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Radiation Injury and the Atomic Veteran: Shifting the Burden of Proof on Factual Causation

By Allan Favish*

Since 1945, the United States Government has conducted over six hundred announced nuclear detonations.¹ The great majority of these tests have taken place at the Nevada Test Site, with over one hundred and twenty of these Nevada detonations occurring in the atmosphere.² In 1951, the Department of Defense (DOD) began troop maneuvers in conjunction with many of these tests. Although the last of these "atomic war games" was conducted in 1962, only recently have the circumstances surrounding the testing been disclosed.³ The facts are coming to light as a result of the difficulties

* B.A., 1977, University of California, Los Angeles. Member, Third Year Class. Many of the documents cited in this Note are on file with the *Hastings Law Journal*.

1. *Effect of Radiation on Human Health—Health Effects of Ionizing Radiation: Hearings Before the Subcomm. on Health and the Environment of the House Comm. on Interstate and Foreign Commerce*, 95th Cong., 2d Sess. 333 (1978) (statement of Dr. Donald M. Kerr) [hereinafter cited as *1978 Hearings*].

2. *Low Level Radiation Effects on Health: Hearings Before the Subcomm. on Oversight and Investigations of the House Comm. on Interstate and Foreign Commerce*, 96th Cong., 1st Sess. 66, 343 (1979) (statement of Mahlon E. Gates) [hereinafter cited as *1979 Hearings*]. See also *1978 Hearings*, *supra* note 1, at 341-67 (detailed list of announced United States nuclear detonations, including name, date, location, type, purpose, and yield); *1979 Hearings*, *supra*, at 111-41 (a similar but more recent list of announced United States nuclear detonations). Approximately 105 detonations took place in the Marshall Islands, while the remaining tests were at other locations, including tests off the San Diego coast in 1955 and 1962. See Noyes, O'Neill & Weir, *Operation Wigwam*, *NEW WEST*, Dec. 1, 1980, at 25; *New York Times*, Dec. 16, 1979, at 72, col. 4; *id.*, May 12, 1962, at 9, col. 2; *id.*, May 18, 1955, at 11, col. 3; *id.*, May 12, 1955, at 5, col. 1; *id.*, May 10, 1955, at 1, col. 3 (details of San Diego tests).

According to recently declassified documents, the Nevada Test Site was intended to handle "a few relatively low-order detonations" and then "only in the event of an emergency." *Washington Post*, Dec. 19, 1978, at A12, col. 4. President Truman's approval of the site was given before the Army Corps of Engineers completed its studies on radiological safety factors. *Id.*

3. See *1978 Hearings*, *supra* note 1; H. ROSENBERG, *ATOMIC SOLDIERS* (1980); M. UHL & T. ENSIGN, *G.I. GUINEA PIGS* (1980); *New York Times*, June 20, 1979, at A1, col. 1; Huyghe & Konissberg, *Grim Legacy of Nuclear Testing*, *New York Times*, Apr. 22, 1979, Magazine,

which many veterans and their dependents are having in recovering compensation for injury and death allegedly caused by radiation encountered at these tests.⁴

While today's soldier may receive training for an atomic battlefield through the use of a simulated nuclear explosion,⁵ the DOD wanted more than "simulation" in decades past. The military believed that actual nuclear explosions were necessary to accomplish its goals of troop indoctrination and training and the enhancement of public relations. The benefits of such maneuvers were seen on two levels. First, individual soldiers would receive training that would prepare them for a possible nuclear battlefield in the future. Second, the participating troops could be studied as to their combat performance and psychological reactions.⁶

at 34; Smith, *Atomic Veterans*, OMNI, Nov., 1980, at 14. Investigative reporter Paul Jacobs wrote an insightful article, published in 1971, on the power and responsibilities of the Atomic Energy Commission (AEC) which did not receive the attention it deserved. See Jacobs, *Precautions Are Being Taken By Those Who Know*, THE ATLANTIC, Feb., 1971, at 45-48, 53.

4. See *Veterans' Claims for Disabilities from Nuclear Weapons Testing: Hearing Before the Senate Comm. on Veterans' Affairs*, 96th Cong., 1st Sess. (1979) [hereinafter cited as *Cranston Hearings*].

5. See *1978 Hearings*, *supra* note 1, at 327 (statement of Major Alan Skerker, Dep't of the Army).

6. A memorandum from the Military Liaison Committee of the AEC to the Chairman of the AEC states: "Indoctrination in essential physical protective measures under simulated combat conditions, and observation of the psychological effects of an atomic explosion are reasons for this desired participation." Memorandum from Military Liaison Committee to Chairman, Atomic Energy Commission (July 16, 1951). A memorandum in reply gave approval for troop participation. Memorandum from Chairman, Atomic Energy Commission, to Chairman, Military Liaison Committee (Aug. 3, 1951). Moreover, a letter from the Armed Forces Special Weapons Project to the AEC's Division of Military Application stated the military's desire to "[o]ccupy a position at the time of detonation which is safe but not beyond a distance from ground zero which is reasonably sound from a tactical standpoint, and . . . [m]aneuver in the vicinity of ground zero as soon as practicable after the explosion." Letter from Armed Forces Special Weapons Project to Division of Military Application of the Atomic Energy Commission (Mar. 7, 1952). A subsequent letter stated: "It is emphasized that the Department of the Army desires to inject the maximum possible realism into the exercise." Letter from Armed Forces Special Weapons Project to Division of Military Application of the Atomic Energy Commission (Apr. 3, 1952).

The general who served as Exercise Director for the 1952 detonations concluded: "From the military standpoint, the analysis of the psychological reaction of the participating troops is probably the most important angle of the Exercise." Armed Forces Talk, Sept. 19, 1952, at 10. A Marine Corps general participating in the same tests stated that the "tests are especially valuable in demonstrating to the troops that the blast area does not necessarily remain deadly and that men can attack soon after an air burst without physical harm." *Id.* at 13. For details of psychological studies on troop reactions to atomic explosions, see *1978 Hearings*, *supra* note 1, at 244-48 (statement of Major Alan Skerker).

The Army established Camp Desert Rock just outside the Nevada Test Site in 1951. At least 80,000 troops from all parts of the country participated in Desert Rock exercises over the next decade.⁷ According to an Army document,⁸ the atomic bombs exploded in conjunction with troop maneuvers were detonated under a variety of circumstances. Bombs were suspended in the air by balloons, were secured to huge steel towers, and were dropped from airplanes.⁹ The troops were positioned at distances varying from twelve miles to just under one and a half miles from ground zero,¹⁰ sometimes in trenches and other times not.¹¹ After several blasts, troops moved within a few hundred yards of ground zero minutes after the detonation.¹² This advance would take place on foot, and by jeep, tank, helicopter, and parachute.¹³ When they were not assaulting a mock enemy, the troops might be examining the remains of equipment placed only a few hundred yards from ground zero,¹⁴ although on occasion the radiation was so intense

A Marine Corps report from 1955 analyzed the benefits of troop participation in atomic detonations, reasoning: "[T]roops were familiarized by realistic means with the passive defense measures which serve to minimize or protect against the effects of an atomic explosion. It served to remove apprehensions concerning the capability of the weapon. All hands gained a high degree of appreciation of its power as well as its limitations and its proper place in the family of weapons. . . . [T]he opportunity to conduct live monitoring exercises provides splendid training available by no other means." Report of Exercise, Desert Rock VI, Marine Corps, 3d Marine Corps Provisional Atomic Exercise Brigade, May 11, 1955, at VII-1, VII-2. See generally M. UHL & T. ENSIGN, G.I. GUINEA PIGS 63-66 (1980).

An Army report from 1957 states that one objective of troop participation at a particular detonation called "Smoky" was to "portray to the public the Army at its best." Exercise Desert Rock VII and VIII, Final Report of Operations, Nov. 25, 1957, at 36. The same report describes the testing of troops to measure their ability to field-strip rifles and sweep dummy minefields after witnessing an atomic explosion and to "navigate a combat course and throw dummy grenades in radiologically contaminated terrain." *Id.* at 39. See generally 1978 Hearings, *supra* note 1, at 263-65 (statement of Major Alan Skerker).

7. DEPARTMENT OF DEFENSE REPLIES TO QUESTIONS GIVEN TO DEFENSE REPRESENTATIVES BY THE SUBCOMM. ON HEALTH AND ENVIRONMENT, COMM. ON INTERSTATE AND FOREIGN COMMERCE, U.S. HOUSE OF REPRESENTATIVES, DESERT ROCK OPERATIONS, 95th Cong., 2d Sess., Jan. 25, 1978, at Topic B-2 (completed in conjunction with 1978 Hearings, *supra* note 1, unpublished but on file with Subcommittee) [hereinafter cited as DOD REPLIES TO QUESTIONS]. According to the DOD, at least another 120,000 military personnel were present at nuclear tests in the Pacific. However, a complete list of the military personnel present at these tests is lacking. *Id.*

8. See *Cranston Hearings*, *supra* note 4, at 29-71.

9. *Id.*

10. *Id.*

11. *Id.*

12. *Id.*

13. *Id.*

14. *Id.*

that the troops were not permitted to advance as planned.¹⁵ It was no secret that troops were participating in such maneuvers; much of the activity was covered by the press.¹⁶

This Note examines the circumstances surrounding the radiation exposure of these veterans. The Note first demonstrates that: (1) both the pathological and genetic dangers of ionizing radiation¹⁷ were known in the 1950's and 1960's;¹⁸ (2) the Atomic Energy Commission (AEC) delegated its responsibility for the safety of the soldiers to the DOD, which then authorized levels of radiation exposure in excess of levels recommended by the AEC's Division of Biology and Medicine;¹⁹ (3) the DOD's dosimetry program was so inadequate that the precise levels of exposure will never be known;²⁰ (4) the soldiers were given inadequate protection;²¹ (5) most of the soldiers were nonvolunteers and none were informed of the hazards involved;²² and (6) there has been little or no medical followup on these soldiers or their offspring, and many of their records have been lost or destroyed.²³

The Note next examines the administrative and legal entanglements that have effectively worked to deny relief to the many

15. *Id.* at 32, 37, 40-41, 67.

16. *See, e.g.*, New York Times, Mar. 25, 1953, at 24, col. 6; *id.*, May 2, 1952, at 1, col. 4; *id.*, Apr. 23, 1952, at 20, col. 1; *id.*, Nov. 3, 1951, at 6, col. 2; *id.*, Sept. 18, 1951, at 1, col. 5. Other news organizations such as *The Las Vegas Sun*, *Time*, *Newsweek*, and the wire services also carried reports of these maneuvers.

17. Ionizing radiation is electromagnetic energy that separates electrons from atoms. When this separation occurs in a human cell, biological changes can occur within the cell. The various forms of ionizing radiation, such as x-rays, gamma rays, beta rays, alpha rays, and neutron radiation, contain different physical properties and energy levels. Therefore, different measuring techniques and protection measures may be needed for each form of ionizing radiation. The classic unit of radiation measurement is the roentgen (r). When referring to human radiation exposure, however, two other units are most commonly used: the rad and the rem. The rad (radiation absorbed dose) is an expression of an amount of radiation energy that one gram of a particular substance will absorb. The rem (roentgen equivalent man) is similar to the rad, but it takes account of the different physical properties and biological effectiveness of the various forms of ionizing radiation. *See Low Level Ionizing Radiation: Hearings Before the Subcomm. on Energy Research and Production and the Subcomm. on Natural Resources and Environment of the House Comm. on Science and Technology*, 96th Cong., 1st Sess. 334-36 (1979) (statement of Donald S. Fredrickson); J. GOFMAN & A. TAMPLIN, *POISONED POWER* 32, 45-48 (1979).

18. *See* notes 29-36 & accompanying text *infra*.

19. *See* notes 37-38 & accompanying text *infra*.

20. *See* notes 40-44 & accompanying text *infra*.

21. *See* notes 45-47 & accompanying text *infra*.

22. *See* notes 48-64 & accompanying text *infra*.

23. *See* notes 65-79 & accompanying text *infra*.

veterans and their dependents who claim that participation in these tests²⁴ has caused cancer, genetic defects, and other health problems. The Veterans Administration has denied the great majority of these claims, maintaining that there is no causal connection between the testing and these health problems.²⁵ As a result, a number of claimants have resorted to the federal courts for relief.²⁶

The Note concludes that because of the unreasonable nature of the government's conduct, the burden of proof to establish factual causation should be shifted from the claimants to the government. It will be argued that such a shift is justified in these cases in accordance with emerging principles of tort law which provide that, under certain circumstances, when the causal link between an innocent victim's injury and the unreasonable conduct of another party is incapable of proof, then the burden of proof on factual causation should be shifted. In these cases, the loss resulting from failure of proof should fall on the negligent party rather than on the innocent victim.²⁷

24. For an example of veterans' testimony describing their presence at specific tests, see 1978 *Hearings*, *supra* note 1, at 143-48, 491-92.

