, the courts should explicitly acknowledge the scientific uncertainty surrounding the risk associated with many industrial activities. Further, the courts should explicitly consider and adopt a policy approach to deal with this uncertainty. The ultimate goal of the courts should be to promote technological and scientific progress without exposing the general public to an unacceptable level of risk from toxic exposure.
Chapter Four: Tort Reform Proposals to Solve the Causation Problem

Introduction

The traditional requirements of proving causation create injustice by allowing defendants to hide behind the barrier of scientific uncertainty thereby escaping liability for the damages they have caused. By adjusting the requirements for proof of causation, the courts can promote technological and scientific progress while maintaining an acceptable level of risk from exposure to toxic substances. Ultimately, the courts must balance the social value of scientific and technological development with the individual rights to personal integrity and property.

Both the courts and legal commentators have struggled with the problem created by the traditional causation requirements in toxic tort litigation. Certain commentators have concluded that the risks associated with toxic substances cannot be addressed within the confines of the tort system. Rather, it is proposed that comprehensive statutory regimes be developed to deal with the effects of toxic substances. Until comprehensive statutory regimes are implemented, toxic tort litigation has an important role in allocating the appropriate balance between the

101 See for example, E.D. Elliott, “Why Courts? Comment on Robinson” (1985) 14 Jour. Leg. Studies 799 and W.J. Hurwitz, “Environmental Health: An Analysis of Available and Proposed Remedies for Victims of Toxic Waste Contamination” (1981) 7 Amer. J. Law & Med. 61. Legislative proposals have been criticized because the costs of generating information about the risks of toxic substances are shifted from defendants to the general public. In addition, industry undoubtedly would lobby for exclusion of certain toxic substances which otherwise should be incorporated into the legislative scheme. See D.C. Harvey, “Epidemiologic Proof of Probability: Implementing the Proportional Recovery Approach in Toxic Exposure Torts” (1984) 89 Dickinson L. Rev. 233. There is additional concern that knowledge regarding the toxic effects of substances might be frozen at the time of legislating. Other commentators have raised the concern that bureaucracy is simply too cumbersome and slow-moving to respond effectively to new scientific developments. See C.H. Buckley, “Notes, A Suggested Remedy for Toxic Injury: Class Actions, Epidemiology and Economic Efficiency” (1985) 26 Wm. & Mary L. Rev. 497.
social value of scientific and technological progress and the individual rights to personal integrity and property. Moreover, although comprehensive statutory regimes may be required to regulate the production, disposal and release of toxic substances, toxic tort litigation will continue to play a role as a back-up to the statutory regime.

Recognizing the important role of toxic tort litigation and the difficulties created by the traditional causation requirements, both the courts and legal commentators have proposed reform mechanisms operating within the context of tort law. These proposals include the imposition of liability pursuant to novel theories of liability, the expansion of damage categories and the use of procedural adjustments.

The Novel Theories of Liability Approach

Novel Theories of Liability in Diethylstilbestrol Litigation

In the United States, a significant response to the causation problem faced in toxic tort litigation has been the development of novel theories of liability. These novel theories of liability arose in the context of diethylstilbestrol ("D.E.S.") litigation. From the late 1940's to approximately 1970, D.E.S. was manufactured and marketed for the purpose of preventing miscarriages. Ultimately, it was discovered that the daughters of mothers who had ingested D.E.S. were prone to develop a rare form of cancer. The plaintiffs in D.E.S. litigation inevitably encountered the problem of an indeterminate defendant. That is, a plaintiff would not be able to identify the particular manufacturer of the D.E.S. ingested by her mother because D.E.S. was manufactured
and marketed by hundreds of corporations, and generally in a nondescript form. Due to the latent nature of the injury, the problem was exacerbated by the passage of lengthy periods of time before the disease was manifest. In response to the problems encountered by D.E.S. plaintiffs, the American courts have developed several novel theories of liability in the form of market share liability theory, risk contribution theory and concerted action liability theory.

The seminal American decision regarding novel theories of liability is *Sindell v. Abbott Laboratories*. Several novel theories of liability were considered in this decision, and the California Court ultimately applied the market share theory of liability. That is, each defendant was held liable for the proportion of the judgment represented by its share of the market. A defendant could exculpate itself by demonstrating that it could not have made the product which caused the plaintiff's injuries. At page 936, the Court made clear its policy considerations in choosing to apply a novel theory of liability:

In our contemporary complex industrialized society, advances in science and technology create fungible goods which may harm consumers and which cannot be traced to any specific producer. The response of the courts can be either to adhere rigidly to prior doctrine, denying recovery to those injured by such products, or to fashion remedies to meet these changing needs. ... [I]n an era of mass production and complex marketing methods the traditional standard of negligence was insufficient to govern the obligations of manufacturer to consumer, so should we acknowledge that some adaptation to the rules of causation and liability may be appropriate in these recurring circumstances.

Application of the market share theory of liability was severely criticized in the dissenting opinion in this case. The dissenting judge objected to any alteration of traditional causation

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102 *Sindell v. Abbott Laboratories, supra.* note 89, (hereafter, "Sindell").
requirements on the basis that it may result in defendants being held liable when they did not cause the actual damage to the plaintiff.

The market share theory of liability has been applied in subsequent D.E.S. cases. In fact, this theory was expanded in *Hymowitz v. Eli Lilly and Co.* In this case, the New York Court considered the defendant’s motion for summary dismissal. The Court concluded that a market share theory based on the national market provides the best solution to the D.E.S. situation. The market share theory was taken to an extreme by the Court which stated that there should be no exculpation of any defendant who participated in producing D.E.S. for pregnancy use, even if there is evidence that a particular defendant did not cause the plaintiff’s injury. The Court justified this extreme application of the market share liability theory on the grounds that liability is based on the over-all risk produced by the defendants. Understandably, this decision has been criticized since it may result in a defendant being held liable even if it has proved the absence of cause-in-fact.

While it acknowledged the fundamental fairness of shifting the burden under the market share theory of liability as proposed in *Sindell*, the Wisconsin Court in *Collins v. Eli Lilly Co.* criticized this approach due to the practical difficulties in attempting to apply such a theory. Rather, the Court applied another novel theory of liability based upon risk contribution. This

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105 *Collins v. Eli Lilly Co.* 342 N.W.2d 37 (Wis. 1984).
theory holds that since each defendant contributed to the risk of injury to the public, and thus to
the risk of injury to individual plaintiffs, each defendant is liable to the proportion of the risk it
created. The Court considered this approach advantageous because as between the injured
plaintiff and the possibly responsible drug company, the drug company can better absorb the
cost of the injury. The drug company can either insure itself against liability, absorb the
damage award or pass the cost along to the public as a cost of doing business. The cost of
damages will be an incentive to adequately test drugs which are placed on the market.

The risk contribution theory of liability has been criticized by other American courts because it
relies on the fact finder's individualized and open-ended assessment of the relative liability of
several manufacturers in every case. Such assessments delay recoveries and may cause
inconsistent results.

A third novel theory, the concerted action theory of liability, was applied by the New York
Court in Bichler v. Eli Lilly and Co. There are three variants of this theory; pure concerted
action, enterprise liability and civil conspiracy. This theory rests on the principle that those
who, in pursuance of a common plan or design to commit a tortious act, actively participate,
lend aid or encouragement to the wrongdoer or ratify and adopt the acts are all equally liable.
There need not be express agreement but rather just a tacit understanding of the common plan or
design.

106 Hymowitz v. Eli Lilly, supra. note 103.
This approach has been considered inappropriate in the D.E.S. context by other American courts because a particular defendant has not been identified as causing the harm, and the plaintiff is not merely attempting to extend liability to other parties. In addition, the parallel or imitative conduct of the defendants in relying upon each others’ tests and promotion methods is a common practice in industry and does not constitute concerted action.

A fourth novel theory of liability considered, but not applied, in the D.E.S. context is the theory of alternative liability. Under this theory of liability, where there are two or more defendants, one of which caused the injury but the plaintiff cannot show which, the burden of proof shifts to each of the defendants to show that he was not responsible. This has not been applied in the context of D.E.S. litigation because this theory assumes that all negligent defendants will be joined in the suit, ensuring that at least one of the defendants was directly responsible for the injury. However, in D.E.S. litigation not all parties that were or could be responsible for the harm will be necessarily joined as defendants. This theory has also been rejected in the D.E.S. context because it presumes that the defendants will be in a better position to offer evidence to determine which one caused the injury. This is not a fair presumption in the D.E.S. cases.

109 Sindell, supra. note 89.
110 See for example; Sindell v. Abbott Laboratories, supra. note 89 and Collins v. Eli Lilly Co., supra. note 105.
111 Collins v. Eli Lilly Co., supra. note 105.
Although these novel theories of liability were developed in the context of D.E.S. litigation, they have subsequently been applied in other contexts.\footnote{112} For example, in \textit{Ray v. Cutter Laboratories, Div. of Miles, Inc.},\footnote{113} the parents of hemophilic children infected with the AIDS virus as a result of plasma products manufactured by an unknown tort-feasor brought action against several manufacturers. The District Court held that the market share theory of liability applied in this case and, accordingly, dismissed the defendants’ application for summary dismissal.

Similarly, use of the market share theory of liability was considered appropriate in \textit{Morris v. Parke, Davis & Company.}\footnote{114} In this case, the plaintiffs alleged that they were injured by the administration of a diptheria-pertussis-tetanus vaccine which had a defective design. The Court reviewed the applicability of the market share theory of liability as expressed in \textit{Sindell}. This theory can only be applied to products with a defect common to all manufacturers. Such defect may be a manufacturing defect arising from common substandard means of production, storage and the like, or may be a design defect. In addition, the plaintiff must establish that manufacturers representing a substantial share of the market have been joined as defendants. Finally, the plaintiff, through no fault of his own, must be unable to identify the manufacturer.

\footnote{112}{C.J. McGuire, \textit{supra}, note 104. In particular, the market share theory of liability has been extended to asbestos cases, vaccines, and plasma products. Some commentators have recommended that this theory be applied to combat air pollution and a variety of other circumstances.}

\footnote{113}{\textit{Ray v. Cutter Laboratories, Div. of Miles, Inc.}, 754 F. Supp. 193 (M.D. Fla. 1991). This decision involved a summary dismissal application which was initially granted. However, upon the Florida Supreme Court decision in \textit{Conley v. Boyle Drug Co.}, 570 So. 2d 275 (Fla. 1990) which applied market share liability to D.E.S., the application was reconsidered and reversed.}

which produced the product actually used. Ultimately, the Court held that claims of design defect and breach of express warranty could be pursued on the market share theory of liability.

