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Reformation of the Burden of Proof

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REFORMATION OF THE BURDEN OF PROOF

TORT—Radioactive Fallout—Problems with Burden of Proof—Need for a Change

FACTS

Between 1951 and 1962 the United States government, through the Atomic Energy Commission, conducted open-air atomic testing at the Nevada Proving Ground.¹ This testing caused radioactive fallout to drift from the Nevada Test Site (NTS) and settle upon isolated communities in southern Utah, northern Arizona, and southeastern Nevada. Two of these detonations are most notable in that they yielded large amounts of nuclear fallout. The first detonation yielded 24.4 kilotons² and occurred on March 24, 1953; the second occurred on May 19, 1953 and yielded 32.4 kilotons.³ A kiloton is equivalent to 1000 tons of a TNT explosion.⁴ However the amount of radiation, not the explosive force, is what is important for purposes of this casenote. It is estimated that 17 percent of the vital energy released by a detonation is the result of radiation.⁵ Consequently, these two detonations released large amounts of radioactive fallout into the atmosphere.

At the time of these test shots several thousand sheep had been grazing close to the detonations within an area forty miles north to 160 miles east of the test site.⁶ Side effects from these detonations began to appear shortly thereafter. Several thousand sheep suddenly died.⁷ The Atomic Energy Commission (AEC) sent out a team of veterinarians to determine the cause for the large numbers of dead sheep. The veterinarians discovered many of the adult sheep to have skin lesions and evidence of radiation in various internal organs.⁸ The majority of lambs were born dead or in

1. The Nevada Test Proving Ground Site was established on December 18, 1950 by order of President Truman. The Site was established at a time of international crisis perceived as a threat to world peace and national security. In 1947 Russia had overthrown the Czech government. In 1949, communist forces overran China. Hostilities broke out between Korea and the United States of America in 1950. Accordingly, the President committed the resources of the Atomic Energy Commission (AEC) to the rapid development of nuclear weapons. See *Bulloch v. United States*, 95 F.R.D. 123, 126 (D. Utah 1982).

2. *Id.* at 126.

3. *Id.*

4. WEBSTER'S DICTIONARY 1242 (3rd ed. 1976).

5. THE COMMITTEE FOR THE COMPILATION OF MATERIALS ON DAMAGE CAUSED BY THE ATOMIC BOMB IN HIROSHIMA AND NAGASAKI, HIROSHIMA AND NAGASAKI 31 (1979).

6. *Bulloch*, 95 F.R.D. at 126, 129.

7. *Id.* at 129.

8. *Id.* at 131.

a stunted condition.⁹ Two of the veterinarians reported to the AEC that radiation was at least a contributing factor to the birth defects.¹⁰

When the AEC learned that the ranchers might sue the government for the loss of their sheep, it asked the two veterinarians to reconsider.¹¹ One refused to change his report. As a direct result, his report remained unpublished.¹² The other signed a "model" letter written by the AEC which stated radiation was not the cause of the defects.¹³

In 1956 the ranchers sued the federal government in the United States District Court for the District of Utah to recover their financial losses.¹⁴ The ranchers had to prove that the radiation fallout was the cause of the sheep's death. However, the ranchers were not able to provide enough evidence to substantiate their claim, and the court ruled against them.¹⁵

In 1979 congressional hearings on AEC activities revealed that during the 1956 trial, government attorneys had concealed documents and data.¹⁶ The AEC had falsified documents. It had pressured investigators and witnesses to change their testimony or not to testify at all.¹⁷ This resulted in the ranchers filing, in 1982, an independent action and motion to set

9. *Id.* at 132.

10. Dr. Robert Veenstra concluded in June 1953: "In view of hyperplasia, presence of detectable gamma radiation in the bone marrow, skin lesions, possibility of toxins due to the lesions and the pregnancy of many ewes, it is my opinion that radiation was at least a contributing factor to the loss of these animals." *Id.* at 134. Dr. Robert Thompsett also concluded radiation was a contributing factor. *Id.* at 137.