25. See notes 80-95 & accompanying text *infra*.

26. See notes 96-109 & accompanying text *infra*.

27. See notes 110-39 & accompanying text *infra*.

Although this Note is concerned primarily with the troops who participated in the Nevada atomic explosions, much of the discussion is applicable to situations involving others who were exposed to radiation from atmospheric nuclear explosions, notably, the civilians who lived in the area surrounding the Nevada Test Site. See *Allen v. United States*, Civ. No. C-79-515 (D. Utah, filed Aug. 30, 1979) (class action by civilians). See generally STAFF OF SUBCOMM. ON OVERSIGHT AND INVESTIGATIONS OF THE HOUSE COMM. ON INTERSTATE AND FOREIGN COMMERCE, 96TH CONG., 2ND SESS., "THE FORGOTTEN GUINEA PIGS," A REPORT ON HEALTH EFFECTS OF LOW LEVEL RADIATION SUSTAINED AS A RESULT OF THE NUCLEAR WEAPONS TESTING PROGRAM CONDUCTED BY THE UNITED STATES GOVERNMENT (Comm. Print 1980) (report concludes that the AEC's desire to secure the nuclear weapons testing program took precedence over the Commission's responsibility to protect the public's health and welfare); *Health Effects of Low-Level Radiation: Joint Hearing Before the Subcomm. on Oversight and Investigations of the House Comm. on Interstate and Foreign Commerce and the Subcomm. on Health and Scientific Research of the Senate Labor and Human Resources Comm. and the Senate Comm. on the Judiciary*, 96th Cong., 1st Sess. (1979); 1979 *Hearings*, *supra* note 2; Fadiman & Jacobson, *The Downwind People*, LIFE, June, 1980, at 32; PEOPLE, Nov. 10, 1980, at 42; Chicago Tribune, Apr. 20, 1979, § 1, at 10, col. 1; *id.*, Apr. 5, 1979, § 1, at 1, col. 1; *id.*, Apr. 2, 1979, § 1, at 1, col. 1; *id.*, Apr. 1, 1979, § 1, at 1, col. 2; Los Angeles Times, Apr. 20, 1979, § 1, at 1, col. 4; New York Times, Apr. 20, 1979, at A1, col. 3; *id.*, Mar. 3, 1979, at 11, col. 1; *id.*, Feb. 24, 1979, at 8, col. 6; *id.*, Feb. 23, 1979, at A18, col. 1; *id.*, Feb. 15, 1979, at A15, col. 1; *id.*, Feb. 4, 1979, § 1, at 21, col. 1; *id.*, Jan. 8, 1979, at A16, col. 4; Washington Post, June 20, 1979, at A5, col. 1; *id.*, Apr. 19, 1979, at A1, col. 3; *id.*, Dec. 10, 1978, at A2, col. 3. The military personnel who entered Hiroshima and Nagasaki soon after the bombings were similarly exposed to such radiation. See generally Solomon, *Naga-*

Historical Background of the Atomic Testing Knowledge of Pathological and Genetic Hazards

At the time the government was exposing military personnel and others²⁸ to radiation from nuclear detonations, scientific knowledge about both the pathological and genetic hazards of ionizing radiation was substantial. Pathological hazards are those that affect the individual exposed to the radiation. These hazards include many types of cancer, tumors, and other diseases, a number of which have a latent period between the radiation exposure and the full effects of the disease. Genetic hazards are those that affect the offspring and future generations of the individual whose reproductive cells have been exposed to radiation. Damage to the reproductive cells can result in later generations of adversely affected individuals.

The medical literature from past decades is filled with articles that documented the causal relationship between radiation and several forms of cancer.²⁹ In 1956, the National Academy of Sci-

saki's Other Victims, the Growing Toll Among GI's Who Helped Clean Up, THE PROGRESSIVE, July, 1979, at 21; Los Angeles Times, Aug. 1, 1979, § 1, at 11, col. 4; *id.*, Aug. 5, 1970, § 2, at 5, col. 1; New York Times, June 9, 1979, at A14, col. 1; Washington Post, Aug. 12, 1980, at A14, col. 4. The military personnel who participated in the Pacific nuclear explosions were also exposed to ionizing radiation. See generally 1978 Hearings, *supra* note 1.

28. See note 27 *supra*.

29. A 1931 article in the *American Journal of Cancer* reported "overwhelming evidence" that luminous watch dial painters using radium paint had developed bone cancers because of the radiation with which they worked. Martland, *The Occurrence of Malignancy in Radioactive Persons*, 15 AM. J. CANCER 2435, 2509 (1931). See generally *La Porte v. United States Radium Corp.*, 13 F. Supp. 263 (D.N.J. 1935); *Vallat v. Radium Dial Co.*, 360 Ill. 407, 196 N.E. 485 (1935); Martland, *Occupational Poisoning in Manufacture of Luminous Watch Dials*, 92 J. A. M. A. 466 (1929). The article noted that undue external exposure to gamma rays and x-rays can cause anemias, and internal exposure to alpha rays can do the same. Martland, *The Occurrence of Malignancy in Radioactive Persons*, 15 AM. J. CANCER 2435, 2511 (1931). A causal link between lung cancer and radioactive sources other than radium was suggested. *Id.* The article also associated a multiplicity of diseases with radiation, including various types of cancers, diseases of the blood and lymphatic systems, and bone disorders. *Id.* at 2511-12. Dr. Martland speculated that doses of radiation too small to detect may produce malignant changes over a long period of time, and concluded: "Theoretically the exposure to, or the use of any radioactive substance that will increase the normal radio-activity of the body is dangerous." *Id.* at 2513-14.

The *American Journal of Cancer* published an article in 1936 that reported an increase in ovarian tumors and lymphatic cancer among irradiated mice. Furth & Furth, *Neoplastic Diseases Produced in Mice by General Irradiation with X-rays*, 28 AM. J. CANCER 54, 64 (1936). A 1946 article discussed the higher incidence of leukemia among radiologists in comparison with other physicians. Ulrich, *The Incidence of Leukemia in Radiologists*, 234 NEW ENGLAND J. MED. 45 (1946). The article concluded that the statistics present "sub-

ences published an extensive study of the causal relationship between atomic radiation and health hazards.³⁰ A similar study by

stantial evidence that exposure to radiation is a potential cause of leukemia." *Id.* at 46. *Radiology* published an article in 1947 that documented cancer induction in laboratory animals following injection and ingestion of radioactive isotopes. Brues, Finkel, & Lisco, *Carcinogenic Properties of Radioactive Fission Products and of Plutonium*, 49 *RADIOLOGY* 361 (1947). Latency periods ranging from 135 to 506 days were observed. *Id.* at 362. An article in 1950 noted experimental work showing an increased incidence of leukemia in mice exposed to radiation, and suggested that the increased incidence of leukemia in radiologists might also result from exposure to radiation. March, *Leukemia in Radiologists in a 20 Year Period*, 220 *AM. J. MED. SCI.* 282, 285 (1950).

Further evidence of the causal relationship between radiation and cancer was derived from studying the effects of the Hiroshima and Nagasaki bombings. The AEC sponsored virtually all of the research (including the following three articles) on the Japanese survivors; it is therefore likely that the AEC was aware of the details of such research. A 1951 article in *Blood* stated: "Although the data on the human [sic] are subject to criticism, the consensus is that exposure to x-rays does increase the incidence of leukemia in man. Preliminary indications reported from studies undertaken on the survivors of the atomic bombs at Hiroshima and Nagasaki in Japan, suggest that there is a substantial increase in the leukemia incidence rate in the exposed population over that found in a comparable control group." Furth, *Recent Studies on the Etiology and Nature of Leukemia*, 6 *BLOOD* 964, 971 (1951) (footnotes omitted). The article noted that x-rays, gamma rays, beta rays, and neutron radiation can cause leukemia. *Id.* at 973. A 1952 article also discussed the increased incidence of leukemia in the Japanese atomic bomb survivors, concluding that "[t]he concept that radiation from the atomic bomb explosions in Hiroshima and Nagasaki is a leukemogenic agent in man is supported." Folley, Borges & Yamawaki, *Incidence of Leukemia in Survivors of the Atomic Bomb in Hiroshima and Nagasaki, Japan*, 13 *AM. J. MED.* 311, 321 (1952). The same article stated that the possibility of leukemia appearing at a later date in those individuals who were more than 2,000 meters from ground zero should be studied. *Id.* A 1954 article noted the period of several years between the Japanese explosions and the full effects of the leukemias, stating that detection of leukemia in its early stages was accomplished with routine blood examinations performed on the survivors. Lange, Moloney & Yamawaki, *Leukemia in Atomic Bomb Survivors*, 9 *BLOOD* 574, 584 (1954). In contrast, there was a significant lack of medical followup on the veterans exposed to nuclear bomb radiation. See notes 68-79 & accompanying text *infra*.

A 1957 *Science* article reported that "[s]tudies of the incidence of leukemia among survivors of the atomic bomb bursts over Hiroshima and Nagasaki have established that ionizing radiations induce leukemia in man." Lewis, *Leukemia and Ionizing Radiation*, 125 *SCIENCE* 965, 965 (1957) (footnotes omitted). The article also noted "the long period of time which sometimes intervenes between irradiation and onset of leukemia." *Id.* at 970. The article stated that the available evidence indicated that there was no threshold dose for induction of leukemia, thus implying that there is no "safe" dose, below which leukemia would not be induced. *Id.* Rather, the article hypothesized that the relationship between radiation dose and leukemia was linear—the greater the dose, the greater the chance of inducing leukemia; the smaller the dose, the smaller the chance of inducing leukemia. As long as there is any radiation, there would be some chance of inducing leukemia. The article also expressed the belief that there were individual differences in susceptibility to radiation-induced leukemia. *Id.*

30. NATIONAL ACADEMY OF SCIENCE—NATIONAL RESEARCH COUNCIL, THE BIOLOGICAL EFFECTS OF ATOMIC RADIATION (summary report 1956), reprinted in *The Nature of Radioactive Fallout and Its Effects on Man: Hearings Before the Special Subcomm. on Radiation*

the British Medical Research Council was published in 1956.³¹ Thus, by 1957, a significant portion of the scientific community urged caution with regard to radiation.³²

of the *Joint Comm. on Atomic Energy*, 85th Cong., 1st Sess. 1827 (1957) [hereinafter cited as *1957 Hearings*]. The report stated: "The occurrence of leukemia and aplastic anemia as late sequelae of exposure to x-ray and radioactive substances was well documented in the medical literature prior to 1937." *Id.* at 1881. The report further stated that "[t]oday [1956] no informed physician believes that exposure to ionizing radiation has either a beneficial or stimulating effect on the blood," *id.* at 1883, and that "[a]ny degree of radiation exposure should be avoided if possible." *Id.* at 1885. The report noted that "an increased incidence of leukemia among survivors [of the Japanese atomic blasts] has been clearly established," citing a statistical analysis. *Id.* at 1886. Commenting on the effect of internally emitted radiation on the lungs, the report noted that "[o]ne microgram of plutonium (or 0.06 microcuries) introduced into the mouse lung as an 'optimal' aerosol has proved toxic after a few months resulting in bronchial metaplasia, cellular infiltrations, and fibrosis, and carcinomas appeared after a year." *Id.* at 1923.

The report discussed the possible existence of a threshold dose of internally emitted radiation, below which no health effects would be induced, admitting "ignorance as to whether there is a true threshold for such late effects as malignant tumors, and as to the degree of variation in response to equally exposed individuals." *Id.* at 1926. In discussing the effects on the blood that could result from a single exposure of radiation, the report noted "the growing belief that there may not be threshold levels for radiation effects." *Id.* at 1890. Doubt about the "threshold concept" was expressed "since inability to detect effects at lower doses may only be a manifestation of inadequate criteria for effect." *Id.* at 1885 n.6.

31. MEDICAL RESEARCH COUNCIL, *THE HAZARDS TO MAN OF NUCLEAR AND ALLIED RADIATIONS* (1956), reprinted in *1957 Hearings*, *supra* note 30, at 1539. This British report stated that the cause and effect relationship between heavy radiation exposure over short periods and leukemia was "beyond doubt." *Id.* at 1554. The report noted that delayed effects of radiation exposure include severe anemia and leukemia. *Id.* at 1553. Among the Japanese leukemia cases that occurred up through 1954, "[t]he average length of the period between exposure to the bomb and the first appearance of symptoms was about 6 years." *Id.* at 1555. The report stated a latency period of 20 years or more "usually elapses between the first exposure to radiation and the clinical appearance of" cancerous tumors induced by radiation. *Id.* at 1557. For those individuals exposed to radiation in their occupations receiving small doses over many years, the report stated "it is not yet known" how their chances of getting leukemia compare to those receiving heavy doses over a short term. *Id.*

Again referring to those individuals exposed to radiation in their occupations, the report noted that radiation may cause a decline in the number of red cells, white cells, and platelets, which can lead to severe degrees of anemia. *Id.* at 1560. In its discussion of lung cancer, the report explained: "In theory . . . the inhalation of radioactive material in particulate form, either as a result of fall-out from nuclear weapon explosions or in the vicinity of nuclear reactors, could lead to the accumulation of a high radiation dose within the lungs. Such particles would not be uniformly distributed within the lungs but would tend to aggregate on discrete small areas of the bronchi, which would thus be subjected to a high radiation dose, with the result that in the long run lung cancers might be produced in some people." *Id.* at 1558. The British report recommended that "the aim should always be to keep the level of exposure as low as possible." *Id.* at 1602.

32. Several prominent scientists discussed the effects of radiation in 1957 before a special subcommittee of the Joint Committee on Atomic Energy. *1957 Hearings*, *supra* note 30, at 781-1008. Dr. Edward Lewis of the California Institute of Technology testified that he

The state of scientific knowledge concerning the pathological hazards of radiation exposure was certainly advanced beyond the point where the government could claim that it had no reason to know of the dangers involved. There was an even greater realization by the scientific community of the genetic hazards involved in radiation exposure. The causal link between ionizing radiation and gene mutations was well documented in the medical literature.³³

doubted that a threshold dose of radiation existed. *Id.* at 958-61. Dr. Lewis concluded his testimony before the special subcommittee stating: "I would like to point out one thing more and that is that if we assume this straight line, this linearity as it is called, this absence of threshold, all these things being essentially the same thing, then we come up with these figures which I am afraid can be twisted to alarm the public unduly. I do think that the danger comes in legislating a dose that is said to be permissible for the public. . . . It would be better to state to the public that there is a distinct possibility that the so-called permissible dose will hurt a definite number of people. The number damaged will be relatively small we think for small doses, such as from fallout which is what we are talking about. But the percentage or the number who are expected to be damaged should be stated, instead of implying that there is no danger from fallout or that the permissible dose will cause no damage." *Id.* at 1007-08.