While these novel theories of liability have been adopted by many courts in the United States, the Canadian courts have not experimented with these devices with the exception of the alternative liability theory.\textsuperscript{115} The classic example of application of the alternative liability theory by a Canadian court is the decision in \textit{Cook v. Lewis}.\textsuperscript{116} In this case, the plaintiff was injured by a gunshot negligently fired by one of two defendants. Due to the circumstances, the plaintiff was not able to adduce evidence indicating which defendant had in fact caused the injury. The Court determined that both defendants were jointly and severally liable unless one could exculpate himself or implicate the other. One of the defendants had surely caused the injury, and the defendants’ actions had impaired the plaintiff’s ability to establish liability. In this situation, it would be unjust to allow the defendants to escape liability.

One commentator has stated that for policy reasons similar to those underlying the imposition of alternative liability, the traditional but-for test of causation will not be applied by the Canadian courts to concurrent or cumulative torts.\textsuperscript{117} A concurrent tort occurs when the wrongful acts of two or more tort-feasors each cause the injury. In contrast, a cumulative tort occurs when the wrongful acts of two or more tort-feasors combine to cause the injury but any

\textsuperscript{117} M. Boodman, \textit{supra}. note 4 at 248.
one wrongful act would not have caused damage. In the circumstance of a concurrent or cumulative tort, strict application of the traditional but-for test would exonerate all wrongdoers and provide no remedy to the injured party. Accordingly, in these instances the defendants should be held jointly and severally liable unless they provide evidence to apportion the liability otherwise.

These novel theories of liability - market share liability, risk contribution, concerted action liability and alternative liability - attempt to address the proof of causation problems associated with indeterminate defendants. Indeterminate defendants exist in situations where a plaintiff can demonstrate exposure to a toxic substance which resulted in his injury but cannot demonstrate which particular defendant is responsible for the exposure. In encountering the problem of the indeterminate defendant, the American courts have experimented with novel theories of liability rather than adhere rigidly to traditional doctrine. The American courts have chosen to do so on the policy grounds that some adaptation to the rules of causation and liability is appropriate in an era of mass production and complex marketing methods.

**Proportional Liability**

Another novel theory of liability which has been proposed to ameliorate the causation problem in toxic tort litigation is the imposition of proportional liability. This proposal specifically attempts to address the proof of causation problem associated with indeterminate plaintiffs. The problem of indeterminate plaintiffs arises when a plaintiff can demonstrate that the
defendant caused his exposure to a substance which causes harm but cannot establish conclusively that the exposure caused his injury.

Pursuant to the proportional liability proposal, damages are awarded in direct proportion to the risk created by the defendant. The risk is equivalent to the proportion of the additional cases of the injury to the total number of cases in an unexposed population. The proportional liability approach attempts to provide compensation to indeterminate plaintiffs by awarding damages in an amount that reflects the likelihood that the defendant caused the injury.

According to proponents, the proportionality rule is “ideally suited to the task of resolving the problem of causal indeterminacy in toxic tort cases”. Further, “from the standpoint of corrective justice, the proportionality rule is more effective than the balance of probabilities rule in achieving the tort system’s goal of preserving the value of entitlements.” The proportionality rule discounts recovery by the probability that the plaintiff’s loss was caused by some other wrongdoer, by a non-culpable source or by the plaintiff.

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120 D. Rosenberg, supra. note 118 at 866

121 D. Rosenberg, supra. note 118 at 881.
One criticism of the proportional liability approach is that it appears to substitute risk for actual injury. Proponents argue that this criticism misconceives the nature and effect of causal indeterminacy in toxic tort cases. Liability is assessed only for *actual* losses, including the imposition of long-term risk.

Another criticism of the proportional liability approach is that it under-compensates those who are injured by the defendant and provides a windfall to those who developed the injury without the defendant’s involvement. Plaintiffs who were in fact injured by the defendant will not receive full compensation. In contrast, plaintiffs who were injured by causes other than the defendant’s actions will receive a windfall.

**The Expansion of Compensable Damages Approach**

*Risk as Injury*

Closely related to the proportional liability proposal is the approach that advocates recognition of exposure to risk as a compensable injury. Given the potential benefits of early recognition and explicit evaluation of risk, this theory holds that damages should be awarded for exposure

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122 D. Rosenberg, *supra* note 118 at 881 to 882.
123 D.C. Harvey, *supra* note 101 at 245.
to toxins before any disease occurs. In other words, there should be compensation for increased risk of future illnesses.

This approach involves application of a probabilistic increase in risk concept under which exposure to risk is classified as an actual compensable injury. Any award would be discounted to the extent that it is likely that the injury will arise from risk factors other than the defendant's negligence. Rather than relaxing the traditional causation requirements the risk as injury approach expands the concept of damage to include tortious exposure to risk as a legal injury. The plaintiff must show on a balance of probabilities that the defendant caused the exposure to risk.

Advocates of the risk as injury approach have pointed out that risk assessment is an unavoidable feature in much of the present tort system. The Supreme Court of Canada decision in Janiak v. Ippolito is cited as providing a foundation for recovery based upon risk exposure. In this case, the central issue was how damages for personal injury should be assessed when the plaintiff unreasonably refuses treatment which would mitigate his injury. At page 170, the Court cited Mallett v. McMonagle, [1970] A.C. 166 with approval:

The role of the court in making an assessment of damages which depends upon its view as to what will be and what would have been is to be contrasted with its

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125 D. Gerecke, "Risk Exposure as Injury: Alleviating the Injustice of Tort Causation Rules" (1990) 35 McGill L. J. 797 at 800 to 801.
126 G.O. Robinson, supra note 124 at 798.
128 B. Pardy, supra. note 118 and D. Gerecke, supra. note 125.
ordinary function in civil actions of determining what was. In determining what did happen in the past a court decides on a balance of probabilities. Anything that is more probable than not it treats as certain. But in assessing damages which depend on its view as to what will happen in the future or would have happened in the future if something had not happened in the past, the court must make an estimate as to what are the chances that a particular thing will or would have happened and reflect those chances, whether they are more or less than even, in the amount of damages which it awards.

In this case, the Court concluded that it must take into account the possibility of failure of the treatment which was refused. The amount by which full compensation is discounted represents the avoidable loss. In other words, the Court approved awarding damages for possible injury to the extent of that possibility.

The criticism of any proportionate recovery approach is that certain plaintiffs will be undercompensated while other plaintiffs will receive a windfall. Plaintiffs who were in fact injured by the defendant will not receive full compensation. In contrast, plaintiffs who were injured by causes other than the defendant’s actions will receive a windfall. The compensation goal of tort law is thereby undermined. Defenders of the injury as risk approach point out that such criticisms are based on the assumption that the interest protected is the actual physical injury to the plaintiff.\textsuperscript{129} However, the risk as injury approach expands the concept of damage to include tortious exposure to risk as a legal injury; the plaintiff is not being compensated for actual physical injury. The compensation goal of tort law is accomplished because risk is the injury and the plaintiff is being adequately compensated for exposure to risk.

\textsuperscript{129} D. Gerecke, \textit{supra}. note 125 at 810.
Another criticism of the risk as injury approach is based upon the hesitancy regarding statistical epidemiological evidence.\(^\text{130}\) Statistical evidence may be greeted with skepticism because of its failure to focus on a particular defendant. Under the risk as injury approach, statistical epidemiological evidence would not be used to prove the defendant was negligent. Rather, such evidence would estimate the magnitude of the association between the risk factor and the injury.

Unlike the Canadian courts, the courts in the United States have had the opportunity to address the viability of claims for enhanced risk of future illness. In *Ayers v. Jackson Township*,\(^\text{131}\) the New Jersey Supreme Court reviewed the treatment of claims for enhanced risk of future illness by the American courts. In this case, an action was brought against the defendant township for damages arising from water contamination caused by the leaching of toxic pollutants from the township landfill. The plaintiffs did not advance claims for recovery for specific illnesses caused by exposure to chemicals. Rather, damages were claimed for enhanced risk of future illness attributable to such exposure.

The Court found that three approaches to enhanced risk claims have been taken by the American courts. Most followed the decision in *Anderson v. W.R. Grace*\(^\text{132}\) which rejected liability for damages based on an enhanced risk for future illnesses which has not been quantified. However, other courts acknowledged the propriety of an enhanced risk cause of action while emphasizing the requirement that occurrence of future illness be reasonably

\(^{130}\) D. Gerecke, *supra* note 125 at 811 to 812.


certain. Finally, several courts have permitted recovery for increased risk of disease where the plaintiff has exhibited some present manifestation of the disease. Ultimately, the Court in this case concluded that a claim for an enhanced risk which is not quantified should not be allowed. However, the Court stressed that it did not decide whether a claim based on enhanced risk of illness supported by testimony demonstrating that the onset of the disease is reasonably probable could be maintained.

It is likely that a claim for enhanced risk of future illness supported by evidence which demonstrates that onset of the illness is reasonably probable will succeed. As expressed in *Sterling v. Velsicol Chemical Corp.*:

> Where the basis for awarding damages is the potential risk of susceptibility to future disease, the predicted future disease must be medically reasonably certain to follow from the existing present injury. While it is unnecessary that the medical evidence conclusively establish with absolute certainty that the future disease or condition will occur, mere conjecture or even possibility does not justify the court awarding damages for a future disability that may never materialize. Tennessee law requires that the plaintiff prove there is a reasonable medical certainty that the anticipated harm will result in order to recover for a future injury. ...Therefore, the mere increased risk of a future disease or condition resulting from an initial injury is not compensable.

This case involved a class action against a chemical corporation for personal injuries and property damage resulting to residents who lived near the corporation’s chemical waste burial site. The medical evidence demonstrated that exposure to toxic substances had increased the plaintiffs’ susceptibility to cancer and other diseases by 25 to 30 percent. The Court held that

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133 *Sterling v. Velsicol Chemical Corp.*, 855 F. 2d 1188 (6th Cir. 1988) at 1204.
this did not constitute a reasonable medical certainty of future illness. Accordingly, damages
should not be awarded on this basis.