11. The AEC, in a letter to Veenstra requested him to change his report.

The scoop is that the ranchers are about to start suing the government for those 1953 losses . . . In the last report . . . you rendered, I got the distinct feeling that you felt that there was a chance that radiation could have caused the death of some of the sheep at least. In the interim substantial work has been done which may have caused you to change you're [sic] mind . . . If you haven't changed your mind I'd like to know what you are basing your opinion on. . . ."

Id. at 134.

12. *Id.* at 135.

13. The model letter signed by Thompsett stated, in part:

I was of the opinion that radiation caused the deaths of sheep or at least contributed to them and due to the presence of affected horses and cattle too, the situation appeared to me to be very serious. Subsequently I've re-evaluated my position as more information became available. . . . I believe it is reasonable to assume sheep could tolerate with impunity the maximum radiation dose possible under the range condition in 1953 . . . In conclusion, let me say my opinion, as of now, is in agreement with the statement of AEC and US Department of Public Health released at Salt Lake City, January 12, 1954.

Id. at 137.

14. *Bulloch v. United States*, 145 F.Supp. 824 (D. Utah 1956).

15. *Id.* at 828.

16. In 1979 Congress and the Department of Health, Education and Welfare conducted investigations of the health effects of low level radiation. The hearings were held at Salt Lake City, Utah, Las Vegas, Nevada, and Washington, D.C. During the course of the investigations, it was admitted by government officials that government attorneys concealed documents and falsified data. See *Bulloch*, 95 F.R.D. at 128.

17. *Id.*

aside the 1956 judgment.¹⁸ The United States District Court for the District of Utah vacated the 1956 judgment and held that the government had conducted a species of fraud on the court.¹⁹

The effects caused by the fallout from the detonations began to appear in the human population around 1965.²⁰ The effects were severe. Twenty-nine people within a one block radius in St. George, Utah became afflicted with leukemia or cancer.²¹ Prior to 1965, St. George had the lowest cancer rate in the country.²² A United States public health study found thyroiditis²³ had increased twofold; thyroid cancer had increased fourfold, which amounted to a 120 percent increase in thyroid cancer above the control groups in other areas.²⁴ In 1965 seventy children in St. George had thyroid nodules. Their leukemia rate was twenty-four times higher than the expected rate among children in the United States.²⁵

In *Allen v. United States*,²⁶ the cancer victims or the personal representatives of the victims brought suit against the government. They alleged the injuries and deaths were caused by the testing conducted at the Nevada Test Site between 1951 and 1963. This tort action was a consolidation of the individual claims of 1,192 named plaintiffs.²⁷ It was not a class action. Twenty-four were selected as "bellwether cases." These were typical cases which, when decided and reviewed, could provide a legal and factual pattern against which the remaining issues in the pending cases could be matched.

HOLDING

The United States District Court for the District of Utah found eight of the twenty-four plaintiffs had established that radiation exposure from the fallouts was a substantial factor in causing their injuries. The re-

18. The action filed by the ranchers was *Bulloch v. United States*, 95 F.R.D. 123 (D. Utah 1982).

19. *Id.* However, the government appealed in *Bulloch v. United States*, 721 F.2d 713 (10th Cir. 1983). The court held the congressional findings resulting from the 1979 hearings were not sufficient to prove the government had conducted fraud upon the court.

20. Reasons for the effects to appear later in humans may be that 1) they were located further from the NTS than the sheep and 2) the biological differences which exist between sheep and humans.

21. Fuller, *The Day We Bombed Utah*, OMNI 136 (May 1983).

22. *Id.*

23. Thyroiditis is an inflammation of the thyroid gland which is due to irritation to the gland. WEBSTER'S DICTIONARY 2388 (3rd ed. 1976).