Dr. Shields Warren, former director of the AEC's Division of Biology and Medicine, testified that he believed that there was a threshold dose for induction of leukemia, but did not say what that dose was, and regarded the absence of a threshold as a possibility. *Id.* at 1006. In contrast to Dr. Warren's testimony, the statement presented to the AEC's Advisory Committee for Biology and Medicine by Dr. Curt Stern, a member of that committee, on October 10, 1953 concluded: "The personal future of exposed individuals even under permissible exposure rates, must be considered as probably slightly less favorable than that of unexposed individuals. This applies to such diseases as leukemia." Minutes of Fortieth Meeting of AEC Advisory Comm. for Biology and Medicine app. A (Oct. 10, 1953).

Dr. Hardin Jones of the University of California agreed with Dr. Lewis that the induction of leukemia by radiation was proportional to the dose. 1957 *Hearings, supra* note 29, at 1002. Dr. Ernest Pollard of Yale University also endorsed the proportionality concept, *id.* at 996, stating: "I think the linear line is rational. I would like to see policy momentarily at least based on it. If later on it seems there is a threshold, then we are not too badly off. But if there is not a threshold, and we bet there is one, we are in trouble." *Id.* at 1004. In addition, Dr. Pollard stressed the scientific community's limited knowledge of cellular processes and warned about the possibility of long-delayed effects from radiation. *Id.* at 998.

33. A 1927 article revealed that x-rays can cause gene mutations in drosophila flies. Muller, *Artificial Transmutation of the Gene*, 66 *SCIENCE* 84 (1927). The article stated that it seemed "likely on general considerations" that "the effect is common to most organisms." *Id.* at 87. An article in 1948 discussed x-ray induced gene mutation in drosophila flies, stating that "one may assume that there exists no tolerance dose below which mutations are not induced." Spencer & Stern, *Experiments to Test the Validity of the Linear R-Dose/Mutation Frequency Relation in Drosophila at Low Dosage*, 33 *GENETICS* 43, 64 (1948). Another article dealing with the same subject appeared in 1949 in *Science*, and after reviewing all the relevant experiments concluded: "There is no threshold below which radiation fails to induce mutations." Uphoff & Stern, *The Genetic Effects of Low Intensity Irradiation*, 109 *SCIENCE* 609, 610 (1949). A statement presented to the AEC's Advisory Committee for Biology and Medicine recognized that radiation could cause genetic mutations in humans. See Minutes of Fortieth Meeting of the AEC Advisory Comm. for Biology and Medicine, at app.

Reports by the National Academy of Sciences³⁴ and the British Medical Research Council³⁵ also documented the genetic hazards

A (Oct. 10, 1953).

34. The 1956 National Academy of Sciences Report stated that radiation causes mutations and that "practically all radiation-induced mutations which have effects large enough to be detected are harmful." 1957 *Hearings, supra* note 30, at 1838. The report explained: "A small but not negligible part of this harm would appear in the first generation of the offspring of the person who received the radiation. Most of the harm, however, would remain unnoticed, for a shorter or longer time, in the genetic constitution of the successive generations of offspring. But the harm would persist, and some of it would be expressed in each generation. On the average, a detrimental mutation, no matter how small its harmful effect, will in the long run tip the scales against some descendant who carries this mutation, causing his premature death or his failure to produce the normal number of offspring." *Id.*

The report left no doubt about the absence of a threshold dose for the induction of genetic mutations when it stated that "[a]ny radiation dose, however small, can induce some mutations. There is no minimum amount of radiation dose, that is, which must be exceeded before any harmful mutations occur." *Id.* The report also stated: "Additional radiation (that is, radiation over and above the irreducible minimum due to natural causes) produces additional mutations (over and above the spontaneous mutations). The probable number of additional induced mutations occurring in an individual over a period of time is by and large proportional to the total dose of extra radiation received, over that period, by the reproductive organs where the germ cells are formed and stored. To the best of our present knowledge, if we increase the radiation by X%, the gene mutations caused by radiation will also be increased by X%." *Id.* at 1839. The report further stated: "It has sometimes been thought that there may be a *rate* (say, so much per week) at which a person can receive radiation with reasonable safety as regards certain types of direct damage to his own person. But the concept of a *safe rate* of radiation simply does not make sense if one is concerned with genetic damage to future generations. What counts, from the point of view of genetic damage, is not the rate; it is the *total accumulated dose to the reproductive cells of the individual from the beginning of his life up to the time the child is conceived.*" *Id.* (emphasis in original).

According to the report, "any additional radiation is genetically undesirable." *Id.* at 1845 (emphasis in original). The report cautioned: "If certain figures (such as 10 roentgens) occur in a recommendation, it should most emphatically not be assumed that any exposure less than that figure is, so to speak, 'all right': nor should it be for a moment assumed that disaster will suddenly descend if one of these figures is exceeded. In any case in which a figure is stated, it is with the idea: stay just as far under this as you can; do not consider that this is an amount of radiation which is genetically harmless, for there is no such figure other than zero." *Id.* A 1957 statement from the Genetics Society of Japan is in accord with the National Academy of Sciences Report. *See id.* at 1945.

The report recommended that "proper safeguards always be taken to minimize the radiation dose to the reproductive cells," and that "every effort be made to assign to tasks involving higher radiation exposures individuals who, for age or other reasons, are unlikely thereafter to have additional offspring." *Id.* at 1846.

35. The 1956 report by the Medical Research Council noted that there was little direct information about the genetic effects of ionizing radiations on humans and that most of the information obtained has come from experiments on other organisms. 1957 *Hearings, supra* note 30, at 1568. However, the report noted: "Since the genetic mechanism in man is the same as that in other animal and plant species, and since the animals and plants that have been studied all show the same type of genetic response to ionizing radiations, it would be unreasonable to suppose that the response in man will do other than follow the same gen-

involved.

Conclusions drawn from experimental data, along with theoretical assumptions based upon knowledge of radiation physics and the biological processes of the human body, helped to shape the state of scientific knowledge about the health effects of radiation in decades past.³⁶ The selected publications illustrate that the state of scientific knowledge at the time of the atomic testing did not reflect a belief in the "safety" of any level of radiation. Rather, the state of knowledge is best described as one of conscious ignorance as to the potential effect of radiation exposure on humans, if not an actual belief in the hazards involved.

The government nonetheless placed thousands of individuals in a situation that it knew could be hazardous. Such knowledge included an awareness of two factors: the probability of harm and the magnitude of the potential harm. The probability of harm at the anticipated dose levels was the more uncertain factor of the two, but knowledge of this uncertainty should have dictated caution. Because knowledge concerning the magnitude of the potential harm was well established, the government knew that if it underestimated the probability of harm, then the harm that did occur potentially could be serious.

Atomic Energy Commission Delegation of Responsibility and Department of Defense Authorization for Excess Exposure

The AEC delegated its responsibility for the radiological safety of the troops to the DOD.³⁷ Thereafter, the DOD authorized

eral pattern." *Id.*

The report stated that there "is no known threshold for the induction of gene mutations by radiation." *Id.* at 1569. Furthermore, "in contrast to most other types of biological response to radiation, damage to the genetic material cannot be repaired and the effect from repeated exposures is cumulative." *Id.* at 1570. The report also noted that genetic effects are greater when the exposed individuals are in their reproductive years. *Id.*

36. The preceding discussion of scientific literature is not intended to be exhaustive. For a more extensive bibliography entitled "Radiation Effects on Blood and Blood-Forming Tissues of Man—1900-March 1956," see *1957 Hearings, supra* note 30, at 1893-1921. See also *Atomic Energy and the Law: A Bibliography*, 12 VAND. L. REV. 229-70 (1958).

37. The authority of the AEC to "conduct experiments and do research and development work in the military application of atomic energy" can be found in the Act of Aug. 1, 1946, Pub. L. No. 79-585, § 6, 60 Stat. 755. The AEC was abolished by the Act of Oct. 11, 1974, Pub. L. No. 93-438, tit. I, § 104(a), 88 Stat. 1233, and its functions and personnel were transferred to the Energy Research and Development Administration. See 42 U.S.C. § 5814 (1976). For an excellent discussion of the AEC's responsibility to protect the public's health

levels of radiation exposure in excess of the levels recommended by the AEC's Division of Biology and Medicine.³⁸ The details of this delegation and authorization are best presented by a chronological examination of various documents, including recently declassified intragovernmental correspondence, along with notes and transcripts of AEC meetings.³⁹ While the military placed greater em-

and safety, see Comment, *Nuclear Accidents: Judicial Review of the NRC's Duty to Issue a Health Warning*, 9 *FORDHAM URB. L.J.* 353, 360-74 (1980).

38. See *Washington Post*, June 20, 1979, at A5, col. 1; *id.*, May 1, 1979, at A3, col. 1; *id.*, Apr. 25, 1979, at A1, col. 5.

39. A few months after the AEC had approved the military's request for troop participation at the November, 1951, nuclear tests, but before those tests had commenced, the Director of the AEC's Division of Biology and Medicine, in a memorandum to the AEC official who would have overall responsibility in conducting the tests, authorized a maximum permissible exposure of 3.9r of gamma radiation per 13 week period for each individual soldier. Memorandum from Dr. Shields Warren to Carroll Tyler (Oct. 11, 1951). After noting that the AEC's test director could authorize deliberate overexposures, the medical director stated that "this Division does not look lightly upon radiation excesses." *Id.* Any authorization for an exposure level beyond the 3.9r limit was to be documented fully setting forth the need for overexposure, the other alternatives available, the number of people to be overexposed, the level of such exposure, and the recent exposure of the individuals involved along with the plans for enabling those individuals to "pay off" their overexposure. *Id.* The AEC's medical director wanted a copy of all such documentation. *Id.* The memorandum emphasized that the 3.9r level would not be raised, and although "[m]ilitary personnel cannot be prevented from making their own decisions . . . insofar as they act as an integral part of this test organization they are requested to fulfill the above requirements for documentation on overexposure." *Id.* The memorandum also contained this advice: "[C]ompliance with the permissible limit should become the mark of distinction in the exercise of ingenuity, rather than a concession to be avoided upon pretext. Indoctrination of this attitude early in this series may save us much trouble, and possibly radiation injuries, in the several series to come." *Id.*

For the November, 1951 tests, the AEC required a distance of seven miles between the troops and ground zero at blast time. Troop maneuvers after the blast were done in single file columns behind AEC radiation monitoring personnel. See note 38 *supra*. The military expressed dissatisfaction with these AEC restrictions. In a letter from the Armed Forces Special Weapons Project's Deputy Chief, to the Director of the AEC's Division of Military Application, it was requested that the troops be allowed to observe a detonation from "a safe but tactically sound distance." Letter from Brigadier General A.R. Luedecke, USAF, to Director, AEC Division of Military Application (Mar. 7, 1952). The letter noted that the 1951 maneuvers, "though of definite value as an initial indoctrination vehicle, had some unfavorable psychological effects" because of the "tactically unrealistic distance of seven miles to which all participating troops were required to withdraw for the detonation." *Id.* Requesting that the seven mile limit be reduced to 7,000 yards (3.9 miles), the letter concluded that the "exercise recommended for indoctrination with the atomic weapon has been devised to preclude casualties in any contingency. The Military Services are prepared and desire to accept full responsibility for the safety of all participating troop units and troop observers." *Id.*

Aware of the military's dissatisfaction with the AEC imposed restrictions, the AEC's medical director sent a memorandum to the AEC's Division of Military Application stating: "The Division of Biology and Medicine recognizes that it is not its function to set standards

phasis upon the training value of the maneuvers than did the AEC,

for the military nor to impede the operations of the Department of Defense. However, the test and the Continental Proving Ground are the responsibility of the Commission both in fact and in the public mind.

"The Division of Biology and Medicine recommends against permitting troops to be closer to ground zero than the seven miles used in the Desert Rock [1951] operation for the following reasons: 1. The Continental Proving Ground is of great value to the program of the Atomic Energy Commission and has been accepted by the public as safe. 2. Accidents occurring at the time and place of an atomic explosion are magnified by the press out of all proportion to their importance, and any injury or death during the operation might well have serious adverse effects. 3. The explosion is experimental in type and its yield cannot be predicted with accuracy.

"While there is very little likelihood that the fallout of fission products would be a hazard under the operating circumstances of the tests, there is uncertainty of the factors controlling blast effects. Also, although the record of the Air Force in the accuracy of the drops has been outstandingly good, precision of the detonation point cannot be guaranteed." Memorandum from Dr. Shields Warren to Brigadier General K.E. Fields, Director, AEC Division of Military Applications (Mar. 25, 1952).

A few days later, the AEC considered the military's requests. A report dated March 31, 1952, by the AEC's Division of Military Application was reviewed by the AEC. The report noted the military's desire to "prove that U.S. troops in combat could survive a detonation of this kind at this distance in field fortifications and emerge immediately thereafter in condition to exploit the enemy's resultant confusion. Their ability to exploit this post-shot confusion, however, is an inverse function of their proximity to ground zero." Report by AEC Director of Military Application, Troop Participation in Operation Tumbler-Snapper 2-3 (Mar. 31, 1952). According to the report, the Marines stated that they would not participate if the seven mile limitation remained in effect. *Id.* at 3. In assessing the possible hazards of moving the troops to 7,000 yards from ground zero, the danger of radiation exposure was considered to be minor. *Id.* There was greater concern for the possibility of eye damage "resulting from possible careless exposure on the part of individual soldiers." *Id.* at 4. The report noted the objection of the Division of Biology and Medicine, but recommended that the AEC approve the military's request. *Id.* at 5.