A similar conclusion was reached in *Stites v. Sundstrand Heat Transfer, Inc.* 134 In this case, the
plaintiffs commenced an action against the owner of a manufacturing plant for damages arising
from exposure to toxic chemicals, including trichloroethylene. Among other claims, damages
were sought for an enhanced risk of cancer. With respect to the claim for damages arising from
the enhanced risk of cancer, the defendant’s motion for summary dismissal was allowed. The
Court stated that to recover for increased risk of future cancer, the plaintiffs must be able to
demonstrate with reasonable certainty that cancer will develop in the future. Since sufficient
facts to establish reasonable certainty at trial did not exist, the claim for enhanced risk of cancer
could not survive the motion for summary judgment.

Generally, the courts are reluctant to extend the category of damages to include enhanced risk of
future illness. Reasons commonly cited for this reluctance include the speculative nature of a
theory that may award damages for injuries which may not materialize, the possible inequity of
damage awards arising from the inability to assess the nature and extent of future injury, and the
need to allocate limited resources to those who are presently injured before those who may be
injured in the future. 135 Generally, the courts will tolerate these claims only if there is
reasonable probability that the future illnesses will actually develop. In other words, the courts

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Def. Couns. J. 495; see also *Ayers v. Jackson Township*, supra. note 131.
have allowed these claims not as recognition of mere exposure to risk as an injury but rather as compensation for future illnesses which are reasonably probable to occur. Although the Canadian courts have not had the opportunity to address the viability of claims for enhanced risk of future illness, it is foreseeable that the approach taken would be the same as that in the United States.

**Medical Monitoring Costs**

The American courts have also responded to the causation problem by expanding the categories of damage to include the costs of medical monitoring associated with exposure to toxic substances. The seminal decision regarding medical monitoring claims is *Ayers v. Jackson Township*. In this case, the plaintiffs sought recovery of the costs of medical monitoring necessitated by toxic exposure caused by water contamination. The Supreme Court drew a distinction between claims for enhanced risk of future illness and claims for medical monitoring costs. An enhanced risk claim seeks damages on the basis that an non-quantified injury should be presently compensable, even though no evidence of disease is manifest. In contrast, a claim for medical monitoring costs seeks specific monetary damages measured by the cost of periodic medical examinations. Since the plaintiffs have been advised to spend money for medical examinations, a cost which would not have been incurred but for the defendant’s actions, there is a present injury. As such, recognition of a medical monitoring claim is not necessarily dependent upon the recognition of an enhanced risk claim. The Court held that the costs of

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medical monitoring can be recovered where the evidence demonstrates that monitoring of the effect of the toxic exposure is reasonable and necessary.

In a similar case, *In Re Paoli Railroad Yard PCB Litigation*,\(^{137}\) persons who either worked in or lived adjacent to the Paoli railroad yard claimed damages arising from exposure to polychlorinated biphenyls. In the course of its review of a grant of summary dismissal by the lower Court, the Circuit Court considered the viability of the plaintiffs' claims for medical monitoring. The Court stated:\(^{138}\)

> Medical monitoring is one of a growing number of non-traditional torts that have been developed in the common law to compensate plaintiffs who have been exposed to various toxic substances. Often, the diseases or injuries caused by this exposure are latent. This latency leads to problems when the claims are analyzed under traditional common law tort doctrine because, traditionally, injury needed to be manifest before it could be compensable. Thus, plaintiffs have encountered barriers to recovery which "arise from the failure of toxic torts to conform with the common law conception of an injury." ... 

Nonetheless, in an effort to accommodate a society with an increasing awareness of the danger and potential injury caused by the widespread use of toxic substances, courts have begun to recognize claims like medical monitoring, which can allow plaintiffs some relief even absent present manifestations of physical injury. More specifically, in the toxic tort context, courts have allowed plaintiffs to recover for emotional distress suffered because of the fear of contracting a toxic exposure disease ... and the reasonable costs of medical monitoring or surveillance.

As in the *Ayers v. Jackson Township*\(^{139}\) decision, the Court drew a distinction between a claim for enhanced risk and a claim for medical monitoring. In a medical monitoring claim, the

\(^{137}\) *In Re Paoli Railroad Yard PCB Litigation*, 916 F. 2d 829 (3rd Cir. 1990).

\(^{138}\) *In Re Paoli Railroad Yard PCB Litigation*, supra. note 137 at 849 to 850.

\(^{139}\) *Ayers v. Jackson Township*, supra. note 131.
appropriate inquiry is whether monitoring is, to a reasonable degree of medical certainty, necessary to diagnose properly the warning signs of disease.

**Fear of Future Illnesses**

The categories of damage have also been expanded by the American courts to allow claims for the fear of future illnesses associated with exposure to toxic substances. Essentially, a claim for fear of future illnesses is a claim for mental distress. Accordingly, most courts have required that the fear be reasonably associated with a present, physical injury. For example, in *Anderson v. W.R. Grace & Co.*, an action was brought for damages arising from toxic exposure by water contamination. With the exception of a few plaintiffs’ claims, the Court granted the defendants’ motion for summary dismissal of the claims for fear of future illnesses. The Court stated that recovery of damages for emotional distress requires that the emotional distress arise from physical injuries caused by the defendant’s conduct. Further, a plaintiff can recover for only that degree of emotional distress which a reasonable person normally would have experienced under the circumstances.

It has been noted that the plaintiff’s burden to demonstrate a present, physical injury associated with the fear of future illnesses is minimal. In fact, certain decisions have held that demonstration of a present, physical injury is not necessary to succeed in a claim for fear of

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future illnesses. In *In Re Moorenovich*,\(^{142}\) the plaintiffs sought damages for cancerphobia arising from exposure to asbestos. The Court held that fear of cancer is a recoverable element of damages which follows from the independent cause of action for emotional distress. To recover damages arising from fear of cancer, the plaintiffs must establish that the fear is caused by the toxic exposure, that the fear must be reasonable, and that the defendants are legally responsible for the plaintiffs’ exposure.

The Canadian courts have had little opportunity to assess the viability of claims for fear of future illnesses. In *Anderson et al. v. Wilson et al.*,\(^{143}\) the Ontario Divisional Court considered an application for certification of a class action for damages associated with a Hepatitis B breakout. Among others, the proposed class included persons who did not contract Hepatitis B after being a patient of the defendant but who were advised by a public health authority that they may have contracted the disease and should be tested, and persons who did not contract Hepatitis B from an infected person but were advised by a public health authority that they may have contracted the disease and should be tested. These persons sought damages for nervous shock and fear of injury to their health. These claims were struck as disclosing no cause of action. The Court stated that in the absence of diagnosed psychiatric or psychological illness, the law does not award damages for mental distress or nervous shock standing alone. Thus, it appears that the Canadian courts will not recognize claims for fear of future illnesses associated

\(^{142}\) *In Re Moorenovich*, 634 F. Supp. 634 (D. Me. 1986).

with toxic exposure unless the fear develops into a diagnosed psychiatric or psychological illness.

The Modified Procedure Approach

Probability of Causation

According to proponents of the probability of causation approach, the solution to the causation problem must focus on the issue of causation and the type of evidence available to prove causation. If there is a lack of other medical evidence, statistical evidence should be admissible. However, the statistical evidence should be strictly limited to the issue of causation. Upon sufficient evidence, the plaintiff should be limited to a recovery proportioned to the probability of causation. In other words, statistical evidence may be admitted to prove causation but with the stipulation that the plaintiff's maximum recovery be limited to a portion of his total damages proportional to the probability that the defendant caused his injury.

This approach has been criticized because it does not achieve proper compensation, which is a fundamental goal of the tort system. As with any approach that involves proportionate recovery, certain plaintiffs will be under-compensated while other plaintiffs will receive a windfall. Plaintiffs who were in fact injured by the defendant will not receive full

\[144\] D.C. Harvey, supra. note 101 at 249 to 259.
\[145\] J.S. Forstrom, supra. note 5 at 153.
compensation, whereas plaintiffs who were injured by causes other than the defendant's actions will receive a windfall.

Class Actions

At least one commentator has proposed that the causation problem in toxic tort litigation can be avoided by the use of class actions. Often the best, if not only, evidence linking a toxic substance to the occurrence of a disease is statistical epidemiological studies. The courts are reluctant to use such evidence on the basis that such studies predict population injury, not individual injury. It is argued that class proceedings remove this traditional obstacle to using epidemiological studies. In dealing with a class action, the courts need not inquire whether the particular injury is part of the background rate or is in fact caused by the defendant's acts. Arguably, the courts can compensate the entire class and be certain that the injuries particularly induced by the defendant's will occur regardless of the background rate.

The flaw in this argument is that an epidemiological study relates to a particular population which is not necessarily, and probably not, the same as the class involved in the civil action. That is, the epidemiological study does not transfer directly over to the class involved in the civil action. The traditional reluctance to use statistical epidemiological evidence is therefore not alleviated.

\(^{146}\) C.H. Buckley, *supra* note 101 at 525.
Under the class action proposal, it is stated that the class can either divide the recovered funds or purchase insurance against future injuries. However, this proposal does not resolve the causation problem because the class itself is in no better position than the courts to determine which injuries can be attributed to the defendant's acts and which injuries are simply a result of background occurrence of the injury.

**Express Burden Shifting**

In light of scientific uncertainty surrounding many substances, it is frequently suggested that the burden of proof should shift once the plaintiff has demonstrated that the substance has been discharged and that the known effects of this substance are consistent with the harm or loss the plaintiff has suffered. The onus of proving that the substance did not in fact cause the plaintiff's harm then falls upon the person who discharged the substance. That is, the burden of proving a substance is safe should be shifted from the person alleging it as harmful to the person who stands to profit from use or production of the substance.\(^{147}\)

Advocates defend shifting the burden of proof to resolve the causation problem on policy grounds. The special health and environmental hazards posed by rapid increases in the manufacture, use and disposal of toxic substances are dramatically different from those traditionally considered by tort law.\(^{148}\) Where the sequence of cause-and-effect is unknown, it


is better that the creator of the risk should bear the burden rather than the victim.\footnote{149} By shifting the burden of proof to the defendant, the person proposing use of the substance is required to demonstrate its safety. Substances should no longer be presumed innocent but rather be proven as such.