24. These conclusions were found by Edward Weiss, a public health expert who studied leukemia and cancer effects of the fallout in Utah for the U.S. Public Health Services. Fuller, *supra* note 21, at 136.

25. *Id.*

26. 588 F. Supp. 247 (D. Utah 1984). The court dealt with extensive pre-trial motions in its earlier opinion. *Allen v. United States*, 527 F.Supp. 436 (D. Utah 1981), before deciding the major issues of government liability in *Allen v. United States*, 588 F. Supp. 247 (D. Utah 1984).

27. *Allen*, 588 F. Supp. 258.

maintaining plaintiffs failed to establish such causation.²⁸ Those plaintiffs who won presented scientific evidence to establish the connection between their injuries and exposure to radiation. No such evidence was available for those plaintiffs who lost. The winning plaintiffs received damages from the United States.²⁹ Those who lost received nothing. The major difference, therefore, between the winning and losing plaintiffs was the ability to prove their injuries were caused by exposure to radiation.

This casenote will focus on those plaintiffs who lacked scientific data to prove causation, and whether they could have successfully done so by using a modified "precursor symptoms theory."³⁰ To fully understand the nature of the problem of proving substantial causation in *Allen*, a brief background of the hazards associated with fallout and the difficulties of dose measurement will be presented. *Allen* will then be compared with recent cases where proof of "substantial connection" was required. It will be demonstrated why substantial connection is appropriate in other cases but not in *Allen*. In conclusion, it will be shown how the majority of plaintiffs who lost in *Allen* could have succeeded under a modified precursor symptoms theory.

Although it is not clear from *Allen* whether the plaintiffs requested the application of this theory, it is clear the court took notice of plaintiffs' difficulty in proving causation. Consequently, the court allowed plaintiffs to prove a substantial connection between their injuries and exposure to radiation, which is a lesser burden of proof. However, this was not effective because only eight of the twenty-four plaintiffs proved radiation exposure was a substantial factor in causing their injuries.

BACKGROUND

A. Radiation

The hazards to which the plaintiffs were exposed in *Allen* were a result of fallout from detonations. Fallout is the residual radiation present in the smoky ashes of the fireball which occurs after detonation. There are two ways in which one can be exposed to radioactive materials: external or internal exposure.

External exposure is direct contact with fallout materials.³¹ The particles settle upon skin or clothing. They fall on houses or cars or other nearby surfaces. Internal exposure is the product of a number of environmental processes. Fallout falls on crops or other food exposed to the air. This

28. *Id.* at 428-92.

29. *Id.* at 446-47.

30. Under the "precursor symptoms theory," a plaintiff can prove his case based on circumstantial evidence. The term was coined by Christine M. Grant. See Grant, *Establishing Causation in Chemical Exposure Cases: The Precursor Symptoms Theory*, 35 RUT. L. REV. 163-94 (1982).

31. *Allen*, 588 F. Supp. 288.

food is then ingested by humans and animals. Fallout deposited on grasslands is later ingested by humans who consume the meat from the cattle and sheep which had grazed on the pasture. The particles land in the water, contaminating fish or drinking water. Weather, distance, time, shielding,³² and the strength of the detonation are all variables which affect the amount of the yield.³³

The plaintiffs in *Allen* faced the problem of correctly determining the fallout levels they were exposed to. Beta-emitting fallout levels³⁴ in Utah, immediately downwind from the NTS, were monitored by only one station in Salt Lake City.³⁵ As a general rule, NTS monitors only counted gamma radiation³⁶ at off-site centers, ignoring the beta count altogether.³⁷ The majority of rays which drifted to the surrounding areas were beta rays. Consequently the amount of radiation to which the public was exposed was not measured. The *Allen* plaintiffs could not determine the dose of beta radiation which they might have received.³⁸

Proof that exposure to fallout caused the injury is further complicated by the nature of the injuries suffered, the nature of the causation mechanism alleged (ionizing radiation from other sources), the extraordinary time factors, and other variables.³⁹