On April 1, 1952, the AEC approved the recommendations of its Division of Military Application and allowed the seven mile limit for troop participation to be reduced to 7,000 yards. See Notes of AEC Meeting No. 677 (Apr. 1, 1952). The official notes of that meeting do not reveal any critical analysis of the military's plan with regard to the hazards of radiation that were then known. Although a staff member of the Division of Biology stated that the troops should be in no danger, provided all safety instructions were followed, one of the Commissioners "emphasized the necessity for pointing out to the military that the distance they proposed to station troops from the point of detonation was less than the distance permitted by AEC safety standards." *Id.* According to the notes, the point was made that the Commission "is not in any way lowering its safety standards for civilians, and uncertainties and accompanying danger always exist in a nuclear detonation." *Id.* The Commission then discussed "the necessity for realistic training by the military in all fields, often accompanied by serious injuries, and that such training was also necessary in the field of atomic weapons." *Id.*

The day following that meeting, a letter from the Chairman of the AEC to the Chief of the Armed Forces Special Weapons Project advised the military of the AEC's action regarding troop participation: "We realize the value and urgency of obtaining quantitative information on close tactical support of troops as well as the value of psychological indoctrination. If officials of the Department of Defense, after review of the hazards involved, still feel

the AEC, primarily its medical division, tended to be more con-

that a military requirement justifies the maneuver, the Commission would enter no objection to stationing troops at not less than 7,000 yards from ground zero, provided that the Exercise Director [the military commander] prepares a safety plan to minimize risk of injury which is acceptable to the Test Manager [the AEC official in charge]. The responsibility for troop compliance with this safety plan rests, of course, with the Exercise Director. . . . In connection with radiological monitoring of this advance, it is assumed that monitoring teams will be provided from the troops and that no requirement whatever will be placed on the monitoring group of the test organization [AEC], since the latter will be otherwise occupied at shot time." Letter from Gordon Dean to General Herbert B. Loper (Apr. 2, 1952).

In response to this letter, the Chief of the Armed Forces Special Weapons Project described the military's planned maneuvers to the Director of the AEC's Division of Military Application: "An army battalion (approximately 1100) will dig in as close to ground zero as permissible. Following the explosion, the battalion proceeds to and through ground zero to link up with a company (approximately 200) of airborne troops dropped in the vicinity of ground zero. All troops then proceed out of the area [and] return to camp. During the advance to ground zero or on the return to camp, troops will pass displays of exposed equipment. . . . Light reconnaissance vehicles will pass through ground zero as an advance element in the battalion link-up with the airborne company. In the event that an undue delay occurs between the explosion and the time the battalion is permitted to advance to ground zero, troops will move by vehicle toward ground zero. This will reduce the time lag in reaching ground zero and will emphasize to participants the high degree of safety in entering the area of ground zero immediately following an air burst of an atomic bomb. . . . It is emphasized that the Department of the Army desires to inject the maximum possible realism into the exercise. It is therefore strongly recommended that the Atomic Energy Commission be urged to approve all of the elements of the above plan that are not incompatible with essential technical restrictions." Letter from General Herbert B. Loper to Director, AEC Division of Military Application (Apr. 3, 1952).

The AEC held a meeting the same day the letter informing them of the Army's planned maneuvers was received. The notes of that meeting state: "The Chairman said that there appeared to be no reason for the Commission to object to the participation of the paratroopers provided their exercise was so arranged as to avoid interference with test operations." Notes of AEC Meeting No. 679 (Apr. 3, 1952). After the AEC meeting, the military was notified of the AEC's approval of the planned maneuvers. In a letter from the Chairman of the AEC to the Chief of the Armed Forces Special Weapons Project, the military was reminded to keep the individual soldier's radiological exposure for the maneuver to 3r. Letter from Gordon Dean to General Herbert B. Loper (approximate date, a few days after April 3, 1952). For an unexplained reason, the 3r figure does not coincide with the earlier 3.9r figure. See Memorandum from Dr. Shields Warren to Carroll Tyler (Oct. 11, 1951). However, a 1951 report on the Nevada "Buster-Jangle" test series of that year states that an "exposure limit of 3r was agreed on prior to the test. . . . The Division of Biology and Medicine agreed to an unpublicized exposure of 3.9r, which was used to give the 3r limit added flexibility where absolutely necessary." Jacobs, *Precautions Are Being Taken by Those Who Know*, THE ATLANTIC, Feb., 1971, at 53.

After the 1952 test series, the military was still dissatisfied with AEC restrictions imposed upon the location of troops and level of radiation exposure. Part of this dissatisfaction was a result of lie detector examinations and psychological studies involving the troops. The research led the military to conclude that the maneuvers were not "realistic" enough. See Washington Post, Apr. 25, 1979, at A1, col. 5. The psychological studies were conducted for the military by the Operations Research Office of The Johns Hopkins University. *Id.* A letter from the AEC's Weapons Research Branch to the AEC's Division of Biology and

cerned about troop safety than did the military. The AEC's origi-

Medicine noted that "20R has been allowed crews of sampling aircraft without apparent ill effect while the limit for ground personnel has been maintained at 3R." Letter from Captain John T. Hayward, USN, Chief, AEC Weapons Research Branch, to Dr. John C. Bugher, Director, AEC Division of Biology and Medicine (Sept. 19, 1952). The Marine Corps sent a letter to the Chief of the Armed Forces Special Weapons Project that stated: "The safety regulations under which past Desert Rock type exercises have been conducted have limited the training value of these exercises. . . . In view of the fact that the permissible radiation dosage limits for Atomic Energy Commission and Armed Forces Special Weapons Project personnel is established on a continuing exposure basis, it is believed that this permissible dose could be raised for military personnel participating on a one-shot basis. It is therefore recommended that the Chief, Armed Forces Special Weapons Project request Atomic Energy Commission concurrence of a permissible dosage limit of six (6) roentgens for military personnel participating in Exercise Desert Rock V [the 1953 test exercises]. It should be noted that it will continue to be the policy of the Marine Corps to expose personnel to the minimum radiation dosages necessary to accomplish the desired training objectives Furthermore, it is believed that trained, disciplined troops and troop observers can be stationed at more realistic distances from ground zero and still be within reasonable safety requirements for peace-time training." Letter from Commandant of the Marine Corps to Chief, Armed Forces Special Weapons Project (Oct. 1, 1952). A letter dated two weeks later from the Chief of the Armed Forces Special Weapons Project to the Director of the AEC's Division of Military Application stated that the DOD wished to "assume full responsibility for the physical and radiological safety of troops and troop observers while in the Nevada Proving Grounds." Letter from Major General Herbert B. Loper to Brigadier General K.E. Fields (Oct. 15, 1952). Furthermore, the letter noted that, if "the safety standards of the DOD are less conservative than those established by the AEC, and if accident or criticism result, the DOD will be prepared to make a public announcement of those facts." *Id.*

Responding to the military's request for relaxation of the radiation exposure limits, a letter from the AEC's Division of Biology and Medicine to the AEC's Weapons Research Branch stated "the Division of Biology and Medicine recommends that there should be no change from the established AEC policy for test operations of a total exposure of not over 3.9r of gamma radiation per 13 weeks." Letter from Dr. John C. Bugher to Captain John T. Hayward (Oct. 20, 1952).

Before formal consideration of the military's requests by the AEC, a report by the AEC's Division of Military Application was considered. The report noted that the military was requesting a total radiation exposure level of 6r while the AEC limit was 3.9r. In discussing the military's request to assume full responsibility for physical and radiological safety of the troops, the report stated: "If the AEC should concur as requested, it would obviously be possible that the DOD might set less conservative limits for exposure than the AEC, that military personnel might be injured, and that the fault might be attributed to the AEC's 'failure to control the maneuver.'" Report by AEC Director of Military Applications, Troop Participation in Continental Tests 2-4 (Dec. 22, 1952). This concern about which agency, the AEC or the DOD, would receive the blame for any injury dominated the rest of the report. A concern for troop safety is not evident. Also mentioned was "the DOD need to develop its own criteria and doctrine for the use of atomic weapons in the same way as for any other weapons." *Id.* at 5. The report suggested the DOD's needs be respected by "allowing the DOD maximum freedom of action in these maneuvers short of unacceptable interference with AEC experiments or of jeopardizing, through unwarranted criticism, the AEC's ability to perform its own mission." *Id.* The report concluded with a recommendation that responsibility for troop safety be delegated to the DOD, but that the military's Exercise Director should be required to submit a safety plan to the AEC's Test Manager for informa-

nal restrictions on radiation exposure levels and troop distance from ground zero met with dissatisfaction from the military. Consequently, the original restrictions were eroded in order that the permissible levels of radiation exposure could be increased, and the troops were moved closer to ground zero.

tion only. According to the report, "[s]hould a truly dangerous situation be apparent, the DOD should so be advised by letter from the Commission." *Id.* at 7. Such "advice" to the DOD would be necessary, the report stated, because the AEC "might still be subject to criticism in case of injury unless it had taken separate and additional exception to the DOD plan when received." *Id.* at 5. It was noted that the Division of Biology and Medicine concurred in the conclusions of the report. *Id.* at 8. At this time the Director of the AEC's Division of Biology and Medicine was no longer Dr. Shields Warren, but was Dr. John C. Bugher. Apparently, Dr. Bugher changed his position subsequent to October 20, 1952. See Letter from Dr. John C. Bugher to Captain John T. Hayward (Oct. 20, 1952).

On December 23, 1952, the AEC adopted the recommendations of the Division of Military Application. Notes of that meeting state: "General Fields [Director, AEC Division of Military Application] outlined the present plans of the DOD for extensive troop participation in the UPSHOT-KNOTHOLE [1953] series. He pointed out that the most significant point of difference between the present proposal and the previous troop participation exercise was that in the forthcoming tests the usual limits of physical exposure to weapons effects would probably be exceeded. It was therefore proposed that responsibility for the physical safety of the troops participating in the exercise be delegated to the DOD and that the DOD be informed of the possibility that exceeding the normal limits of exposure to radiation or pressure might endanger the participating personnel. Dr. Bugher briefly discussed the possible effects of exceeding the normal radiation and pressure limits to the extent proposed by the DOD. "Mr. Dean [Chairman of the AEC] observed that since the DOD had apparently considered it necessary to conduct the exercises in this manner, the AEC was not in a position to recommend that the normal limits be observed." Notes of AEC Meeting No. 794 (Dec. 23, 1952).

As late as 1957 there was still dissatisfaction within the military concerning restrictions on troop participation at nuclear tests. The final report of operations for the troop exercises at the 1957 test series expressed displeasure with the status quo that entailed the military having to work around the AEC's tests. See Exercise Desert Rock VII and VIII, Final Report of Operations 71 (Nov. 25, 1957). The report stated a desire that the military conduct its own detonations, so as to be free of any AEC control, suggesting that "[a]s a long range objective, the feasibility of conducting such training on a military reservation should be explored. The objective should be the integration of atomic training into annual training programs on a regularly scheduled basis at an atomic training center." *Id.*

The military's continuing desire for "realism" in its atomic maneuvers may have affected the way the two related issues of offsite fallout and underground testing were handled by the AEC. The notes of an AEC meeting held on November 14, 1958, state: "Mr. McCone [AEC Commissioner] recommended and the Commissioners agreed that if weapons tests are to be resumed by the United States, a strict limitation on off-site fallout should not be announced at this time. Mr. Libby [AEC Commissioner] added that AEC's ability to develop specific instruments with clean devices was evident; however, he understood there was a desire by the military for some degree of off-site radiation for troop training purposes. In commenting on Mr. McCone's question regarding the limitation of future testing only to underground shots, Mr. Libby said the AEC could accept this position but he felt it would impair the DOD training program and DOD weapons development." Notes of AEC Meeting No. 1427 (Nov. 14, 1958).

The documents in this chronological history are much more significant when viewed as a coherent whole. A process is revealed in which the AEC's vision of public relations and undue deference to the military combined with the military's disregard of known hazards and a zeal for "realism" to produce a reordering of priorities that left little concern for individual safety.

The degree to which society can further its own interests by properly invading the interests of the individual is a serious issue. In this situation, the process became infected to such an extent that the interests of the individual were not adequately confronted. The government did not completely ignore the issue of troop safety; ultimately, however, it allowed the crucial determinations to be made by those who had demonstrated the least interest in such safety.

The Inadequacy of DOD Dosimetry

Many of the soldiers who participated in the nuclear tests did not wear film badges to record their exposure to individual doses of radiation.⁴⁰ In 1951, when the AEC controlled radiation safety, each soldier wore a badge. During the 1952, 1953, and 1955 test series, however, only one badge was issued per platoon (about 35 soldiers). During this period, the Army Surgeon General's policy was that one-time exposures need not be reported. Dr. Shields Warren, the director of the AEC's Division of Biology and Medicine from 1947 to 1952, states that he was unaware of such a practice and that it "is contrary to all radiation protection standards I'm aware of."⁴¹

The use of film badges alone, however, did not measure all forms of ionizing radiation that were hazardous. Although radiation from neutrons, alpha rays, and beta rays were produced with each blast, the military's film badge only recorded gamma rays. Accordingly, an Army report from 1957 describing radiation exposure limits stated that its discussion was limited to gamma radiation only: "As long as a limit of 5 roentgens gamma is observed, alpha,

40. See DOD REPLIES TO QUESTIONS, *supra* note 7, at B-5(c); 1978 Hearings, *supra* note 1, at 279-82 (1970 AEC study); *id.* at 251 (statement of Major Alan Skerker, Department of the Army); Washington Post, May 1, 1979, at A3, col. 1.