Advocates also argue that shifting the burden of proof to the defendant will assist in bringing the risk of unknown, unintended or ill-considered hazards to public attention before irreversible harm is done.\footnote{150} A person undertaking an activity should be recommending that activity because other alternatives are not suitable. In other words, a defendant should be able to show that there are no feasible and prudent alternatives to his activity.

This approach to resolving the causation problem has not been immune to criticism. The primary criticism is that this approach is unfair to defendants. Defendants are in no better position to access the information than the plaintiffs, resulting in unlimited liability for chemical manufacturers and users of toxic substances.\footnote{151} In the face of scientific uncertainty, neither party is in a position to bring certainty to the issue of risk and neither party can prove the unprovable. The issue of factual causation is resolved in the plaintiff's favour since the defendant becomes burdened with proving the unprovable.

\footnote{149}{J. Irvine, "Annotation to Letnick v. Metropolitan Toronto (Municipality)" (1988) 44 C.C.L.T. 69.}
\footnote{150}{J.F. Castrilli, \textit{supra}, note 148 at 78 to 79.}
\footnote{151}{M.R. Hadskis, \textit{supra}, note 119 at 120-122.}
The burden shifting approach has also been criticized as not assisting the plaintiff to overcome the causation problem. Before the burden of proof will shift, the plaintiff must demonstrate that the toxic substance traveled a particular pathway from the defendant to the plaintiff and that the known effects of the toxic substance are consistent with the injury claimed. However, given the limits of scientific knowledge, requiring proof of the injury's etiology may present an insurmountable barrier to the plaintiff. Thus, the causation problem is encountered even in attempting to meet the minimum standard required to shift the burden of proof.

Both the Canadian courts and the English courts have experimented with the notion of shifting the burden of proof from the plaintiff having to prove causation to the defendant having to disprove causation. The English House of Lords in \textit{McGhee v. National Coal Board}\textsuperscript{153} recognized that the burden of proving causation is becoming heavier in the modern, complex world. This decision was interpreted by many Canadian courts as advocating, in some cases, a shift in the burden of proof from the plaintiff having to prove causation to the defendant having to disprove causation.

In \textit{McGhee}, the plaintiff was exposed to abrasive brick dust in the course of his employment. The defendant, the plaintiff's employer, negligently failed to provide washing facilities. As a consequence, the plaintiff had to cycle home after work caked with sweat and grime. Eventually, the plaintiff was found to be suffering from dermatitis which could not be

\footnotesize{\textsuperscript{152} D.C. Harvey, \textit{supra}. note 101 at 243.  
\textsuperscript{153} \textit{McGhee v. National Coal Board, supra}. note 86, (hereafter, "McGhee").}
conclusively linked to the defendant's negligence. On appeal to the House of Lords, the issue was whether the defendant's breach of duty to provide washing facilities was the cause-in-fact of the plaintiff's dermatitis.

In the course of his decision, Lord Wilberforce stated:\textsuperscript{154} To merely show that a breach of duty increases the risk of harm is not, in abstracto, enough to enable the plaintiff to succeed. \textit{But the question remains whether a plaintiff must necessarily fail if, after he has shown a breach of duty, involving an increase of risk of disease, he cannot positively prove that this increase of risk caused or materially contributed to the disease while his employers cannot prove the contrary.} It is a sound principle that where a person has, by breach of duty of care, created a risk, and injury occurs within that area of risk, the loss should be borne by him unless he shows that it has some other cause. In many cases of which the present is typical, it is impossible to prove that the risk caused the injury, just because honest medical opinion cannot segregate the causes of an illness between compound cases. And if one asks which one of the parties, the workman or the employers should suffer from this inherent evidential difficulty, the answer as a matter of policy or justice should be that it is the creator of the risk who, ex hypothesis, must be taken to have foreseen the possibility of damage, who should bear its consequences. A defendant is liable in negligence to the pursuer if the defender's breach of duty caused, or materially contributed to, the injury suffered by the plaintiff notwithstanding that there were other factors, for which the defendant was not responsible, which had contributed to the injury. \{emphasis added\}

In other words, where a defendant has created a risk by his breach of duty and the plaintiff's injury falls within that area of risk, it is appropriate to shift the burden of proof from the plaintiff having to prove causation to the defendant having to disprove causation.

A subsequent decision of the English House of Lords reversed the trend toward shifting the burden of proof which had been set by the decision in \textit{McGhee}. In \textit{Wilsher v. Essex AHA}\textsuperscript{155}

\textsuperscript{154} \textit{McGhee, supra.} note 86 at 1012.
the infant plaintiff was born prematurely and was suffering from several conditions common to premature babies, including oxygen deficiency. In the course of his treatment, the plaintiff was negligently given excess oxygen on two occasions. Subsequently, it was discovered that the plaintiff was suffering from a retinal condition which caused near blindness. The retinal condition could be caused by any of five conditions from which the plaintiff had suffered or by receiving excess oxygen. Medical evidence was inconclusive as to whether the excess oxygen had caused or materially contributed to the retinal condition.

In *Wilsher*, the House of Lords reviewed the decision in *McGhee* and concluded that it laid down no new rule of law whatever. While it was acknowledged that Lord Wilberforce's decision advocated a reversal of the burden of proof, the House of Lords stated that this was a minority opinion. The principle that the burden of proving causation lies on the plaintiff was confirmed by the House of Lords in *Wilsher*. Further, it was determined that the Court in *McGhee* had merely made a legitimate inference that the defendant's negligence had materially contributed to the plaintiff's injury. Finally, the House of Lords held that such an inference could not be made in the *Wilsher* case since excess oxygen was only one of six possible causes of the plaintiff's injury.

Before the decision in the *Wilsher* case, three doctrines of causation had begun to emerge:156

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1. the burden of proof could be shifted away from the plaintiff and to the defendant so that the consequences of deficiency in the evidence fell upon the defendant;

2. in some circumstances, evidence indicating that the defendant had merely increased the risk of the plaintiff's injury was used to show that the defendant actually caused the plaintiff's injury; or

3. in some circumstances, the court would draw an inference of causation if the plaintiff showed that the defendant's negligence materially increased the risk of the plaintiff suffering his injury.

The effect of the Wilsher decision was to leave the door ajar with respect the third doctrine of causation. That is, when it is demonstrated that the defendant has materially increased the risk of injury, an inference that the defendant caused the injury is allowable. The other two doctrines of causation were abolished. After Wilsher, it is no longer considered appropriate to shift the burden of proof away from the plaintiff and to the defendant so that the consequences of deficiency in the evidence fall upon the defendant. Likewise, it is inappropriate to use evidence indicating that the defendant had merely increased the risk of the plaintiff's injury to show that the defendant actually caused the plaintiff's injury.

In Snell v. Farrell, the Supreme Court of Canada summarized the impact of the McGhee and Wilsher decisions on Canadian tort law as follows:

Canadian cases decided after McGhee but before Wilsher tended to follow McGhee by adopting either the reversal of onus or the inference interpretation. Which interpretation was adopted made no practical difference because even when the latter approach was applied, the creation of the risk by the defendant's breach of duty was deemed to have established a prima facie case, thus shifting the onus to the defendant. ...

\[157\] N.J. Tuytel & K.N. Affleck, supra, note 156 at 108.
\[158\] Snell v. Farrell, supra. note 7 at 325 to 326.
Decisions in Canada after *Wilsher* accept its interpretation of *McGhee*. In the circumstances in which *McGhee* had been previously interpreted to support a reversal of the burden of proof, an inference was now permissible to find causation, notwithstanding that causation was not proved by positive evidence.

Ultimately, the Court concluded that the principle that the plaintiff simply prove that the defendant created a risk that the injury would occur, or the principle that the defendant has the burden of disproving causation was no longer applicable. Rather, in the absence of contradicting evidence, evidence adduced by the plaintiff may result in an adverse inference being drawn against the defendant. Given this decision, it seems that overt attempts to shift the burden of proof from the plaintiff to the defendant or attempts by the plaintiff to satisfy the onus placed upon him solely by establishing that the defendant’s conduct created risk of injury will not be received well by Canadian courts.

**Conclusion**

Recognizing the problem associated with the traditional causation requirements in toxic tort litigation, both the courts and legal commentators have proposed mechanisms designed to resolve the causation problem. These proposals include the imposition of liability pursuant to novel theories of liability, the expansion of damage categories, or the use of procedural adjustments. Rather than developing legal fictions designed to resolve the causation problem, the courts should adopt an approach which allows explicit balancing of the values in conflict in toxic tort litigation.
As will be argued in the following chapter, the courts should acknowledge the scientific uncertainty which surrounds the risk associated with many industrial processes. Further, the courts should explicitly adopt an appropriate policy approach to deal with this uncertainty. The courts may adopt one of three approaches to deal with the scientific uncertainty surrounding the risk associated with technological and scientific processes. At one extreme, the courts may allow these processes to proceed until there has been clear demonstration of harm. At the other extreme, the courts may disallow these processes to proceed until there has been clear demonstration of safety. Falling between these extremes, the courts may allow cautious progress with industrial processes until there has been clear demonstration of harm or safety. Ultimately, the courts' selection of an approach dealing with this uncertainty is a matter of policy which should be resolved by explicit consideration of the values in conflict in toxic tort litigation.

The notion of causation as expressed by the Supreme Court of Canada in *Snell v. Farrell* can be applied to ease the traditional requirements for proving causation in toxic tort litigation. That is, the courts should draw inferences adverse to the defendant even though the plaintiff may not be able to establish causation on a strict balance of probabilities. In making inferences of causation, the courts should be guided by the notion of precaution. In other words, if the extent of risk associated with a particular scientific or technological process is uncertain, the courts should allow only cautious progress with such processes to avoid further harm. Once a toxic tort plaintiff has demonstrated a rational connection between his injury and an act of the defendant, the courts should draw an inference of causation unless the defendant adduces contradicting evidence.
In contrast to the traditional approach, this approach encourages the courts to explicitly weigh the social value of scientific and technological development with the individual rights to personal integrity and property. By being guided by the notion of precaution, the courts do not presume scientific and technological developments to be harmless and do not require a plaintiff to prove otherwise. The courts can determine, as a matter of policy, the extent of risk from toxic exposure to which the general public should be exposed. In the light of evidential uncertainty, the courts should make decisions designed to prevent further harm.
Chapter Five: Conclusion

Introduction

In the context of toxic tort litigation, the requirements for proof of causation set by the courts determine the extent to which the general public will be exposed to the risks associated with technological and scientific progress. Individuals will be less successful in protecting their rights to physical integrity and property if the requirements for proving causation are set too high. Consequently, the general public will be exposed to greater risk of harm by the toxic substances associated with technological and scientific activities. Further, the true cost of such activities, including adverse environmental effects, will not be considered in valuing technological and scientific activities. On the other hand, overly lax causation requirements will stifle technological and scientific development by placing an excessive burden on the manufacturers and users of toxic substances. By adjusting the proof of causation requirements, the courts can promote technological and scientific progress while maintaining an acceptable level of risk from exposure to toxic substances.