First, radiation does not cause every case of cancer or leukemia. Not every individual exposed to radiation develops cancer. However, a population exposed to a certain dose of radiation will show a greater incidence of cancer than the same population would have shown in the absence of such exposure.⁴⁰

Second, when the cancer or leukemia is alleged as an injury, the specific clues as to cause or source are usually lacking. A radiation-induced cancer cannot be distinguished from a cancer of the same organ arising from the unknown causes we so commonly lump together as 'spontaneous'.⁴¹ Se-

32. Shielding means protection from fallout by being indoors or having clothing on. *Id.* at 308.

33. The yield is the amount of radioactive material which was generated from the detonation. *Id.* at 288.

34. Beta radiation is an electron or positron emitted by the nucleus of an atom during radioactive decay. It is not as potent as gamma rays but does have a greater range. The beta-emitting fallout levels are the amounts of beta radiation emitted by the detonation. *Id.* at 268-79.

35. *Id.* at 304.

36. Gamma radiation is a form of electromagnetic radiation. It contains much more energy than alpha or beta radiation. However, gamma radiation does not have as great a range as beta radiation. *Id.* at 268-79.

37. *Id.* at 305.

38. In 1980, the Committee on Biological Effects of Ionizing Radiation of the National Research Council (the "BEIR-III Committee") reported that dose rate may affect the risk of cancer induction, but believes that the information available on man is insufficient to adjust for it. *Id.* at 326.

39. *Id.* at 405.

40. *Id.*

41. *Id.* at 406.

rious genetic effects from radiation may affect future generations of offspring. Such generations may be congenitally injured.⁴² Moreover, man is subject to exposure from other ionizing sources both man-made and naturally occurring.⁴³ It is evident that the plaintiffs in *Allen* faced great difficulties in proving radiation caused their injuries. The very nature of radiation, its characteristics and qualities, complicated the burden of proof.

B. Substantial Connection

Causation-in-fact is an essential element of any personal injury action.⁴⁴ If a plaintiff cannot prove that a defendant's action is the cause-in-fact of plaintiff's injury, the plaintiff cannot recover damages from the defendant.⁴⁵ The plaintiff must prove her case by a preponderance of the evidence.⁴⁶ To do this, the plaintiff must present evidence which leads a jury to conclude the existence of a contested fact is more probable than its nonexistence. The contested fact is whether defendant's actions caused plaintiff's injury.

However, where the plaintiff has no means of identifying the specific cause-in-fact of her injury, she need only prove a substantial connection between the cause and the injury. The burden of proof then shifts to the defendant to prove to the contrary.⁴⁷ The theory of substantial connection was adopted by the courts when cases began appearing where the plaintiff could not identify the specific cause-in-fact of the injury.⁴⁸

For example, in *Sindell v. Abbott Laboratories*⁴⁹, drug companies which had manufactured DES⁵⁰ were sued by the children whose mothers had taken the drug during pregnancy. The result of the mothers' taking this drug while pregnant caused their children to later have cancer. In *Sindell*, the plaintiff was unable to identify the specific cause-in-fact of her injury. She was, however, able to establish general causation—the tendency of DES to cause certain rare types of cancer—and negligence in the marketing and labeling of the product. The plaintiff established a substantial

42. Congenital injuries occur when a chromosome is deleted by radiation passing through a cell in the lining of the stomach. Deletion of this chromosome in the germ cells of the reproductive system may viably affect a child yet unborn. *Id.* at 322.

43. *Id.* at 327. Naturally occurring radiation derives from a number of sources such as uranium, thorium, radium, radon, and polonium. It is in the soil, in building materials, and in trace amounts in meat, vegetables, fruits, grain, and water. The most prominent source of man-made radiation is x-rays.