41. Washington Post, May 1, 1979, at A3, col. 1. Dr. Warren also stated that "[i]t was rather characteristic of the Army to downgrade the importance of radiation." *Id.* The military's failure to badge each individual was also based on a lack of enough trained personnel who could process the badges. *Id.*

beta, and neutron radiation will not be included until such time as AEC may prescribe safety criteria for one or more of these last three."⁴² In addition, there was no monitoring of radiation that was ingested or inhaled.⁴³

In 1978, a Department of the Army spokesman read from 1955 Army project reports about the dosimetry procedure in use to a congressional subcommittee. The testimony revealed that the Army was aware of the limitations and the significance of those limitations in its dosimetry program.⁴⁴

42. Exercise Desert Rock VII & VIII, Final Report of Operations 97 (Nov. 25, 1957).

43. See DOD REPLIES TO QUESTIONS, *supra* note 7, at B-7; *id.* at A-2 (executive summary of Ad hoc Committee formed by Army Surgeon General to review troop participation in nuclear tests concludes that radiation safety procedures did not account for hazard of internal emitters; magnitude and significance of internal exposure cannot be determined at this time (1977-78)); 1978 Hearings, *supra* note 1, at 52 (statement of Martin Sperling of Science Applications, Inc., estimates that a particular soldier at one test could have inhaled as much as 100r); *id.* at 1121 (DOD replies to questions from subcommittee). A radionuclide emitting alpha particles can be inhaled or ingested, thus irradiating internal tissues. See J. GOFMAN & A. TAMPLIN, POISONED POWER 42 (1979). Troops also received unmonitored exposure while rehearsing maneuvers in previously contaminated areas. See Washington Post, Feb. 1, 1979, at A4, col. 1.

44. "Major Skerker. . . . Satisfactory tactical dosimeters and rate meters are now available for measuring gamma radiation However, beta and neutron radiations can also have important biological effects. The importance of these effects from nuclear detonations is becoming more and more recognized. . . . No available rate meter meets military specifications and measures beta radiation satisfactorily. Casualties could easily result from beta burns received in a contaminated area indicated safe by gamma instruments. . . .

"Mr. Rogers. And is not the fallout heavy in beta?"

"Major Skerker. Yes." 1978 Hearings, *supra* note 1, at 317-18 (testimony of Major Alan Skerker, Department of the Army).

Additional testimony of Major Skerker established that alpha radiation was not measured at the tests:

"Mr. Carter. What about alpha rays, how are they recorded?"

"Major Skerker. No way of determine [sic] that, sir.

"Mr. Rogers. No way of determining those.

"Major Skerker. No, sir.

"Mr. Carter. And they were the ones that were in the dust, supposedly, nearest to the site, nearest to ground zero?"

"Major Skerker. Well, you had a mixture of alpha, beta, and gamma.

"Mr. Carter. All of them.

"Major Skerker. The proposition is basically that if you go into a mixed radiation field from a fission device, that the predominant radiation is gamma. You can measure that, and if you can stay within what you believe to be reasonable amount—

"Mr. Carter. But you really do not know.

"Major Skerker. You really do not know; that is correct.

"Mr. Carter. You do not know if alpha was more or less because there was no way of measuring it, was there?"

"Major Skerker. No way of measuring it"

Id. at 238-39. See generally *Radiation Protection: Hearings before the Subcomm. on En-*

A proper concern for troop safety would not have allowed exposure to unmonitored radiation that was known to have adverse biological effects. Moreover, the absence of this dosage information increases the uncertainty regarding a causal link between exposure and injury.

Inadequate Protection

During the military maneuvers on the atomic desert, there was no special protective clothing worn by the troops. Dust from the desert floor, kicked up by the advance of scores of foot soldiers, helicopters, and other military vehicles, contained radioactivity that was easily inhaled and ingested by the troops.⁴⁵ In addition, an Army report on the 1957 maneuvers states that “[t]he primary means of decontamination employed was the sweeping of personnel and vehicles with brooms to remove contaminated dust.”⁴⁶ De-

ergy, Nuclear Proliferation, and Federal Services of the Senate Comm. on Governmental Affairs, 96th Cong., 1st Sess. 561-92 (1979) [hereinafter cited as Radiation Protection Hearings].

45. See DOD REPLIES TO QUESTIONS, *supra* note 7, at B-4(c), B-13(c)(1)-(4), d(1), (4): “Q. Any protective clothing issued to troops? Any gas masks or respirators? A. The normal fatigue uniform was worn by all participants. Gas masks were worn on occasion, but this was not the general rule. No other protective clothing for participating troops is reported. Research is still ongoing. Q. Can you describe dust conditions at Smoky and other blasts after detonation and during post-blast maneuvers? A. The length of time the dust conditions remained after a blast varies as a function of the yield, height of burst, wind conditions and soil type. Q. Did helicopters moving assault troops toward ground zero stir up considerable dust? A. Yes, when landing or taking off. Q. Is it possible that such dust would contain radioactive materials? A. Dust stirred up by helicopters during landing or take off may have contained radioactive particulate either if the area had been subject to fallout or if the area was sufficiently close to ground zero that substantial neutron activation of the soil had taken place. Neutron activation of the soil is generally limited to a fairly short range, such as 1,000 yards [sic] from ground zero for shot Smoky. Q. Were there any safeguards to reduce troop exposures to radioactive dust? A. In the early Desert Rock series, and on Desert Rock V [1953], it appears that gas masks and other protective gear wear [sic] used. While gas masks were often carried in other series, there is little indication they were used. Further research will seek more precise information on this matter. Q. What additional fallout material would exist in the area of a device which was detonated from a tower rather than balloon- or air-detonated? A. In a shot from a balloon-suspended device, the only radioactive debris comes from the fission products of the detonated device and from soil particulate which has been drawn up into the hot fireball and has had fission products attached to it. In a tower shot, much—if not all—of the iron in the tower is vaporized and made radioactive in the same process. Thus, the fallout is therefore greater than from a balloon-suspended shot of the same yield and altitude. Q. Would troops entering the area of ground zero after such a blast risk exposure to inhalation or ingestion of tower particles or vapors? A. Yes.” See also 1978 Hearings, *supra* note 1, at 157-58 (no gas masks or other special clothing required).

46. Exercise Desert Rock VII & VIII, Final Report of Operations 6 (Nov. 25, 1957).

partment of Defense testimony in 1978 pointed out that the danger of such a procedure included inhalation of radioactive material.⁴⁷ Nonetheless, not only did the government fail to provide adequate protection, but the soldiers themselves were not in a position to do any better, because most were nonvolunteers⁴⁸ and uninformed about the hazards.

Soldiers Not Informed of Hazards

Information regarding the true hazards of radiation exposure never reached the troops. The military was more concerned with the elimination of fear that might be associated with the bomb and convincing the soldiers that they were not "obsolete."

A military publication in 1952 told the soldiers that a nuclear air burst would not "make anything in the area dangerously radio-

47. "Mr. Rogers. And what was the decontamination procedure? One of them said they told him to flip his jacket to get the dust off of it, and he brushed his boots with a whisk broom. Is that the procedure?

"Major Skerker. The initial types of decontamination procedures would in fact be to dislodge the loose material from the clothing or vehicles; that would mean brooming down, hosing down, things like that. Silly as it may sound, that is a factor.

"Mr. Carter. What about that material he had inhaled in his lungs?

"Major Skerker. What we are suggesting there, everything he shook off, he breathes in. You are right, sir, I mean, some amount of that, that you would shake off from your body would be resuspended and inhaled." 1978 *Hearings, supra* note 1, at 326 (testimony of Major Alan Skerker, Department of the Army).

48. According to the DOD, "[w]ith few exceptions, the participants and observers were not volunteers." DOD REPLIES TO QUESTIONS, *supra* note 7, at B-3. The DOD had revealed that about 43 volunteers participated in nuclear blast exercises at a closer range than other troops. At some shots they were only 2,000 yards (1½ miles) from ground zero, and at one aerial detonation, volunteers stood at ground zero, 18,000 feet under the explosion. See 1978 *Hearings, supra* note 1, at 266 (statement of Major Alan Skerker, Department of the Army). Whether these 43 volunteers were informed adequately of the hazards involved is not clear. A quotation from a post-shot report by one of the volunteers does not indicate a satisfactory appreciation of the risks: "The dust was sufficient to make the visibility very poor beyond a hundred yards or so in any direction, but was not heavy enough to be suffocating. I did not feel the need of putting on my gas mask, and did not use it." Report of Participation in Selected Volunteer Programs of Desert Rock V-7 (Apr. 25, 1953) (report of Captain Robert A. Hinners, USN, at 9). The volunteers stationed 18,000 feet below a nuclear explosion at ground zero were there to prove that an atomic air-to-air rocket was "safe to use defensively over cities." NEWSWEEK, July 29, 1957, at 21. A questionnaire given to some of the 43 volunteers after the shot included such questions as: "Did you at all times feel that you were in complete control of all your facilities?"; and "Do you believe that you could have emerged from the trench immediately after the blast and have efficiently engaged in close combat?" Report of Participation in Selected Volunteer Programs of Desert Rock V-7 (Apr. 25, 1953). See also ATOMIC SOLDIERS, *supra* note 3, at 60-61, 88-90.

active,"⁴⁹ and that "the question of nuclear radiation is not of direct concern to troops who will enter the area of a bomb air burst soon afterwards, because there is no significant radioactivity present after the first 90 seconds."⁵⁰ "In fact," the article continued, "a new mission for airborne assault forces might well develop: to mop up the remainder of a huge reserve concentration after it had been A-bombed!"⁵¹

Another military publication told the soldiers that a position several miles from ground zero is "a safe distance"⁵² and that the permissible dosage of radiation, "as far as we know, does no harm at all."⁵³ According to the publication, particles of fallout after an air burst "definitely do not present any hazard to personnel."⁵⁴ The possibility of health effects appearing many years after exposure was not mentioned. Rather, the publication stated that the "length of time before damage appears may vary from a few hours to several days."⁵⁵ The publication concluded with this advice: "Learn to respect, but not to be blindly fearful of A-weapons."⁵⁶

Military publications continued to make similar statements throughout the decade of the 1950's. Soldiers were told that the most difficult problem with nuclear weapons is not handling them, but devising the appropriate tactics and logistics for their use.⁵⁷ The atomic fighting force was envisioned as "commanded by young officers possessed of the fortitude necessary to withstand the shock of the opening phases of atomic warfare."⁵⁸ According to one publication, "[r]adiation presented no problem"⁵⁹ at a test involving armored tank maneuvers, despite the fact that recently declassified army documents report radiation levels of up to 12r inside the

49. Infantry School Quarterly, Oct., 1952, at 29.

50. *Id.*

51. *Id.* at 31.

52. Armed Forces Talk, Sept. 19, 1952, at 3.

53. *Id.* at 5.

54. *Id.* at 6.

55. *Id.* at 8.

56. *Id.* at 15. Also included at the end of this publication was the following: "A. (If anyone in your discussion group has seen an atomic bomb burst, ask him to describe it.) "B. Many of the men interviewed after one atomic burst at Desert Rock said they would pay anywhere from \$25 to \$500 to see 'the show' again. Most of those interviewed said that they would pay between \$25 and \$50. How much would you be willing to pay to see an A-bomb burst at Desert Rock?" *Id.*

57. See Infantry School Quarterly, Apr., 1957, at 6; *id.*, Apr., 1955, at 14.

58. *Id.*, Apr., 1955, at 14. No mention is made of genetic hazards in this article.

59. Armor, May-June, 1955, at 13.

tanks.⁶⁰ One article stated that “[t]he deadliest killer in a thermo-nuclear war may not be heat or blast or radiation. It may be panic.”⁶¹ It continued:

How many times have you heard remarks like these?

“Once you are exposed to radiation, your number is up.”

“The greatest threat produced by a nuclear explosion is from radiation.”

“Radioactivity causes sterility.”

None of these statements happens to be true. They are exaggerations—rumors—the seeds of panic—and they can do incalculable harm.

The *facts* are these:

Your troops can move into or leave an exposed area a few minutes after an air burst. Surface and sub-surface bursts will require more caution.

A moderate dose of gamma radiation is rarely fatal, and even casualties with severe doses can usually be helped by medical treatment. . . . A soldier is not a casualty until he requires treatment. Even though he has been exposed to a lethal dose of radiation, he can perform his combat mission until symptoms appear.

Radioactivity does not permanently affect sexual potency. Men exposed to radiation can have normal, healthy children. Radiation sufficient to produce permanent sterility or impotency would also be lethal.⁶²

In 1957, troops were told that if they move quickly through a contaminated area they “will not suffer casualties.”⁶³ In the case of smaller atomic weapons, the fallout hazard “can be disregarded.”⁶⁴

Many of the same themes also were presented in military training films from the 1950’s.⁶⁵ The troops were told that the atomic age would not render them obsolete. The blast and heat effects of nuclear weapons were stressed while radiation dangers

60. See Army Summary of Test Shot Reports, Working Copy, reprinted in *Cranston Hearings*, *supra* note 4, at 52.

61. Infantry School Quarterly, Oct., 1955, at 11.

62. *Id.* at 13.

63. Infantry School Quarterly, Jan., 1957, at 43.

64. *Id.* at 45.

65. See *The Armor Soldier on the Nuclear Battlefield*, TF 17-2826 (1959); *Individual Protection Against Atomic Attack*, TF 20-2531 (1957); *Troop Indoctrination for an Atomic Exercise*, TF 21-1921 (1954); *Radioactive Contamination*, MF 39-8148 (1952); *The Medical Aspects of Nuclear Radiation*, MF 8-7897 (1950); *Effects of Atomic Weapons on Troops in the Field*, MF 20-8598 (date unavailable). These films are available from the Department of the Army, Defense Audiovisual Agency, Distribution and Depository Activity, Tobyhanna, Pennsylvania, 18466.

were deemphasized. The word "safe" was used when discussing radiation exposure. Moreover, these films conveyed a sense of certainty regarding radiation knowledge that was not present in the scientific community at that time.⁶⁶ The training films did not mention cancer, leukemia, or other latent pathological effects from radiation exposure.⁶⁷ The films made at the end of the decade stated the same things as films made at the beginning of the decade, thus ignoring the increase in scientific knowledge about radiation hazards that occurred during the decade of the 1950's.