The notion of causation is often treated as a purely factual, policy neutral inquiry. However, the purpose of the causal inquiry is not to obtain the scientific truth regarding cause and effect but rather to obtain the most desirable policy judgment. In addressing the issue of causation in toxic tort litigation, the courts should move from a formulaic conception of causation to an explicit

\[\text{159} \text{ J.Z. Swaigen, supra. note 147.}\]
consideration of policy concerns. That is, the courts should not treat the notion of causation as a purely factual inquiry. Rather, the courts should explicitly acknowledge the policy concerns which influence the causal inquiry. In particular, the courts should acknowledge the scientific uncertainty surrounding the risk associated with many technological and scientific processes and adopt an appropriate policy approach to this uncertainty. Ultimately, the courts' selection of an approach to this uncertainty is a matter of policy which should be resolved by explicit consideration of the values in conflict in toxic tort litigation.

Essentially, the courts may adopt one of three approaches to deal with the scientific uncertainty surrounding the risk associated with technological and scientific processes. At one extreme, the courts may allow these processes to proceed until there has been clear demonstration of harm. At the other extreme, the courts may disallow these processes to proceed until there has been clear demonstration of safety. Falling between these extremes, the courts may allow cautious progress with these processes until there has been clear demonstration of harm or safety.

By its decision in *Snell v. Farrell*, the Supreme Court of Canada has begun the movement away from a formulaic conception of causation to a more flexible, policy sensitive conception. The notion of causation as expressed in *Snell v. Farrell* can be exploited by toxic tort litigants to ease the traditional requirements for proving causation. This flexible notion of causation allows an inference adverse to the defendant to be drawn on the evidence adduced by the plaintiff, even though he may not be able to establish causation on a strict balance of probabilities.
As a matter of policy, if the extent of risk associated with a particular scientific or technological process is uncertain, the courts should allow only cautious progress with such processes to avoid further harm or, at least, to reduce harm. That is, the ability of the courts to draw an inference of cause-in-fact, even though there may not be conclusive evidence of such, should be guided by the notion of precaution. Once a toxic tort plaintiff has demonstrated a rational connection between his injury and the actions of the defendant, the courts should draw an inference of causation unless the defendant adduces contradicting evidence. To demonstrate a rational connection, a plaintiff must establish that the defendant did release the substance which the plaintiff alleges caused his harm and that the substance can cause harm to living organisms.

In contrast to the traditional approach, this approach encourages the courts to explicitly weigh the social value of technological and scientific development with the individual rights to personal integrity and property. The traditional requirements for proof of causation effectively presume that new technological and scientific developments are harmless until proven otherwise. As such, the traditional approach places the burden of proving that a particular technological or scientific process is harmful upon the victims of toxic exposure. In contrast, by being guided by the notion of precaution, the courts do not presume technological and scientific developments to be harmless and do not require a plaintiff to prove otherwise. Rather, the courts will explicitly consider the appropriate level of risk from toxic substances to which the general public will be exposed. In the light of scientific uncertainty, the courts will apply precaution to achieve a decision designed to prevent further harm. Further, actions which avoid, reduce or eliminate the effects of toxic substances associated with technological and scientific processes will be encouraged by the courts.
Possible Responses to the Scientific Uncertainty Surrounding Risk

Generally, the precise nature and extent of adverse effects on human and environmental health accompanying a particular scientific and technological development are unknown. Faced with a technological or scientific process accompanied by uncertain risks, the courts can respond in three ways:\(^{160}\)

1. proceed with the new technological or scientific process until it has been demonstrated to be harmful;

2. do not proceed with the new technological or scientific process until it has been demonstrated to be safe; or

3. proceed cautiously with the new technological or scientific process until it has been demonstrated to be either harmful or safe.

Although often treated as a neutral stance, a strict application of the traditional requirements for proof of causation is, in effect, an adoption of the first approach. The traditional requirements for proof of causation presume that there is no causal relationship between the defendant's act and the plaintiff's harm. The plaintiff bears the burden of demonstrating, on a balance of probabilities, that the defendant's act did cause the plaintiff's harm. In the light of scientific uncertainty, the plaintiff will fail to meet his burden of proof and the defendant will not be held liable. Specifically, in the context of toxic tort litigation, the release of a toxic substance accompanying a technological or scientific process is presumably harmless. The burden lies

upon the victim of toxic exposure to demonstrate that a particular technological or scientific process is harmful.

Indeed, certain scholars have found that shifts in tort law were used to encourage industrial progress during the industrial revolution. For instance, McLaren found “[w]ith the advent of industrialism at the end of the nineteenth century courts began to deal with cases which raised in bold relief the question of where the balance should lie between the traditional conservatory used of land and the new exploitative use.” A historical analysis revealed that judges were divided on whether weight should be given to the argument that imposing liability on industrialists would be detrimental to the industrial and public welfare. Although there was not a conclusive commitment to a doctrine of liability which would necessarily deter an individual from suing for the adverse consequences of industrialization, there is evidence that legal principles were adjusted to encourage industrial expansion.

Similarly, Ginsberg and Weiss argue that the nineteenth century transition from strict liability to negligence was a reflection of popular enthusiasm for industrial development. The negligence standard shifted the social costs of industrialization from the entrepreneurs to those harmed by industrial endeavours. Further, Ginsberg and Weiss argue that by the turn of the twentieth century attitudes regarding the welfare of individuals began to change and the benefits

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of unfettered industrial growth were beginning to be questioned. Accordingly, strict liability expanded to make business more responsive to public welfare.

Horwitz also found that American law was transformed to encourage industrial growth and development.\(^{163}\) According to Horwitz, there was movement in American law from a position of protecting property rights from any interference to a position of tolerating more interference, even to the point of uncompensated expropriation. This transformation in law nurtured the expansion of industrial development.

In the context of toxic tort litigation, the traditional requirements for proving causation operate to encourage technological and scientific growth. The production or release of a substance associated with a technological or scientific process is allowed until a plaintiff can demonstrate, on a balance of probabilities, that the substance is harmful. Implicitly, this requirement reflects the attitude that industrial growth is necessarily valuable and should not be impeded by a fear of liability for the consequences arising from such activity. Any interference with an industrial process is negative and must be strongly justified by other concerns. Thus, the burden of proof of causation should fall upon the plaintiff. The idea that the burden of proof of causation should be borne by the plaintiff is also underpinned by the concept of individualism.\(^{164}\) Without this requirement, the rights and liberties of the individual would arguably be violated.


\(^{164}\) P.J. Zwier, *supra*, note 62.
The traditional requirements for proof of causation reflect the ideals of unimpeded industrial growth and individualism. The result is that when faced with a technological or scientific process accompanied by uncertain risks, the courts will allow the technological or scientific process to proceed until demonstrated to be harmful. This approach does not appropriately deal with the risks posed by toxic substances. Rather, the courts should adopt an approach which is designed to eliminate or, at least, to reduce the effects associated with toxic substances.

The potential environmental and human health effects of toxic substances are significant, irreparable and irreversible. Given the devastating effects of toxic substances, it is desirable to prevent their release into the environment. At the very least, efforts to mitigate the effects of toxic substances are necessary. The courts can encourage the prevention or, at least, the mitigation of the release of toxic substances into the environment by adopting an alternative approach to the traditional conception of causation. When dealing with unknown environmental and human health effects, the courts may either disallow industrial processes to proceed until demonstrated to be safe, or may allow industrial processes to proceed cautiously until demonstrated to be harmful or safe.

The approach which disallows industrial processes to proceed until they are demonstrated to be safe is the extreme opposite of the traditional approach to dealing with the scientific uncertainty surrounding the risk associated with industrial processes. Adoption of this approach effectively presumes all industrial progress to be harmful until a defendant producer or user of toxic substances demonstrates otherwise. The proposal that exposure to risk be regarded as a
compensable injury is an illustration of this approach. Under the risk as injury proposal, mere exposure to risk is regarded as a compensable injury. Any award is discounted to the extent it is likely that the injury will arise from risk factors other than the defendant’s negligence. Generally, the courts have been reluctant to extend the category of damages to include enhanced risk and have tolerated these claims only if there is reasonable probability that the future illnesses will actually develop. In other words, the courts have allowed these claims not as a recognition of mere risk as an injury but rather as compensation for future injuries which are reasonably probable to occur.

By adopting the approach that progress with scientific and technological processes is not allowed until proven safe, the courts presume all scientific and industrial progress to be harmful until a defendant producer or user of toxic substances demonstrates otherwise. In the context of toxic tort litigation, this means that a plaintiff would be required to merely demonstrate that the defendant’s act caused the plaintiff’s exposure to risk. A producer or user of toxic substances would be liable for the mere creation of a risk to which the plaintiff is exposed. Thus, the burden of scientific uncertainty would fall upon the producer or user of toxic substances.

Undoubtedly, the release of toxic substances into the environment would be discouraged by the courts’ adoption of the approach that progress with technological and scientific processes is not allowed until proven safe. However, this approach would have a chilling effect on

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165 See infra. pages 89 to 95.
technological and scientific advancement. Since it is a null hypothesis, a particular industrial process cannot be demonstrated to be absolutely safe. As such, under this approach, a producer or user of toxic substances would be consistently held liable for the risks associated with technological and scientific processes. The effect of this approach is to create overly lax causation requirements which would stifle technological and scientific development by placing an excessive burden on the manufacturers and users of toxic substances.