44. PROSSER, LAW OF TORTS, 241 (4th ed. 1985).

45. *Id.*

46. *Id.*

47. *Id.*

48. *Id.*

49. 26 Cal.3d 588, 607 P.2d 924, 163 Cal. Rptr. 132, cert. denied, 449 U.S. 912 (1980).

50. DES stands for diethylstilbestrol, a drug which was used for the purpose of preventing miscarriages. *Id.* at 925.

connection between the ingestion of DES and cancer. The burden of proof then shifted to the drug manufacturers to show that their drug was not ingested by that plaintiff. The defendants failed to meet their burden of proof and the Supreme Court of California held for the plaintiff. All the manufacturers of DES named in the suit were liable for the plaintiff's injuries. The plaintiff had presented sufficient scientific data to prove DES caused her particular injury.

Another example in which the plaintiff met the required burden of proof was *Smith v. Ithaca Corp.*⁵¹ The plaintiff, decedent's wife, sued her husband's employer in a wrongful death action. The decedent was a crewman on a shipping tanker for 161 days. For forty-one days, the tanker transported benzene.⁵² Two days after the decedent completed the ship duty, he suffered a fatal heart attack. The decedent had a preexisting heart condition. The plaintiff established through expert testimony that benzene is a toxic substance whose vapor in sufficient concentrations is harmful and affects heart disorders.⁵³ Although the employer contended that decedent could only have been exposed to the fumes for two days, crew members testified that fumes were present in the ship's quarter because of faulty ventilation. Again, this was a case where specific cause-in-fact could not be proved. Nonetheless, the court held for plaintiff because she presented sufficient scientific evidence to establish the substantial connection between the exposure to benzene and the resulting death of her husband.

In *Ithaca* and *Sindell* the plaintiffs could not identify the specific cause-in-fact so the courts required them to prove a substantial connection between the harm they were exposed to and the resulting injuries.⁵⁴ The plaintiffs were able to do so by providing scientific evidence which linked the damaging element to their injuries. Consequently, the defendants in these cases were held liable for plaintiffs' injuries.⁵⁵

The plaintiffs in *Allen* also could not prove specific cause-in-fact. Therefore, the district court in *Allen* required proof of a substantial connection before the government would be held liable. For those eight cases where scientific evidence existed, the plaintiffs could link their injuries to the

51. 612 F.2d 215 (9th Cir. 1980).

52. Benzene is a toxic substance present in industrial chemicals. Employees in any of the following industries risk exposure to benzene on a daily basis: chemical printing and lithography; fabricating rubber and rubber cement; manufacture of paint, varnish, stain remover, and adhesives; production of petroleum; the sale of petrol to stations; and operation of medical labs. Grant, *supra* note 30, at 120, n. 33.

53. An expert testified that the fumes would have aggravated decedent's underlying heart condition. A medical toxicologist testified that six to eight weeks of exposure to benzene could cause the chronic effects decedent suffered. *Ithaca*, 612 F.2d at 218-19.

54. *Sindell*, 607 P.2d 928; *Ithaca*, 612 F.2d 216.

55. *Sindell*, 607 P.2d 943; *Ithaca*, 612 F.2d 226.

radiation they were exposed to. However, most of the plaintiffs' injuries have not yet been scientifically proven to be associated with radiation exposure. Yet enough circumstantial evidence⁵⁶ did exist to provide a logical connection between the injuries plaintiff suffered and the radiation exposure caused by the detonations.

ANALYSIS

The precursor symptoms theory suggests five elements upon which a toxic tort plaintiff can rely to prove causation by circumstantial evidence.⁵⁷ Those elements are proof of (1) existence of exposure to a particular chemical; (2) the level of exposure such as the total amount, frequency and duration; (3) previous occurrence of symptoms associated with exposure to that particular chemical; (4) demonstration of the chemical's association with the disease caused by the chemical; and (5) length of time following exposure.⁵⁸ These elements, with some modification, can be applied to the plaintiffs in *Allen*.