Lack of Medical Followup

One would have expected the government to realize that misinformation would lull many veterans into a false sense of security regarding their health, and therefore to initiate a process whereby all of those affected could be given the correct information and provided with proper medical monitoring. Before 1977, however, there was no medical monitoring of the troops who were present at the nuclear blasts.⁶⁸ The government first became involved in medical monitoring when an exposed soldier who was dying of leukemia in a Salt Lake City, Utah, hospital told his physician in November, 1976, about a nuclear test he witnessed in 1957. This information reached the United States Public Health Service's Center for Disease Control, which was interested in conducting field epidemiological studies of cancer cases. Following inquiries by the Center, the DOD and other government agencies finally began to take some action.⁶⁹

In 1977, at the request of the Army Surgeon General, an ad hoc committee was formed within the DOD to review the problem. The committee's preliminary conclusions stated that "there is no scientific basis to support a requirement for a general medical follow up of nuclear test participants and no reasonable cause for

66. See notes 28-36 & accompanying text *supra*.

67. To the military, a harmful dose was one that had immediate debilitating effects—anything less had no military significance and thus was not mentioned.

68. Nonmilitary government personnel who have had radiation exposure in excess of government standards at the Nevada Test Site and in the Pacific "have not been told that their exposures can potentially increase the risk of cancer or other disease." *1978 Hearings, supra* note 1, at 1163 (DOD replies to subcommittee questions).

69. See *Cranston Hearings, supra* note 4, at 281-90 (statement of Dr. Clark W. Heath, Jr., M.D., Director, Chronic Disease Division Bureau of Epidemiology, Center for Disease Control); *id.* at 17 (testimony of Vice Admiral Robert R. Monroe, Director, Defense Nuclear Agency); *NEWSWEEK*, Feb. 6, 1978, at 57; *New York Times*, Dec. 25, 1977, at A18, col. 1.

public apprehension regarding the state of health of those who did participate."⁷⁰ This conclusion was reached even though the committee was aware that initial investigations by the Center for Disease Control had indicated an abnormally high rate of cancer among the troops present at a 1957 blast called "Smoky."⁷¹

In 1978, it was revealed that the government had been alerted to the problem in a more formal manner in 1970. After the National Broadcasting Company aired a report about the atomic veterans, Congressman Olin Teague wrote a letter to Secretary of Defense Melvin Laird requesting more information and a medical followup. Nothing of consequence was ever done.⁷² Since that time, private legal action has been taken to compel the government to issue warnings and provide followup medical care for everyone involved, but the government has resisted these efforts.⁷³

Currently, the government is sponsoring studies by the National Academy of Sciences and the Center for Disease Control into the health effects of the atomic tests on some of the veterans.⁷⁴ These studies will take several years to complete, however, and their primary purpose is to gather scientific data. There is no government activity attempting to notify every affected veteran.⁷⁵

Any medical followup that is implemented will be difficult because many of the records needed do not exist.⁷⁶ There was no central records depository for troops who participated in atomic maneuvers.⁷⁷ Furthermore, in 1973 a fire in a government building

70. Executive Summary of the Ad Hoc Committee to Study Military Participation in Atmospheric Tests, *reprinted in Cranston Hearings, supra* note 4, at 4.

71. *Id.* at 3.

72. See 1978 Hearings, *supra* note 1, at 1110 (testimony of Vice Admiral Robert R. Monroe, Director, Defense Nuclear Agency).

73. See notes 103-06 & accompanying text *infra*.

74. See *Cranston Hearings, supra* note 4, at 291 (statement of Semour Jablon, National Academy of Sciences). Preliminary studies by the Center for Disease Control indicate a significantly higher than expected incidence of leukemia among veterans who attended shot "Smoky" in 1957. See Caldwell, Kelley & Heath, *Leukemia Among Participants in Military Maneuvers at a Nuclear Bomb Test: A Preliminary Report*, 244 J. AM. MED. A. 1575 (1980).

75. The government is in the process of centralizing and coordinating all of its information on the subject, including the identification of affected veterans. A toll free telephone number has been established (800-336-3068), see *New York Times*, June 20, 1979, at A24, col. 6, for veterans to call, but as yet, the government is not initiating contact with every affected veteran to recommend that medical monitoring be done.

76. See 1978 Hearings, *supra* note 1, at 1104-05.

77. See *id.* at 272-73, 310-16.

destroyed millions of military personnel records.⁷⁸ Thus many veterans are now finding it extremely difficult, if not impossible, to prove that they attended a nuclear blast. Those who can prove their attendance are finding it equally difficult to prove the dosage level of radiation to which they were exposed.⁷⁹

Having knowingly exposed soldiers to a situation that could result in adverse consequences many years later, the government had a duty to compile and safeguard records of that exposure. Failure to do so is unjustifiable. The consequences of that failure are: (1) an inability to contact all those who were involved, and (2) the creation of an evidentiary void that could preclude many veterans from obtaining relief.

The magnitude of the hazards involved in forced exposure to radiation, as they were known at the time of the testing, far outweighed the military need for maneuvers entailing such exposure. However, if the military need was imperative, then fully informed volunteers should have been used. In any case, adequate dosimetry, protection, recordkeeping, and medical monitoring were absolutely required. Failure of the government to meet even these minimum requirements must therefore be considered unreasonable.

Administrative and Legal Impediments to Relief

Approximately eight hundred and thirty claims for compensation for disorders alleged to have been induced by radiation from nuclear tests have been denied by the Veterans Administration (VA).⁸⁰ This represents a denial rate of about ninety-nine percent.⁸¹ It is the duty of the VA to pay compensation for service

78. *See id.* at 1098-1100.

79. The DOD's ad hoc committee concluded: "The fact that all participants in the nuclear weapons program were not issued film badges and the failure to maintain central control of radiation dosimetry records have resulted in a loss of dosimetry data. Corroborative information to establish the participation of some individuals will be difficult to obtain, and it [is] unlikely that [information for] all individuals who participated will ever be obtained." Executive Summary of the Ad Hoc Committee to Study Military Participation in Atmospheric Tests, *reprinted in Cranston Hearings, supra* note 4, at 2.

80. Internal VA Working Memorandum entitled "Radiation Exposure Claims" (Feb. 2, 1981). A class action suit has been filed against the VA and others by the National Veterans Law Center in Washington, D.C. Complaint for Plaintiff at 3, *Gott v. Cleland*, Civ. No. 80-0906 (D.D.C., filed July, 1980) [hereinafter cited as Complaint]. *See note 95 infra. See generally* New York Times, Apr. 11, 1980, at A10, col. 1.

81. Internal VA Working Memorandum entitled "Radiation Exposure Claims" (Feb. 2, 1981). *See generally* New York Times, Nov. 27, 1979, at A18, col. 1; Washington Post, Nov.

connected disability or death.⁸² Accordingly, the VA has promulgated regulations relating to the establishment of disorders as being service connected. These regulations state in part:

Service connection connotes many factors but basically it means that the facts, shown by evidence, establish that a particular injury or disease resulting in disability was incurred coincident with service in the Armed Forces, or if preexisting such service, was aggravated therein. This may be accomplished by affirmatively showing inception or aggravation during service or through the application of statutory presumptions Determinations as to service connection will be based on review of the entire evidence of record, with due consideration to the policy of the Veterans Administration to administer the law under a broad and liberal interpretation consistent with the facts in each individual case. . . .

Service connection may be granted for any disease diagnosed after discharge, when all the evidence, including that pertinent to service, establishes that the disease was incurred in service.⁸³

The VA has been unclear as to what level of proof is required to show service connection and which party should bear that burden. The VA has stated: "Where the evidence in its entirety creates a reasonable doubt as distinguished from speculation or remote possibility, such doubt should be resolved in favor of service connection."⁸⁴ In addition, a VA official has testified: "We have a basic doctrine of reasonable doubt . . . in favor of the claimant which means if you balance the facts 50-50 pro and con, we are required by our regulations and by law to grant the benefit."⁸⁵

The VA's doctrine of "reasonable doubt" contrasts sharply with the allocation of the burden of proof in a civil case.⁸⁶ The

28, 1979, at A5, col. 1 (VA granted benefits to veteran stating nuclear radiation a "probable factor" in his development of cancer. The veteran was Orville Kelly, founder of the National Association of Atomic Veterans, 1109 Franklin Street, Burlington, Iowa 52601).

82. 38 U.S.C. §§ 310, 321, 331, 341 (1976). It should be noted that an attorney who represents a veteran with respect to a claim before the VA is limited to a fee of ten dollars. *Id.* § 3404(c)(2). Many attorneys may not wish to work for such a nominal fee.

83. 38 C.F.R. § 3.303(a), (d) (1979).

84. 45 Fed. Reg. 29,163 (1980); 44 Fed. Reg. 49,091 (1979).

85. 1979 *Hearings*, *supra* note 2, at 210 (testimony of J. Charles Peckarsky, Director, Compensation and Pension Service, Department of Veterans' Benefits, Veterans Administration). Problems arise when there are little or no "facts" to balance. "Reasonable doubt," as explained in 38 C.F.R. § 3.102 (1979), means in part that "the claimant is required to submit evidence sufficient to justify a belief in a fair and impartial mind that his claim is well grounded." A lack of evidence thus would seem to work against a claimant.

86. See notes 116-38 & accompanying text *infra*.

burden of proof encompasses both a burden of producing evidence and a burden of persuasion.⁸⁷ Both must be satisfied in order for the party who has the burden of proof to prevail. The burden of producing evidence is satisfied when the evidence is "[s]uch that a reasonable man could draw from it the inference of the existence of the particular fact to be proved."⁸⁸ Thus, an evidentiary void of sufficient degree would prohibit the party who has the burden of proof from satisfying the burden of producing evidence. Assuming this first part of the burden of proof is met, the burden of persuasion must still be satisfied. This means in a civil case that the party carrying the burden must show the existence of the contested fact to be more probable than not.⁸⁹ Therefore, a so-called 50-50 balance in the evidence results in a loss for the party who carries the burden of proof.

The VA laws and regulations do not impose the burden of producing evidence or the burden of persuasion upon the VA.⁹⁰ Even if the VA's doctrine of "reasonable doubt" did mean that the VA carries the burden of persuasion, the burden of producing evidence would still remain, as it does, with the claimant. Because of the evidentiary void involved in these cases,⁹¹ the VA's high rate of rejection for such claims⁹² is not surprising. The real issue in these circumstances is which party shall bear the loss when there is an evidentiary void. Under the VA's "reasonable doubt" doctrine the claimant bears the loss. When the burden of proof is placed upon the VA, the claimant prevails.

The VA does utilize presumptions of service connection relating to certain chronic diseases and disabilities.⁹³ These presump-

87. E. CLEARY, *McCORMICK'S HANDBOOK OF THE LAW OF EVIDENCE* § 336, at 783-84 (2d ed. 1972) [hereinafter cited as CLEARY]. See F. JAMES & G. HAZARD, *CIVIL PROCEDURE* § 7.5, at 240-41 (2d ed. 1977) [hereinafter cited as JAMES & HAZARD].

88. CLEARY, *supra* note 87, § 338, at 789. See JAMES & HAZARD, *supra* note 87, § 7.7, at 245-46.

89. CLEARY, *supra* note 87, § 339, at 794. See JAMES & HAZARD, *supra* note 87, § 7.6, at 243-45.

90. The "50-50" balancing referred to by a VA official, see note 85 & accompanying text *supra*, would seem to indicate that the VA is assuming the burden of persuasion. But this "50-50" language is absent from any laws or regulations relating to the VA's adjudicatory process.

91. See notes 40-44, 68-79 & accompanying text *supra*; note 117 & accompanying text *infra*.

92. See note 81 & accompanying text *supra*.

93. 38 U.S.C. §§ 301(3), 312, 333, 337 (1976). Chronic diseases and disabilities currently subject to presumptive service connection are listed at 38 C.F.R. § 3.309(a) (1979).

tions are of little benefit to the veterans exposed to radiation at the atomic testings, because the presumptions apply only if the disease becomes manifest within one year after separation from the service.⁹⁴ The latency period for most of the disorders alleged to be radiation-induced is usually over a year.⁹⁵

Because of the difficulty in establishing causation in VA proceedings, some plaintiffs may find the possibility of judicial action more promising. However, tort suits against the United States by affected veterans and their dependents are difficult to bring. The Federal Tort Claims Act of 1946⁹⁶ (FTCA) contains a general waiver of governmental immunity,⁹⁷ modified by several express exceptions that retain immunity in certain cases.⁹⁸ In 1950 the United States Supreme Court in effect added another exception to the FTCA in the case of *Feres v. United States*,⁹⁹ stating that the

The VA has authority to add to this list. 38 U.S.C. § 301(3) (1976).

94. 38 C.F.R. § 3.307(a)(3) (1979).

95. In a related matter, Representative Thomas Daschle has introduced a bill to provide a presumption of service connection for the occurrence of certain diseases in Vietnam veterans who were exposed to phenoxy herbicides contaminated by dioxins (agent orange). H.R. 6377, 96th Cong., 2d Sess., reprinted in 126 CONG. REC. H428-29 (daily ed. Jan. 30, 1980).

The VA has issued several documents setting forth its policies for evaluation of radiation claims. See Rating Practices and Procedures; Disability; Ionizing Radiation Exposure, 44 FED. REG. 49,090 (1979); Development of Ionizing Radiation Exposure, M21-1, Change 245, § 22.05.1 (Sept. 10, 1979) (not published in the Federal Register); Joint Department of Defense and Veterans Administration Memorandum of Understanding on Investigation of Ionizing Radiation Claims from Veterans Atmospheric Nuclear Weapons Test Participants (June 15, 1979) (not published in the Federal Register). See also 45 FED. REG. 29,161 (1980) (revised version of Rating Practices and Procedures; Disability; Ionizing Radiation Exposure). However, a lawsuit filed against the VA alleged that the VA violated several public notice, comment, and rulemaking requirements in issuing these documents. See Complaint, supra note 80, at 10 (alleging violation of 5 U.S.C. §§ 552, 553 (1976) and 38 C.F.R. §§ 1.12, 1.550-559 (1979)). This allegation is especially serious in light of the fact that the VA's claims decisions are not subject to judicial review. See 38 U.S.C. § 211 (1976).