The approach which allows industrial processes to proceed cautiously until demonstrated to be either safe or harmless falls between the extremes of presuming industrial processes to be either harmless or harmful. It must be stressed that the progress with new technological and scientific processes must be cautious. This means that any decision to proceed with a particular technological or scientific process must be guided by the notion of precaution. In other words, before proceeding with a particular industrial process, a party must take steps to avoid possible harm or to mitigate possible harm. These steps must be taken even if the harm is not scientifically certain to occur. Any error must be made on the side of precaution. For the purposes of addressing the issue of causation in the context of toxic tort cases, the courts must

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166 Logically, it is not possible to demonstrate a null hypothesis. Thus, it cannot be shown with absolute certainty that a particular scientific or industrial process is harmless. Lack of evidence of harmful effects is some evidence that a process is safe but it is not proof of safety. Rather, it may simply indicate that experimentation has not be sufficient to detect the harm. That is, scientific experimentation can only result in evidence which does or does not support a particular hypothesis; it cannot provide certainty.

167 There is a concept of international, environmental law referred to as the precautionary principle or precautionary approach. This concept has a long history of development, and its precise meaning, application and so forth are subject to great controversy. I do not intend to explore this concept in a scholarly fashion. Rather, in referring to precaution, I refer to the ordinary meaning. That is, taking appropriate steps beforehand to avoid harm or to secure good. See E. Hey, "The Precautionary Concept in Environmental Policy and Law: Institutionalizing Caution" (1992) 4 Georgetown Int'l Envt'l L. Rev. 303 and J. Cameron and J. Abouchar, "The Precautionary Principle: A Fundamental Principle of Law and Policy for the Protection of the Global Environment" (1991) 14 B.C. Int'l. & Comp. L. Rev. 1 for discussion of the precautionary concept.
be prepared to attach liability to the defendant even though the traditional requirements for proof of causation have not been met by the plaintiff.

Some courts have recognized the need to proceed with precaution when dealing with threats to human health and other environmental concerns. For instance, in *Reserve Mining Company v. Environmental Protection Agency*, the Environmental Protection Agency, the State of Minnesota and several environmental groups sought an injunction ordering Reserve Mining to cease discharging wastes from its taconite ore processing plant in Silver Bay, Minnesota into the ambient air and waters. The plaintiffs maintained that the taconite ore mined by the defendant contained an asbestiform variety of the amphibole mineral cummingtonite-grunerite, and resulted in release of mineral fibers substantially identical to amosite asbestos into the ambient air and water. Ultimately, the Court of Appeal granted an injunction but allowed the defendant reasonable time to convert its Minnesota taconite operations to in-land disposal of taconite tailings and to restrict air emissions from its Silver Bay plant, or to close its existing Minnesota taconite operations. The Court held that an immediate injunction was not "justified in striking a balance between unpredictable health effects and the clearly predictable social and economic consequences that would follow the plant closing."

The Court found that the evidence established that the defendant's discharges into the ambient air and water gave rise to a potential threat to the public health. Further, the risk to the public

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169 *Reserve Mining Company*, supra. note 168 at 536.
health was of sufficient gravity to be legally cognizable and sufficient for an abatement order. Although the Court found that there had been no harm to the public health to the time of trial and that the danger was not imminent, the evidence called for "preventative and precautionary steps". The Court stated at page 520:

These concepts of potential harm, whether they be assessed as "probabilities and consequences" or "risk and harm", necessarily must apply in a determination of whether any relief should be given in cases of this kind in which proof with certainty is impossible. The district court, although not following a precise probabilities-consequences analysis, did consider the medical and scientific evidence bearing on both the probability of harm and the consequences should the hypothesis advanced by the plaintiffs prove to be valid.

In assessing probabilities in this case, it cannot be said that the probability of harm is more likely than not. Moreover, the level of probability does not readily convert into a prediction of consequences. On this record it cannot be forecast that the rates of cancer will increase from drinking Lake Superior water or breathing Silver Bay air. The best that can be said is that the existence of this asbestos contaminant in air and water gives rise to reasonable medical concerns for the public health.

In this case, the Court expressly acknowledged the uncertainty surrounding the risks associated with the industrial process at hand. Rather than find that the plaintiffs had failed to meet their burden of proving causation, the Court was guided by the concept of precaution. Measures were taken to prevent harm to human health even though there was not conclusive evidence that harm would occur. The Court further made an express attempt to balance the individual right to personal integrity with the social value of industrial development.

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170 Reserve Mining Company, supra. note 168 at 500.
The value and wisdom of the approach taken in *Reserve Mining Company* has been recognized in other toxic tort litigation. In *Ayers v. Jackson Township*, residents brought a nuisance action against the defendant township for damages arising from toxic exposure caused by the leaching of pollutants into an aquifer from the township landfill. The plaintiffs did not advance claims for specific illnesses caused by the toxic exposure. Rather, damages were claimed for enhanced risk of future illness and for medical monitoring costs. In its consideration of the medical monitoring claim, the Court stated:

> We find a helpful analogy in *Reserve Mining Co. v. E.P.A.*, 514 F. 2d 492 (8th Cir. 1975) ...

The court ruled that “the existence of this risk to the [affected] public justifies *** requiring abatement of the health hazard on reasonable terms as a precautionary and preventative measure to protect the public health.” *Id.* The critical holding for our purposes is that the public health interest may justify judicial intervention even where the risk of disease is problematic.

Ultimately, the Court allowed recovery of damages for medical monitoring costs. Similar to the decision in *Reserve Mining Company*, the public health interest was held to justify the imposition of liability for reasonable and necessary medical monitoring even in light of scientific uncertainty. Rather than strictly apply the traditional causation requirements, the Court chose to act with precaution and expand the categories of liability.

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172 As will be recalled from previous discussion, *infra* page 92 of this thesis, the plaintiffs’ claim for enhanced risk of future illness did not succeed. In other words, the Court acted with precaution but did not adopt the extreme position that a defendant should be liable for the mere creation of risk.

173 *Ayers v. Jackson Township*, supra. note 131 at 312.
The Supreme Court of Canada has also seen it appropriate to act with precaution when dealing with potential harm to the environment.\textsuperscript{174} In \textit{R. v. Crown Zellarbach Canada Limited,}\textsuperscript{175} the defendant was charged under section 4(1) of the \textit{Ocean Dumping Control Act}, S.C. 1974-75-76, c.55, which prohibits the dumping of any substance at sea except in accordance with the terms and conditions of a permit. The defendant had dumped wood waste into the waters of Beaver Cove, which were internal marine waters of British Columbia. There was no evidence to demonstrate that there had been any dispersal of the waters of Beaver Cove, or of any effect on navigation or marine life.

The Court considered whether the federal jurisdiction to regulate the dumping of substances at sea, as a measure for the prevention of marine pollution, extends to the regulation of dumping in provincial marine waters. Ultimately, the Court upheld the provision as constitutionally valid pursuant to the national concern doctrine of the federal peace, order and good government power.

The Court stated that, due its predominantly extra-provincial and international character and implications, the issue of marine pollution was a matter of national concern to Canada. Further, its unique characteristics and scientific concerns made marine pollution a single, indivisible matter falling within the national concern doctrine of the federal peace, order and good government power.

\textsuperscript{174} J. Cameron and J. Abouchar, \textit{supra.} note 167.
government power. The distinction between fresh water and sea water created an ascertainable and reasonable limit on the provision's infringement on provincial jurisdiction.

The importance of applying precaution is implicitly recognized in this decision. The imperative of applying a comprehensive scheme to protect against marine pollution was acknowledged by the Court. Rather than defer to the arbitrary distinctions between federal and provincial jurisdictions, the problem of marine pollution was recognized as a matter of national concern. A strict, technical interpretation of jurisdiction was not allowed to hinder steps designed to prevent marine pollution.

Essentially, there are three approaches for dealing with the scientific uncertainty surrounding the risk associated with technological and scientific processes. At one extreme, the courts may allow industrial processes to proceed until there has been clear demonstration of harm. A strict application of the traditional requirements for proof of causation is, in effect, an adoption of this approach. At the other extreme, the courts may disallow these processes to proceed until there has been clear demonstration of safety. The proposal that mere exposure to risk be recognized as a compensable injury is an illustration of this approach. Finally, falling between these extremes, the courts may allow cautious progress with these processes until there has been clear demonstration of harm or safety.

To effectively address the issue of causation in toxic tort litigation, the courts should move from a formulaic conception of causation to an explicit consideration of policy concerns. In particular, the courts should expressly acknowledge the scientific uncertainty which surrounds
the risk associated with many scientific and technological processes. Further, the courts should expressly consider and adopt the most appropriate policy approach to deal with this uncertainty. Ultimately, the courts’ selection of an approach to this uncertainty is a matter of policy which should be resolved by explicit consideration of the values in conflict in toxic tort litigation.

Causation and Precaution

In *Snell v. Farrell*, the Supreme Court of Canada recognized the concern surrounding the traditional causation requirements in toxic tort litigation. Writing for the Court, Justice Sopinka stated at page 320:

> The traditional approach to causation has come under attack in a number of cases in which there is concern that due to the complexities of proof, the probable victim of tortious conduct will be deprived of relief. This concern is strongest in circumstances in which, on the basis of some percentage of statistical probability, the plaintiff is the likely victim of the combined tortious conduct of a number of defendants, but cannot prove causation against a specific defendant or defendants on the basis of particularized evidence in accordance with traditional principles.

> The challenge to the traditional approach has manifested itself in cases dealing with non-traumatic injuries such as man-made diseases resulting from the widespread diffusion of chemical products, including product liability cases in which a product which can cause injury is widely manufactured and marketed by a large number of corporations. ... Except in the United States, this challenge has had little impact in the common law jurisdictions. Even in the United States, its effects have been sporadic. In the area referred to above, courts in some states have experimented with a theory of probability at less than 51 percent, and apportionment of liability among defendant manufacturers of the product in question on the basis of market share...

> Although to date these developments have had little impact in other common law countries, it has long been recognized that the allocation of the burden of proof is not immutable. The legal or ultimate burden of proof is determined by the substantive law upon broad reasons of experience and fairness.
The Court expressly stated that, with respect to medical malpractice cases, it is not necessary to adopt the alternatives set out in *McGhee*. Properly applied, the traditional principles relating to causation are adequate to the task and it is not necessary to adopt the principle that the plaintiff simply prove that the defendant created a risk that the injury would occur, or the principle that the defendant has the burden of disproving causation.