The nature of the case in *Allen* is very similar to that of a toxic tort action.⁵⁹ The toxic tort victim suffers an injury caused by a chemical substance. Some chemical substances have been demonstrated to cause an injury. However, other toxic chemicals are undemonstrated.⁶⁰ The undemonstrated chemical leaves no evidence of its contact with the victim; neither plaintiff nor defendant can produce direct evidence to prove or disprove cause-in-fact. Shifting the burden would not help. For expert testimony to have weight, it must be based on reasonable medical certainty and scientific data. Expert testimony cannot satisfy the requisite standard of reasonable medical certainty when the expert's conclusion that the chemical caused the injury is based solely on the fact of exposure and the fact of the appearance of the disease years later.⁶¹

The injuries suffered by the losing plaintiffs in *Allen* can be labeled as undemonstrated. Expert testimony in *Allen* did not hold much weight because of the lack of reasonable medical certainty. Not enough scientific data existed. Therefore, the plaintiffs could only show exposure to radiation and the appearance of the disease years later. However, some of

56. See *infra* notes 79-85 and accompanying text. A toxic material is "one which demonstrates the potential to induce cancer, to produce long-term disease or bodily injury, to affect health adversely, to produce acute discomfort, or to endanger the life of man or animals through exposure through the respiratory tract, skin, eye, mouth or other routes." *Grant, supra* note 30, at 165, n. 12.

57. *Grant, supra* note 30, at 190.

58. *Id.*

59. A toxic tort cause of action is brought by a victim who developed a serious latent disease following prolonged exposure to a chemical. *Id.* at 164.

60. An undemonstrated chemical is one which has yet to be associated with injuries as a result of exposure to the chemical. *Id.* at 168.

61. *Id.* at 189.

these plaintiffs could prove radiation caused the injury by use of a modified precursor symptoms theory. It must be modified because although the chemical and radiation victims face the same problems of proving causation, the symptoms vary between chemical injury and radiation received.

The first element of the theory requires a showing that the victim was exposed to the harmful substance. The plaintiffs who lived in the geographical area where the fallout drifted sometime around 1953 would be able to prove exposure to the radiation. This was one factor which all the plaintiffs had in common.⁶² During the course of the trial it became an established fact that the fallout, specifically from the 1953 detonations, drifted from the NTS and settled upon isolated communities in southern Utah, northern Arizona and southeastern Nevada.⁶³

The second element, the level of exposure, is not specifically known. Weather, shielding, distance, and the lack of monitoring make this element harder to prove.⁶⁴ Yet this element may not even be that relevant for the plaintiffs in *Allen*. Science has established that increased exposure to radiation yields, even at "low" doses, increases risk of human cancer and leukemia.⁶⁵ The court in *Allen* noted it would be absurd to reconstruct the estimated exposure of fallout by detonating atomic weapons in the open air to reproduce the fallout effects.⁶⁶ The court focused on how much additional risk the plaintiffs were exposed to.⁶⁷ For radiation victims it is not the amount of radiation but the risk to exposure which is relevant. Therefore, the second element of the precursor theory should be modified accordingly. Instead of proof of amount of exposure, proof of increased risk of exposure would be required.

The third element of the theory requires the plaintiffs to prove that after exposure to radiation they began to experience symptoms of an illness. These symptoms are labeled as precursor: "symptoms or diseases which, more often than not, precede the appearance of another disease, and which may have been caused by the same agent or agents as that for which compensation is sought. . . ."⁶⁸ For instance, thyroiditis, an inflammation of the thyroid glands, would be a precursor symptom. Children in St. George contracted thyroiditis and many later came down with leukemia—cancer of the thyroid glands.⁶⁹ However this third element is difficult to apply to cancer. Sometimes one has cancer without discovering

62. *Allen*, 588 F. Supp. 429-42.

63. *Id.* at 372, 379.

64. See *supra* note 32 and accompanying text.

65. *Allen*, 588 F. Supp. 425.