96. 28 U.S.C. §§ 1291, 1346(b)-(c), 1402(b), 1504, 2110, 2401(b), 2402, 2411(b), 2412, 2671-2680 (1976). See generally L. JAYSON, HANDLING FEDERAL TORT CLAIMS: ADMINISTRATIVE AND JUDICIAL REMEDIES (1980).

97. 28 U.S.C. § 2674 (1976).

98. *Id.* § 2680. The statute of limitations under the FTCA is two years. *Id.* § 2401(b). The latency period for allegedly radiation-induced injuries should not pose a problem in these cases. See *United States v. Kubrick*, 444 U.S. 111, 120 n.7 (1980) (as to medical malpractice claims under the FTCA, the statute of limitations does not begin to run until the plaintiff has discovered the injury or reasonably should have discovered it); Note, *The Application of the Statute of Limitations to Actions for Tortious Radiation Exposure: Garret v. Raytheon Co.*, 21 ALA. L. REV. 509 (1980) (discussion of the discovery rule as applied to radiation injury).

99. 340 U.S. 135 (1950).

government is immune from suit "for injuries to servicemen where the injuries arise out of or are in the course of activity incident to service."¹⁰⁰

Although the rationale underlying the *Feres* decision is questionable,¹⁰¹ it has been supported by the Court as recently as 1977.¹⁰² *Feres* was also relied upon in 1979 in *Jaffee v. United States*,¹⁰³ in which the Third Circuit sustained the government's claim of immunity in a suit for damages brought by a veteran who was present at an atomic bomb blast. However, the plaintiff veteran in *Jaffee* also asked that the government be required to warn all veterans who attended atomic blasts of the health risks that now face them. The Third Circuit held that the government was not immune from such a request.¹⁰⁴ In so holding, the court relied upon a 1976 amendment to the Administrative Procedure Act that partially waives the immunity of governmental agencies by allowing "relief other than money damages."¹⁰⁵ *Jaffee* was remanded

100. *Id.* at 146.

101. See 36 CONG. REC. 12,014, 12,021 (1940); 3 K. DAVIS, ADMINISTRATIVE LAW TREATISE §§ 25.04-.11 (1958); Hitch, *The Federal Tort Claims Act and Military Personnel*, 8 RUTGERS L. REV. 316 (1954); Note, *Sovereign Immunity—FTCA—Injuries to Armed Services Personnel*, 18 CASE W. RES. L. REV. 1788 (1967); Note, *The Supreme Court and the Tort Claims Act: End of an Enlightened Era?*, 27 CLEV. ST. L. REV. 267 (1978); Note, *Recovery for "Service-Incident" Injuries Under the Federal Tort Claims Act*, 50 COLUM. L. REV. 827 (1950); Note, *Federal Tort Claims Act: Status of Soldier as Claimant: Brooks v. United States*, 337 U.S. 49 (1949), 35 CORNELL L.Q. 233 (1949); Note, *Federal Tort Claims Act As Applied to Military Personnel*, 40 KY. L. J. 438 (1952); Note, *FTCA—Liability of the Government for Service Connected Injuries to Members of the Armed Forces*, 11 LA. L. REV. 125 (1950); Note, *From Feres to Stencel: Should Military Personnel Have Access to FTCA Recovery?*, 77 MICH. L. REV. 1099 (1979); Note, *Jaffee v. United States: Feres Doctrine at the Cliff's Edge?*, 42 U. PA. L. REV. 115 (1980). Note, *Military Rights Under the FTCA*, 43 ST. JOHN'S L. REV. 455 (1969); Note, *Rights of Servicemen Under the Federal Tort Claims Act*, 1 SYRACUSE L. REV. 87 (1949); Note, *Military Personnel and the Federal Tort Claims Act*, 58 YALE L.J. 615 (1949). See generally Gottlieb, *The Federal Tort Claims Act—A Statutory Interpretation*, 35 GEO. L.J. 1 (1946); Note, *The FTCA*, 56 YALE L.J. 534 (1947).

102. See *Stencel Aero Engineering Corp. v. United States*, 431 U.S. 666 (1977). See also *Hatzlachh Supply Co. v. United States*, 100 S. Ct. 647, 650 (1980) (per curiam) (implicit approval of *Stencel*).

103. 592 F.2d 712 (3d Cir.), cert. denied, 441 U.S. 961 (1979). See Comment, 25 N.Y.L. SCH. L. REV. 377 (1979).

104. 592 F.2d at 718-20. But see *New York Times*, Aug. 2, 1979, at A12, col. 5 (district court judge disapproving of government's proposed warning letter to veterans, saying letter might encourage the veterans to ignore hazards rather than seek medical attention). See also *Punnett v. Carter*, 621 F.2d 578 (3d Cir. 1980) (upholding district court's denial of the plaintiff's motion for a preliminary injunction compelling the government to warn atomic veterans of possible genetic hazards facing them and their offspring).

105. 5 U.S.C. § 702 (1976). See Comment, *Nuclear Accidents: Judicial Review of the*

to the district court where the plaintiff attempted to sue the individual governmental officials responsible for his exposure to radiation. The district court ruled that the protection of *Feres* extends to those individuals and reluctantly dismissed the action.¹⁰⁶

Another potential cause of action against the United States for veterans or their dependents arises from the government's failure to inform the veterans *after* they left the service of the health risks they were facing. In many cases of cancer and other diseases, early detection can improve the chances for survival. Significantly, the governmental immunity provided by *Feres* has been held inapplicable when the government's negligence occurs after the veteran's discharge from the military.¹⁰⁷ Similarly, it has been alleged that the government's failure to inform veterans after their discharge that they have incurred increased health risks because of their radiation exposure forms the basis for negligence that is unprotected by *Feres*.¹⁰⁸ A federal district court has recently found that such a claim stated a cause of action in the case of a veteran's widow whose husband participated in atomic maneuvers in 1953.¹⁰⁹

NRC's Duty to Issue a Health Warning, 9 FORDHAM URB. L.J. 353 (1980).

106. *Jaffee v. United States*, 468 F. Supp. 632, 634-35 (D.N.J. 1979), *rev'd*, No. 79-1543 (3d Cir., filed Feb. 20, 1980) (petition for rehearing granted and panel decision vacated April 11, 1980) (rehearing by Third Circuit, *en banc*, held Nov. 17, 1980). See Note, *Jaffee v. United States: Feres Doctrine at the Cliff's Edge?*, 42 U. PA. L. REV. 15 (1980); see Note, 11 SETON HALL L. REV. 275 (1980).

107. See *United States v. Brown*, 348 U.S. 110 (1954). Therefore, an allegedly negligent postdischarge failure to warn of increased health risks resulting from the Army's covert administration of LSD to a soldier on active duty was held to be beyond the protection of *Feres*. See *Thornwell v. United States*, 471 F. Supp. 344 (D.D.C. 1979). The result in *Thornwell* should be contrasted with *Nagy v. United States*, 471 F. Supp. 383 (D.D.C. 1979), where a claim for postdischarge failure to warn in another Army-LSD case was dismissed, apparently because the Court believed that the government was not negligent. Other cases also have involved an allegedly negligent postdischarge failure to warn. See *Henning v. United States*, 446 F.2d 774 (3d Cir. 1971), *cert. denied*, 404 U.S. 1016 (1972) (claim dismissed); *Wisniewski v. United States*, 416 F. Supp. 599 (E.D. Wis. 1976) (claim dismissed); *Schwartz v. United States*, 230 F. Supp. 536 (E.D. Pa. 1964), *aff'd*, 381 F.2d 627 (3d Cir. 1967) (claim allowed).

108. Brief for Plaintiff-Appellant at 29-30, *Broudy v. United States*, No. 79-3829 (9th Cir., filed June 18, 1980).

109. *Everett v. United States*, 492 F. Supp. 318 (S.D. Ohio 1980).

Another legal avenue open to the atomic veterans grows out of the University of California's involvement in the country's nuclear weapons program. Both the Los Alamos Scientific Laboratory and the Lawrence Livermore National Laboratory have worked jointly with the United States Government in major aspects of the program. Both labs have been, and still are, comanaged by the United States Government and the University of California. See Bradbury, *The Los Alamos Laboratory*, BULLETIN OF THE ATOMIC SCIENTISTS, Nov., 1954, at 358; Day, *The Nuclear Weapons Labs*, BULLETIN OF THE ATOMIC SCIENTISTS, Apr., 1977, at

If a plaintiff can establish a valid claim, there is reason to believe that factual causation would be a less difficult issue of proof in the courts than it has been before the VA.

Burden of Proof

A cause of action for negligence entails five primary elements: (1) a duty to act reasonably; (2) failure to so act; (3) factual causation; (4) legal causation; and (5) resulting injury.¹¹⁰ The first element, duty, involves a legal obligation imposed by law based on the relationship between the parties.¹¹¹ The second element involves unreasonable conduct.¹¹² Factual causation entails the "mat-

21; Manley, *The Los Alamos Scientific Laboratory*, BULLETIN OF THE ATOMIC SCIENTISTS, Apr., 1949, at 101; Schwartz, *The Berkeley Controversy Over Nuclear Weapons*, BULLETIN OF THE ATOMIC SCIENTISTS, Sept., 1978, at 20; New York Times, Nov. 18, 1978, at A22, col. 1; *id.*, July 31, 1977, § 4, at 18, col. 1, 3; *id.*, July 19, 1977, at A14, col. 2; *id.*, Nov. 15, 1975, at A28, col. 1; *id.*, June 19, 1971, at A30, col. 1; *id.*, Jan. 8, 1971, at A11, col. 1. Conceivably, the University of California could be held liable as a joint tortfeasor based upon a concerted action theory. Section 876 of the RESTATEMENT (SECOND) OF TORTS (1977), entitled "Persons Acting in Concert," states in part: "For harm resulting to a third person from the tortious conduct of another, one is subject to liability if he . . . (b) knows that the other's conduct constitutes a breach of duty and gives substantial assistance or encouragement to the other so to conduct himself, or (c) gives substantial assistance to the other in accomplishing a tortious result and his own conduct, separately considered, constitutes a breach of duty to the third person." Bernard Witkin states that the *Restatement's* definition of "joint tortfeasors" applies to "those who order, direct or permit others to do the act, and who give assistance or encouragement." 4 B. WITKIN, SUMMARY OF CALIFORNIA LAW *Torts* § 30, at 2330 (8th ed. 1974). Dean Prosser states: "All those who, in pursuance of a common plan or design to commit a tortious act, actively take part in it, or further it by cooperation or request, or who lend aid or encouragement to the wrongdoer, or ratify and adopt his acts done for their benefit, are equally liable with him. Express agreement is not necessary, and all that is required is that there be a tacit understanding." W. PROSSER, HANDBOOK OF THE LAW OF TORTS § 46, at 292 (4th ed. 1971) (footnotes omitted) [hereinafter cited as PROSSER]; see also Prosser, *Joint Torts and Several Liability*, 25 CALIF. L. REV. 413, 429-30 (1937). Dean Prosser further notes that in establishing a cause of action based on concerted action, "it is . . . essential that each particular defendant who is to be charged with responsibility shall be proceeding tortiously, which is to say with intent to commit a tort, or with negligence. One who innocently, and carefully, does an act which furthers the tortious purpose of another is not acting in concert with him." PROSSER, *supra*, § 46, at 292 (footnotes omitted); see also RESTATEMENT (SECOND) OF TORTS §§ 875, 877, 880 (1977). Two suits have been filed against the University of California by survivors of two atomic veterans. See First Amended Complaint, *Sanders v. Livermore Labs*, No. 535223-8 (Sup. Ct. of Cal. for Alameda County, filed Aug. 7, 1980); Complaint for Plaintiff, *Konizeski v. Livermore Labs*, No. 535489-0 (Sup. Ct. of Cal. for Alameda County, filed Aug. 6, 1980). See generally A. VAN ALSTYNE, CALIFORNIA GOVERNMENT TORT LIABILITY PRACTICE (1980).

110. See PROSSER, *supra* note 109, § 30, at 143.

111. *Id.* § 53, at 324.