The Court asserted that dissatisfaction with the traditional causation approach stems to a large extent from its too rigid application in many cases. Causation need not be demonstrated with scientific precision. Evidence adduced by the plaintiff may result in an inference being drawn adverse to the defendant, in the absence of contradicting evidence. Thus, while declining to expressly rewrite traditional causation requirements in tort law, the Supreme Court of Canada restated the nature and the extent of the onus borne by a plaintiff to prove the cause of his injury.

According to one commentator, the decision in *Snell v. Farrell* has two important aspects for environmental litigants. 176 Firstly, the emerging branch of the law of causation has been rejected by the Supreme Court of Canada. Secondly, the ability of the courts to draw a reasonable inference from the evidence has been emphasized. In a difficult technical situation, a plaintiff who cannot unequivocally point to the cause of his injury can invite the court to make a reasonable inference that the defendant’s action gave rise to the plaintiff’s injury. The

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defendant must then attempt to negate that inference. Further, the Supreme Court of Canada rejected the notion that a plaintiff can satisfy the onus placed upon him solely by establishing that the defendant’s conduct created risk of injury.

It is this second aspect of the decision which may be exploited by toxic tort litigants to ease the traditional requirements of proving causation. Causation can be viewed as a flexible device which will not be applied with scientific precision. Although a plaintiff may not be able to establish causation on a strict balance of probabilities, sufficient evidence may be adduced to create an inference adverse to the defendant. The ability of the courts to draw an inference of cause-in-fact, even though there may not be conclusive evidence of such, will greatly benefit toxic tort plaintiffs.

Given the Supreme Court of Canada’s decision in Snell v. Farrell, it seems that overt attempts to shift the burden of proof from the plaintiff to the defendant or attempts by the plaintiff to satisfy the onus placed upon him solely by establishing that the defendant’s conduct created risk of injury will not be received well by Canadian courts. However, this does not mean that all attempts to ease the problems associated with the traditional requirements of proving causation in toxic tort litigation will be quashed.

The flexible notion of causation as expressed in Snell v. Farrell can be exploited by toxic tort litigants to ease the traditional causation requirements. Although a plaintiff may not be able to establish causation on a strict balance of probabilities, sufficient evidence may be adduced to create an inference adverse to the defendant. The courts should be guided by the notion of
precaution when using their ability to draw an inference of causation based upon evidence adduced by the plaintiff. In other words, the courts should use their capacity to draw inferences of causation as a mechanism to prevent or, at least, reduce further harm caused by toxic exposure. To effectively apply the notion of precaution, the courts should explicitly balance the benefits of scientific and technological developments with the adverse effects of such developments. In addition, the courts should consider the appropriate level of risk from toxic substances to which the general public will be exposed.

At least one Canadian toxic tort decision has been guided by precaution by using the notion of causation in the flexible manner described in *Snell v. Farrell*. The plaintiffs in *Donkin v. River Road Co-Op et al.* brought an action in nuisance against the defendant service station operators for damages resulting from gasoline ground water pollution. The Court summarized the evidence as follows:

The evidence is, however, that this gasoline escaped below the bedrock and through the groundwater. It is agreed that in this strata it is not possible to predict with accuracy the paths that gasoline product will take for the reasons set out above. It was not practical in the present circumstances to do a thorough scientific analysis of the groundwater paths. The fact is that gasoline product did come on to the plaintiffs’ property and that there was a known escape on the defendants’ adjoining property. It is a fact that under certain circumstances a petroleum product will travel in an irregular fashion.

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177 *Donkin v. River Road Co-Op et al.* (1991), 293 A.P.R. 56 (N.B. Q.B.), (hereafter, “*Donkin*”).
178 *Donkin*, supra. note 177 at 72.
In other words, due to limited scientific knowledge, the plaintiffs could not establish that the escape of gasoline from the defendant's property had contaminated their groundwater. However, the Court relied upon its ability to draw inferences adverse to the defendant:179

In a recent decision of the Supreme Court of Canada Snell v. Farrell, [1990] 2 S.C.R. 311; 110 N.R. 200; 107 N.B.R. (2d) 94; 267 A.P.R. 94; 72 D.L.R. (4th) 289, Mr. Justice Sopinka dealt with the distinction between scientific proof and the court's responsibility to determine causation on a balance of probabilities.

At p.330 S.C.R. Sopinka, J., stated:
"The legal or ultimate burden remains with the plaintiff, but in the absence of evidence to the contrary adduced by the defendant, an inference of causation may be drawn although positive or scientific proof of causation has not been adduced."

In the face of limited scientific knowledge, the Court in this case drew an inference of causation from the evidence adduced by the plaintiff and in the absence of contrary evidence adduced by the defendant. Rather than focus on the inability of the plaintiff to demonstrate a conclusive causal relationship between the plaintiff's harm and the defendant's act, the Court applied a more flexible concept of causation.

Although not explicit, the Court's decision in this case reflects an attitude of precaution. Recognizing the limits of scientific knowledge, the Court eased the traditional requirements for proving causation. Rather than presume the defendant's activities to be harmless until the plaintiff demonstrated otherwise, the Court placed a greater onus on the defendant. The Court demonstrated less tolerance for activities which cause potential human health and

179 Donkin, supra. note 177 at 73.
environmental problems thereby encouraging parties undertaking such activities to take precautionary steps to avoid further harm.

The precautionary approach taken in Donkin contrasts sharply with the traditional approach taken by the British Columbia Supreme Court in Privest Properties. In this case, the plaintiffs sought compensation for the costs incurred and revenue lost while having the asbestos-containing material removed from the building and replaced with another asbestos-free fireproofing material. In other words, the plaintiffs sought compensation for precautionary steps which were required as a result of the defendant's actions.

The Court adopted the traditional approach which presumes industrial processes harmless until a victim of toxic exposure can clearly demonstrate otherwise. On the grounds that low levels of exposure would be experienced in the plaintiffs' building, the Court found that a causal relationship between the asbestos-containing product and the possibility of disease was not established. In other words, in the face of limited scientific knowledge regarding the levels of asbestos required to cause harm, the Court refused to find a causal relationship despite an established increased risk of harm due to asbestos exposure. Not only does the approach adopted by the Court in this case fail to respond to an established increase in risk; it also discourages precautionary steps designed to eliminate or reduce the harmful effects of toxic substances.

\[180\] See Privest Properties Ltd. v. Foundation Co. of Canada, supra, note 46.
Rather than unquestionably adopt the traditional causal requirements, the courts should adopt an approach to scientific uncertainty and causation which allows cautious progress with industrial processes until they are demonstrated to be harmful or safe. In the context of toxic tort litigation, the courts should be prepared to draw an inference of causation when confronted with evidence that demonstrates a rational connection between a plaintiff’s harm and a defendant’s act. A rational connection can be established by evidence that the defendant did release the substance which the plaintiff alleges caused his harm. In addition, the plaintiff would have to establish that there is at least some scientific evidence that the substance can cause harm to living organisms. The scientific evidence necessary to fulfill this requirement need not be particularistic to the plaintiff, correspond directly to the type of harm suffered by the plaintiff, nor be based upon human experiments. That is, animal studies which demonstrate significant increase in a particular harm is sufficient evidence to establish a rational connection. Upon adducing such evidence, the plaintiff has satisfied the onus of demonstrating a rational connection between the plaintiff’s harm and the defendant’s act. At this point, the courts should draw an inference of causation unless the defendant can adduce contrary evidence. In more conventional language, the burden of proof will then fall upon the defendant to demonstrate either that his act did not cause the plaintiff’s exposure to the substance or that the substance does not cause the harm which was suffered by the plaintiff. The requirements of natural justice guaranteed by section 7 of the Canadian Charter of Rights and Freedoms should be satisfied by requiring that the plaintiff demonstrate a rational connection between the defendant’s act and the plaintiff’s harm before an inference is drawn against the defendant.¹⁸¹

¹⁸¹ See for example, B.H. Wildsmith, supra, note 54.
In contrast to the traditional approach, this approach encourages the courts to explicitly address the values in conflict in the context of toxic tort litigation. The courts can consider the appropriate level of risk from toxic exposure to which the general public will be subject. Rather, than an artificial, seemingly objective inquiry to determine scientific truth, decisions will be based upon a conscious examination of the benefits and adverse effects of industrial development. As Cranor states:\textsuperscript{182}

When the facts are even more uncertain than usual, as they are for toxic substances, norms become more important, for we have to place greater reliance on them. If we have to make a choice under great uncertainty our only or main guidance may be the concerns we promote or frustrate as a result of the decision. The uncertainties focus our attention clearly on the harms at stake when we decide to regulate or not. And even the decision to do nothing in the face of uncertainty is to receive greater guidance from the normative considerations, we should be aware of what the normative principles commit to us. Moreover, different normative principles will assign different weights or urgency to avoiding false negatives and false positives.

In other words, the courts must explicitly balance the social value of industrial development with the individual rights to personal integrity and property. Further, when the risks associated with a particular industrial process are uncertain, the courts should be guided by the notion of precaution.

\textsuperscript{182}C.F. Cranor, \textit{Regulating Toxic Substances: A Philosophy of Science and the Law} (New York: Oxford University Press, 1993) at 157 to 158
Why Should the Courts use Precaution?

The position that the courts' ability to draw inferences of causation should be guided by the notion of precaution can be justified by reference to several policy concerns. Although grounded in fact, the determination of causation is not a purely factual investigation. Rather, policy concerns play a role in the causal inquiry especially as facts become more uncertain and removed from general knowledge and experience. Accordingly, a move from the traditional requirements for proof of causation should be made by explicit reference to policy.

The approach that the courts adopt with respect to the issue of causation affects the risk from toxic substances to which the general public will be exposed. Where the degree of risk is uncertain, the concept of causation applied by the courts, the level of proof required and who bears the burden of proof are crucial to the determination of who succeeds in the face of uncertainty. In toxic tort cases, where the level of uncertainty is high, the adoption of new theories of causation may be the only way to avoid substantial risks to the public. The theory of causation applied by the courts should allow explicit consideration of the appropriate level of risk from toxic exposure associated with industrial processes. In addition, the courts should consider the more appropriate party to bear the risk - the innocent victim of toxic exposure or the person who derived a benefit from the creation of the risk.

\[183\] J.Z. Swaigen, supra. note 147.
\[184\] J.Z. Swaigen, supra. note 147.
Many victims of toxic exposure do not consent and are not even aware of the risk to which they are exposed. In contrast, a producer or user of toxic substances benefits from his voluntary release of these substances into the environment. A strict application of the traditional requirements for proof of causation places the burden of the risk upon the innocent victim of toxic exposure. A victim of toxic exposure is denied a remedy unless he can demonstrate, on a balance of probabilities, that the defendant’s actions caused his harm. Due to limited scientific knowledge, this can be an insurmountable barrier. As such, in addition to the initial benefit derived from the production or use of toxic substances, a producer or user of the toxic substances benefits from scientific uncertainty.