66. *Id.*

67. *Id.*

68. Grant, *supra* note 30, at 170, n. 38.

69. See *supra* notes 21-25 and accompanying text.

it until much later. Proof of an increased incidence of cancer in the population could be used instead to accommodate the radiation victim. There was an increased incidence in colon cancer, stomach cancer, breast cancer among women, and thyroid cancer.⁷⁰

The fourth element of the theory requires the plaintiffs to demonstrate that the radiation exposure resulted in cancer. The chemical victim must establish three interrelated propositions: (1) the chemical is generally associated with the disease, (2) the chemical is demonstrated to be associated with the precursor symptoms at the proven level of exposure, and (3) the disease, when found, has never been known to occur in the absence of the precursor.⁷¹ The radiation victims could prove that the exposure is associated with the disease. Scientists know that radiation exposure can cause cancer.⁷² In addition, they know what types of cancer can occur because of radiation exposure.⁷³ However the level of exposure would have to be modified as was done with element two of the theory because the level cannot be adequately assessed.⁷⁴ It would be sufficient to show an increased risk of exposure. The victim could not show that the cancer caused by radiation had never been known to occur in the absence of precursor symptoms of cancer. Cancer sometimes can occur without any precursor symptoms.⁷⁵ Furthermore, cancer can occur without exposure to radiation.⁷⁶ It would be sufficient for plaintiffs to show an increased incidence of that type of cancer in the same geographic vicinity.

The fifth element of the theory requires the victim to prove that the latency period⁷⁷ associated with the exposure is consistent with and characteristic of the particular disease. Many of the cancers the *Allen* plaintiffs developed were discovered within the known latency period associated with exposure to radiation and developing the cancer. For instance, evidence of stomach cancer experienced by one of the plaintiffs did not surface for 17 years.⁷⁸ This time period is consistent with scientific data.

Consequently, under a modified precursor symptoms theory, there are a number of *Allen* plaintiffs who lost who could prove the following: (1) they were exposed to radiation; (2) the exposure created an additional risk of contracting cancer; (3) there was an increased incidence of cancers within the areas located near the NTS which occurred after the detona-

70. *Allen*, 588 F. Supp. 431-43.

71. *Gran*, *supra* note 30, at 192.

72. *See supra* note 40 and accompanying text.

73. *Allen*, 588 F. Supp. 431-43.

74. *See supra* notes 34-38 and accompanying text.

75. *See supra* notes 39-43 and accompanying text.

76. *Id.*

77. Latency period is the time between when one is exposed to a cancer-causing factor and the time the cancer has surfaced.

78. *Allen*, 588 F. Supp. 434.

tions; (4) the cancer contracted is associated with radiation exposure; and (5) the latency period associated with exposure to radiation was consistent with and characteristic of the particular cancer. The following provides three different instances where losing plaintiffs in *Allen* stand a better chance of proving causation by using the modified precursor theory.

First, in two separate instances, women diagnosed as having ovarian cancer failed to prove a substantial connection between their cancer and radiation exposure.⁷⁹ The district court found that the plaintiffs failed to prove a substantial connection because of the paucity of evidence of an increased incidence and the tenuous correlation associated with that cancer and radiation.

By applying the modified precursor theory, the following can be shown: 1) the women lived in geographical proximity to the NTS at the time of the fallout; 2) the exposure to radiation created additional risks of developing ovarian cancer;⁸⁰ 3) there existed an increased incidence of ovarian cancer; however, it was slight;⁸¹ 4) the cancer is associated with radiation exposure; and 5) the latency period was consistent and characteristic with ovarian cancer.

The fact that two elements are weak, i.e., the increased incidence and correlation between radiation exposure and ovarian cancer, create a gap. Thus the plaintiffs fail to prove a substantial connection. However, the modified precursor theory enables a plaintiff to combine all the elements to build a case. Where a gap exists, such as lack of scientific evidence, the sum of other factors increases the inference radiation exposure caused the cancer.