As a matter of policy, it is more appropriate that the burden of risk and scientific uncertainty be borne by the creator of the risk. The producer or user of a toxic substance benefited by the creation of risk and should be required to bear the burden of the risk. In limited circumstances, the courts’ review of the conflicting values in toxic tort litigation may lead to the imposition of the risk onto the general public. However, the *a priori* position should not be that the burden of scientific uncertainty should be borne by the victims of toxic exposure nor should substances associated with industrial progress be presumed innocent.

Admittedly, a defendant producer or user of a toxic substance is in no better position to resolve the scientific uncertainty surrounding a particular substance than the plaintiff victim of toxic exposure. However, unlike the plaintiff, the defendant producer or user of a toxic substance has an the opportunity to take precautionary steps to eliminate or reduce the risks associated with a toxic substance. Before the substance was released into the environment, the producer or user
of the substance had the opportunity to test the substance and to assess its possible risks. In
addition, the producer or user of the substance had the opportunity to develop methods to
eliminate, reduce or contain the adverse effects of the substance. Finally, presumably in light of
his acquired knowledge regarding the substance, the decision to produce or use a particular
substance is made by the defendant. Once the substance has been released into the
environment, the defendant can continue to monitor and respond to its effects. In stark contrast,
the plaintiff has essentially no power to control his exposure to the substance released by the
defendant. In effect, the defendant has, or should have had, superior knowledge regarding the
adverse effects of a substance before allowing its release. Accordingly, the defendant should
bear the burden of the risks associated with the substance he created or used. The plaintiff was
exposed to a toxic substance as a consequence of the defendant’s action and the defendant
should bear the scientific uncertainty surrounding the precise effects of the toxic substance.

Since it is a null hypothesis, neither party can adduce evidence to demonstrate that a particular
substance has no harmful effects. Further, the safe level of a particular substance is not a matter
of science. Concerns encompassing social, economic and philosophical values determine the
definition of harm and of safety. Thus, it is essential that the courts consider the conflicting
values in a toxic tort case to establish the appropriate level of risk from toxic exposure to which
the general public should be subject. The courts must undertake to balance the individual rights
to personal integrity and property with the social value of scientific and technological
development. Ultimately, the courts must protect individual rights to personal integrity and
property without stifling scientific and technological development. An explicit consideration of
these concerns by the courts is a more direct approach than a strict application of the traditional causation requirements to determine the scientific truth regarding safety and risk.

Given the significant, irreparable and irreversible effects of toxic substances, the courts should encourage the elimination or, at least, reduction of such effects. The traditional causation requirements presume that the substances associated with industrial processes are harmless until the plaintiff demonstrates otherwise. This approach does not promote the reduced release of toxic substances. As such, the courts must adopt an alternative approach which encourages such a reduction. By being guided by the notion of precaution, the courts can achieve this goal without stifling technological and scientific development.

By applying its ability to draw inferences of causation guided by the notion of precaution, the deterrence effect of tort law is enhanced. In contrast, strict application of the traditional causation requirements can undermine the deterrence goal of tort law. For example, toxic tort litigants often encounter the problem of the indeterminate plaintiff. That is, the evidence establishes that the defendant caused harm but it cannot be conclusively attached to any particular plaintiff. The effect of denying the existence of a causal relationship in these cases is to allow the defendant to escape liability for harm he most certainly has caused. Similarly, in the case of indeterminate defendants, it can be established that all defendants acted in a negligent manner; however, due to the fungible nature of the product it cannot be established which particular defendant harmed the plaintiff. Again, denying the existence of a causal relationship has the effect of safeguarding the defendant against liability for his tortious actions.
By drawing inferences of causation guided by the principle of precaution, the problems of the indeterminate plaintiff and the indeterminate defendant are resolved. In either case, the evidence adduced by the plaintiff would be sufficient to permit an inference of causation. The onus would then fall upon the defendant to exonerate himself from liability. Thus, the defendant is not able to hide behind the barrier of scientific uncertainty to avoid liability for the consequences of his actions. If a producer or user of toxic substances is aware that he will be held liable for injuries caused by his actions, then he will be encouraged to conduct more thorough initial tests on the substances which he intends to produce or use. In addition, a producer or user will be encouraged to develop methods for the containment and mitigation of harmful effects of toxic substances. Ultimately, the producers and users of toxic substances will be encouraged to eliminate or reduce the adverse effects of such substances.

Since the courts' ability to draw inferences of causation will be guided by the notion of precaution, toxic tort plaintiffs will be more successful in their claims. This result causes some concern. There is the concern that the gates will open to a flood of toxic tort litigation which will pressure an already overloaded judicial system and may lead to corporate bankruptcies. Concern surrounding the overloaded judicial system should not be allowed to push aside the protection of human health and the environment. In the light of mass toxic disasters, the legislative bodies may decide to create alternative mechanisms to remedy injured parties thereby relieving pressure on the judicial system. As well, in response to mass toxic tort actions, the courts may implement procedural mechanisms, such as class action certification, to
ease congestion of the judicial system. In any event, administrative convenience is not a valid justification for the denial of justice.

The concern surrounding the possibility of corporate bankruptcy is not unfounded. The Johns Mansville Company was driven into bankruptcy as a result of toxic tort claims based upon exposure to asbestos. Similarly, Dow Corning entered into bankruptcy in response to numerous claims for damages arising from allegedly defective implants. Ultimately, this concern can be addressed by reference to the values in conflict in toxic tort litigation. The courts must determine the extent of risk from toxic exposure which will be tolerated in order to protect corporations from bankruptcy. In particular, the courts must assess whether corporate viability is important enough to impose the burden of industrial growth on the public at large rather than on the creators of risk. The courts must decide which value - human health or corporate health - has priority.

Alteration of the traditional requirements for proof of causation also raises the concern that a defendant may be held liable even if he did not harm the plaintiff. Since the causation problem in toxic tort litigation arises in the light of scientific uncertainty which cannot be resolved, it is no answer that the defendant has the opportunity to adduce evidence to contradict the inference of causation drawn by a court. If the traditional requirements for proof of causation are not altered, the plaintiff will usually stumble on the issue of causation. Thus, the courts must choose between two possible injustices - that the defendant is required to pay compensation for a harm he did not cause or that the plaintiff is not compensated for the harm which the defendant caused. In the former case, the defendant is subject to excessive liability. The result
may be a chilling effect on technological and scientific progress. At the very least, the producers and users of toxic substances will be encouraged to perform more extensive testing, monitoring and containment of the substances associated with technological and scientific progress. In the latter case, the plaintiff is not compensated for his injuries and the defendant is not held responsible for his actions. There is little encouragement to test, monitor or contain the substances associated with technological and scientific progress. The defendant is allowed to continue production or use a substance with significant, irreparable and irreversible effects until there is proof on a balance of probabilities that the substance is harmful. The latter approach does little to respond to the effects of toxic substances. The courts must determine which potential injustice - the over-compensation of a victim of toxic exposure or the unchecked use of toxic substances - can be better tolerated.

**Conclusion**

The immense social benefits of technological and scientific development have been accompanied by an increased release of persistent, toxic substances into our environment which may have devastating effects. Unfortunately, current scientific knowledge regarding the effects of many substances is limited. In addition, the etiology of many diseases is unknown. Given that reliance on scientific evidence is necessary to establish toxic causation and that such evidence is uncertain, the traditional requirements for proof of causation often present an almost insurmountable barrier to success in toxic tort litigation.
The requirements for proof of causation set by the courts determine the extent to which the general public will be exposed to the risks associated with technological and scientific progress. Individuals will be less successful in protecting their rights to physical integrity and property if the requirements for proving causation are set too high. Consequently, the general public will be exposed to greater risk of harm by toxic substances associated with technological and scientific activities. Further, the true cost of such activities, including adverse environmental effects, will not be considered in valuing technological and scientific activities. On the other hand, overly lax causation requirements will stifle technological and scientific development by placing an excessive burden on the producers and users of toxic substances.

By adjusting the causation requirements, the courts can promote technological and scientific progress while maintaining an acceptable level of risk of exposure to toxic substances. The notion of causation as expressed by the Supreme Court of Canada in *Snell v. Farrell* should be exploited by toxic tort litigants to ease the traditional requirements for proving causation. A plaintiff may adduce sufficient evidence to create an inference adverse to the defendant even though he may not be able to establish causation on a strict balance of probabilities. The ability of the courts to draw an inference of cause-in-fact, even though there may not be conclusive evidence of such, will be greatly benefit toxic tort plaintiffs.

The notion of precaution should guide the ability of the courts to draw inferences of causation. In other words, if the extent of risk associated with a particular scientific or technological process is uncertain, the courts should allow only cautious progress with such processes to avoid further harm. Once a toxic tort plaintiff has demonstrated a rational connection between
his injury and an act of the defendant, the courts should draw an inference of causation unless the defendant adduces contradicting evidence. A rational connection can be established by evidence that the defendant did release the substance which the plaintiff alleges caused his harm and by some evidence that the substance can cause harm to living organisms.

This approach, in contrast to the traditional approach, encourages the courts to explicitly weigh the social value of technological and scientific development with the individual rights to personal integrity and property. The courts can determine, as a matter of policy, the extent of risk from toxic substances to which the general public should be exposed. This approach moves from the traditional requirements for proof of causation which effectively presume that new technological and scientific development are harmless until proven otherwise. The traditional approach places the burden of proving that a particular technological or scientific process is harmful upon the victims of toxic exposure. In contrast, by being guided by the notion of precaution, the courts do not presume technological and scientific developments to be harmless and do not require a plaintiff to prove otherwise. Rather, the courts will explicitly consider the appropriate level of risk from toxic substances to which the general public will be exposed. In the light of evidential uncertainty, the courts should make the decision designed to prevent further harm.
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