A second instance in *Allen* where a plaintiff lost concerned a victim who had stomach cancer.⁸² The victim satisfied the following elements: 1) he resided in geographical proximity to the NTS; 2) there was an increased risk of exposure to radiation; 3) there existed an increased incidence of stomach cancer; 4) stomach cancer is associated with radiation exposure; and 5) he satisfied the requirements of the latency period. However, this victim lost. The court held the stomach cancer could be a result of coal mining, which was predominant in that area, and therefore this plaintiff could not prove a substantial connection between exposure to radiation and his injury.⁸³

79. *Id.* at 430.

80. *Id.*

81. Admittedly, this factor is weak; however, it is not as weak as the court made it. The sensitivity of these organs is lower than other human tissues. "It is admitted that each individual reacts differently to exposure to radiation." Therefore a significant increase would be impossible because (1) the population is limited to women and (2) the organs' sensitivity is low so only those women whose ovaries are sensitive to radiation would be at risk, i.e., a minority.

82. *Allen*, 588 F. Supp. 434.

83. *Id.*

The fact coal mining could be a contributing factor created a gap in proving causation. By using the modified precursor theory, a strong case could be built to overcome this problem. All the elements of the theory are satisfied. At the very least coal mining may have contributed to this cancer, but in light of the other elements it could not be the sole reason.

The third instance from *Allen* where a plaintiff lost proves to be even more unjust. The victim suffered from lymphatic cancer.⁸⁴ The plaintiff satisfied the following elements: 1) she resided in geographical proximity to the NTS; 2) the exposure to radiation caused an increased risk of developing this cancer; 3) there was an increased incidence of this cancer; 4) this cancer has been associated with radiation exposure; and 5) the latency period was consistent. However, the court held the causal relationship was possible but the plaintiff failed to establish a substantial connection. The rationale for the court's holding was that this cancer is more likely observed in children, not adults.⁸⁵ The lack of scientific data strengthening the likelihood of adults developing this cancer was lacking and a gap resulted. The precursor theory fills this gap. By satisfying all the elements of this theory, as this victim did, the inference is quite conclusive radiation exposure caused the lymphatic cancer.

These three instances from *Allen* where the plaintiff lost range from the most difficult to prove to the easiest. The point is that even under the most difficult fact pattern, the precursor theory enables the plaintiff to present a stronger case. The plaintiffs do not have to prove all five elements of the precursor theory to be successful. They can prove fewer than five because it is the sum of the elements which decide whether the plaintiff has met her burden of proof. To prove substantial connection, failure of one or two factors is fatal.

CONCLUSION

The plaintiffs in *Allen* should not lose in a situation where the government has been so blatantly negligent in its duty to the people.⁸⁶ Under the modified precursor symptoms theory, sufficient circumstantial evidence exists to prove causation.⁸⁷ By not applying a new theory of proof

84. *Id.* at 440.

85. *Id.*

86. The government had a statutory duty imposed by the Atomic Energy Act of 1946, Act of Aug. 1, 1946 c. 724, 60 Stat. 755. The Act makes repeated express reference to the protection of health and safety as a significant goal for activities of the AEC created by that Act. See *Allen* 588 F. Supp. 348-50. The court found the government had breached its duty to the public for the following reasons: "The off-site personnel failed to adequately inform persons at risk of the dangers; they failed to adequately instruct persons at hazard how to avoid or how to minimize such risk; and failed to adequately, contemporaneously, and thoroughly measure and monitor such fallout. *Id.* at 40.

87. See *supra* notes 79-85 and accompanying text.

for radiation victims, the plaintiffs in *Allen* could not prove the substantial connection between exposure to radiation and their injuries. New theories of proof should be welcomed to aid victims of torts where scientific evidence supporting the victims is lacking. Only then, in light of the circumstances, can one say there has been a fair trial.

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