112. *Id.* § 32, at 150. Proof of this element is sometimes aided by a type of circumstan-

ter of what has in fact occurred."¹¹³ Legal causation in a particular case essentially is a question of policy as to whether the law will impose responsibility for the consequences that have occurred as a result of the conduct.¹¹⁴ Injury involves actual loss or damage to the interests of a person.¹¹⁵

Should any of the veterans or their families claiming the right to relief reach the trial stage, they will face considerable difficulty in establishing the causal connection between their disability and their exposure to nuclear radiation.¹¹⁶ The very nature of the radiation injury makes proof of causation uncertain because: (1) the injury from radiation exposure can take decades to manifest itself clinically; (2) cancer and other diseases induced by radiation are indistinguishable from identical diseases induced by other causes, such as heredity or other environmental hazards; (3) direct evidence of causation in individual cases is impossible; and (4) only circumstantial evidence based upon expert opinion and statistical

tial evidence called *res ipsa loquitur*. *See id.* § 39, at 211-13. "Negligence, like any other fact, may be proved by circumstantial evidence. This is evidence of one fact, or a set of facts, from which the existence of the fact to be determined may reasonably be inferred." *Id.* (footnotes omitted). The set of facts from which negligence may be inferred include: "(1) the event must be of a kind which ordinarily does not occur in the absence of someone's negligence; (2) it must be caused by an agency or instrumentality within the exclusive control of the defendant; (3) it must not have been due to any voluntary action or contribution on the part of the plaintiff." *Id.* § 39, at 214. Satisfaction of the first element would only help prove that the plaintiff had been injured by the negligence of an unidentifiable party. It is the second element that helps prove it was the *defendant* whose conduct was negligent. *See id.* § 39, at 218-21. The second element, therefore, necessarily embodies the issue of factual causation. This can lead to confusion between *res ipsa loquitur* and the entirely different issue of shifting the burden of proof on factual causation. *See Rabin v. Tumin*, 36 Cal. 2d 654, 661-65, 226 P.2d 574, 578-81 (1951). "Only confusion can result . . . if rules designed to shift the burden of proof or the burden of going forward with the evidence are treated as rules governing the sufficiency of circumstantial evidence." *Id.* at 664, 226 P.2d at 580 (Traynor, J., dissenting and concurring). Inasmuch as *res ipsa loquitur* is merely a form of circumstantial evidence, it may be confused with other uses of circumstantial evidence, such as violation of a statute constituting circumstantial evidence of factual causation. *See note 132 & accompanying text infra*. For two excellent discussions of *res ipsa loquitur*, see Malone, *Res Ipsa Loquitur and Proof by Inference—A Discussion of the Louisiana Cases*, 4 LA. L. REV. 70 (1941); Prosser, *Res Ipsa Loquitur in California*, 37 CALIF. L. REV. 183 (1949).

113. PROSSER, *supra* note 109, § 41, at 237.

114. *Id.* § 42, at 244; *id.* § 41, at 237.

115. *Id.* § 30, at 143.

116. The need to prove a causal connection between radiation exposure and subsequent injury can be obviated. If the negligent conduct alleged is a postdischarge failure to warn, see notes 107-09 & accompanying text *supra*, then a causal connection between the injury and the failure to warn (not the exposure) must be shown.

probabilities is available.¹¹⁷

The burden of proof¹¹⁸ on factual causation, as with the burden of proof on other elements of the negligence cause of action, generally is on the plaintiff.¹¹⁹ In certain limited circumstances, however, the burden of proof on factual causation may be shifted to the defendant. Courts have been willing to justify such a shift in cases where an evidentiary void existed as to the causal connection between a defendant's unreasonable conduct and an innocent plaintiff's injury. In each case where the court allowed such a shift, the plaintiff was in a position to show the elements of duty, breach, and injury, but was unable to show the element of factual causation because of an evidentiary void. In each case, the plaintiff provided as much circumstantial evidence of factual causation as fairly could be required under the circumstances. The courts then allowed a shift in the burden of proof on factual causation such that the defendants were required to show that their conduct did not in fact cause the plaintiff's injuries. It is proposed that the principles developed in these cases are applicable to the claims of the veterans.

In *Summers v. Tice*,¹²⁰ two hunters simultaneously shot in the direction of the plaintiff, resulting in the plaintiff's injury. Although able to prove that both defendants acted unreasonably in shooting, the plaintiff was unable to prove which defendant fired the shot that hit him. The court recognized that both defendants were negligent and that one of them did in fact cause the plaintiff's injury. Recognizing in addition that the plaintiff was innocent, the court shifted the burden of proof on factual causation to the defen-

117. See *Radiation Protection Hearings*, *supra* note 44, at 318-23 (statement of Irwin D.J. Bross, Ph.D., Director of Biostatistics, Roswell Park Memorial Institute).

118. For a discussion of the burden of proof, see notes 86-89 & accompanying text *supra*.

119. See PROSSER, *supra* note 109, § 41, at 241. For suits brought against the United States under the FTCA, liability is assessed "in accordance with the law of the place where the act or omission occurred." 28 U.S.C. § 1346(b) (1976). See *Richards v. United States*, 369 U.S. 1 (1962). See also FED. R. EVID. 302 (in federal civil cases, the burden of proof is determined by state law).

120. 33 Cal. 2d 80, 199 P.2d 1 (1948). See *Malone, Ruminations on Cause-In-Fact*, 9 STAN. L. REV. 60, 82-85 (1956); *Miller, Cases of Uncertain or Unknown Causation and Negligence: Relationship Analysis as a Real Alternative to Present Inadequate Concept*, 16 U. KAN. L. REV. 209, 210-12 (1968); *Owen, The Highly Blameworthy Manufacturer: Implications on Rules of Liability and Defense in Products Liability Actions*, 10 IND. L. REV. 769, 778-80 (1977); 37 GEO. L.J. 627 (1949); 23 S. CAL. L. REV. 412 (1950); 27 TEX. L. REV. 732 (1949).

dants.¹²¹ Each defendant was then required to produce evidence, and show by a preponderance of such evidence, that he was not the cause of the plaintiff's injury.

The decision in *Summers* reflects an appropriate policy choice based upon principles of justice. Dean Prosser approved of the result in *Summers*, stating:

It seems a very desirable solution where negligence on the part of both defendants is clear, and it is only the issue of causation which is in doubt, so that the choice must be made between letting the loss due to failure of proof fall upon the innocent plaintiff or the culpable defendants.¹²²

The *Restatement (Second) of Torts* has also endorsed the decision in *Summers*:

Where the conduct of two or more actors is tortious, and it is proved that harm has been caused to the plaintiff by only one of them, but there is uncertainty as to which one has caused it, the burden is upon each such actor to prove that he has not caused the harm.¹²³

The Reporter's comment explains that the reason for the rule "is the injustice of permitting proved wrongdoers, who among them have inflicted an injury upon the entirely innocent plaintiff, to escape liability merely because the nature of their conduct and the resulting harm has made it difficult or impossible to prove which of them has caused the harm."¹²⁴

The principle underlying *Summers* was later applied in a case that involved only a single defendant. *Haft v. Lone Palm Hotel*¹²⁵ involved the drowning of a father and son in a hotel swimming pool. The defendant was held negligent as a matter of law because of its failure to comply with statutory safety requirements requiring the presence of a lifeguard and warning sign.¹²⁶ There were no

121. 33 Cal. 2d at 86, 199 P.2d at 4.

122. PROSSER, *supra* note 109, § 41, at 243. A similar statement has been made by former Chief Justice Traynor of the California Supreme Court: "The *Summers* rule is based on the policy that it is preferable to hold liable a negligent defendant who did not in fact cause the injury than to deny an innocent plaintiff any remedy when it cannot be determined which of the defendants is responsible for the harm but it appears that one of them was." *Vasquez v. Alameda*, 49 Cal. 2d 674, 682-83 n.2, 321 P.2d 1, 7 (1958) (Traynor, J., dissenting).

123. RESTATEMENT (SECOND) OF TORTS § 433B(3) (1965).

124. *Id.* § 433B, comment f.

125. 3 Cal. 3d 756, 478 P.2d 465, 91 Cal. Rptr. 745 (1970). *See also* 12 WM. & MARY L. REV. 928 (1971).

126. 3 Cal. 3d at 763, 478 P.2d at 468, 91 Cal. Rptr. at 748.

witnesses to the drownings and the lack of evidence surrounding the event made it unlikely that the plaintiff would be able to prove that the defendant's unreasonable conduct was a factual cause of the deaths. The court therefore shifted the burden of proof on factual causation to the defendant.¹²⁷

The court noted a distinction that made the shifting of the burden of proof in *Haft* even more desirable than in *Summers*. In *Summers*, the absence of proof on causation, although a result of the defendants' conduct, was not a consequence that was reasonably foreseeable by the defendants. In *Haft*, the absence of proof regarding causation was a result of the defendant's conduct, because that conduct "deprived the present plaintiffs of a means of definitively establishing the facts leading to the drownings."¹²⁸ In *Haft*, however, the court found that the lack of evidence was a foreseeable result of the defendant's failure to provide a lifeguard. The court thus deemed the defendant in *Haft* to be more " 'culpably' responsible" and more "at 'fault'" for the absence of proof than were the defendants in *Summers*.¹²⁹ The fact that the lack of evidence was a *foreseeable* result of the defendant's conduct is not essential to the holding in *Haft*.¹³⁰

The major question remaining unanswered is the degree to which a plaintiff must establish a causal link between the defendant's conduct and the injury before the burden shifts. The *Haft* opinion spoke of shifting the burden of proof "when there is a substantial probability that a defendant's negligence was a cause of an accident."¹³¹ Although this "substantial probability" may have ex-

127. *Id.* at 769-75, 478 P.2d at 473-77, 91 Cal. Rptr. at 753-57.

128. *Id.* at 771, 478 P.2d at 475, 91 Cal. Rptr. at 755.

129. *Id.* at 773-74, 478 P.2d at 476, 91 Cal. Rptr. at 756. Fault for the absence of proof resulted not merely from having caused the absence, but also from the foreseeability of such an absence.

130. See Note, *A New Burden of Proof in Negligence Actions Involving Statutory Violations?*, 23 HASTINGS L.J. 650, 666-67 (1972). That this is not a requirement for shifting the burden of proof is made clear in the recent case of *Sindell v. Abbott Laboratories*, 26 Cal. 3d 588, 601, 611, 607 P.2d 924, 930, 936, 163 Cal. Rptr. 132, 138, 144, *cert. denied*, 101 S. Ct. 285 (1980). See note 139 & accompanying text *infra*.

131. 3 Cal. 3d at 774 n.19, 478 P.2d at 476, 91 Cal. Rptr. at 756. One California appellate court has used this "substantial probability" language to deny a shift in the burden of proof because it could not "say that there was a substantial probability that the defendants' negligence caused the accident." *Smith v. Americana Motor Lodge*, 39 Cal. App. 3d 1, 6, 113 Cal. Rptr. 771, 774 (1974). This reading of *Haft* is incorrect, however, for it fails to take into account other relevant language in the opinion. See notes 132-33 & accompanying text *infra*.

isted in the *Haft* situation,¹³² it should not be interpreted to require of the plaintiff an evidentiary showing that cannot be met. Naturally, the greater the evidentiary void, the less likely a "substantial probability" of causation could be established by the plaintiff. A negligent defendant thus would be able to avoid a shifting of the burden by ensuring a greater evidentiary void. The rationale underlying *Haft* indicates that the plaintiff need only establish the causal relationship to a degree which is fair under the particular circumstances. The court in *Haft* reasoned:

[P]laintiffs have gone as far as they possibly can under the circumstances in proving the requisite causal link between defendants' negligence and the accidents. To require plaintiffs to establish "proximate causation" to a greater certainty than they have in the instant case, would permit defendants to gain the advantage of the lack of proof inherent in the lifeguardless situation which they have created.¹³³

The recent case of *Sindell v. Abbott Laboratories*¹³⁴ further amplifies the principles underlying *Summers*¹³⁵ and *Haft*. In

132. It is likely that the court's use of the phrase reflected California law that allows an inference of factual causation to arise when the negligence involves the breach of a statutory duty, see 3 Cal. 3d at 765, 478 P.2d at 469-70, 91 Cal. Rptr. at 749-50, and the particular circumstances of the *Haft* case in which the facts "strongly suggest" that causal connection. *Id.* at 772, 478 P.2d at 475, 91 Cal. Rptr. at 755. See Note, *A New Burden of Proof in Negligence Actions Involving Statutory Violations?*, 23 HASTINGS L.J. 650, 667-68 (1972). This use of circumstantial evidence to establish an inference of factual causation should not be confused with *res ipsa loquitur*, which is a use of circumstantial evidence to establish an inference of unreasonable conduct. See note 112 *supra*.

133. 3 Cal. 3d at 772, 478 P.2d at 475, 91 Cal. Rptr. at 755. The court's reference to "defendants" rather than "defendant" is due to the joint ownership of the hotel. See *id.* at 761 n.1, 478 P.2d at 466, 91 Cal. Rptr. at 746. For purposes of causation analysis, they can be considered as a single defendant as they all acted as a unit through the hotel.

134. See 26 Cal. 3d 588, 607 P.2d 924, 163 Cal. Rptr. 132, *cert. denied*, 101 S. Ct. 285 (1980). See also Note, *Market Share Liability: An Answer to the DES Causation Problem*, 94 HARV. L. REV. 668 (1981).

135. The *Sindell* court noted that *Summers* relied on the earlier case of *Ybarra v. Spangard*, 25 Cal. 2d 486, 154 P.2d 687 (1944). 26 Cal. 3d at 599, 607 P.2d at 928, 163 Cal. Rptr. at 136. In *Ybarra*, the California Supreme Court held that it was error to enter a judgment of nonsuit against a plaintiff who, because he was unconscious during an operation, was unable to specify which of several medical personnel in attendance during his period of unconsciousness were negligent. *Ybarra* is distinguishable from *Summers*, *Haft*, and *Sindell* in that the plaintiff in *Ybarra* could not establish the negligence of any particular defendant. For insightful discussion of *Ybarra*, see *Dierman v. Providence Hosp.*, 31 Cal. 2d 290, 296, 188 P.2d 12, 15 (1947) (Traynor, J., dissenting); Adamson, *Medical Malpractice: Misuse of Res Ipsa Loquitur*, 46 MINN. L. REV. 1043 (1962); Seavey, *Res Ipsa Loquitur: Tabula in Naufragio*, 63 HARV. L. REV. 643 (1950); Thode, *Unconscious Patient: Who Should Bear the Risk of Unexplained Injuries to a Healthy Part of His Body*, 1969 UTAH L. REV. 1.

Sindell the California Supreme Court not only shifted the burden of proof, but also expressed a willingness to hold a defendant liable when there is no substantial probability that the defendant's conduct was a cause of the plaintiff's injury. *Sindell* involved a suit against the manufacturers of diethylstilbestrol (DES) for personal injuries by a plaintiff whose mother ingested the drug during pregnancy. Alleging negligence and strict liability in the marketing, promoting, and testing of the drug, the plaintiff was unable to identify which of the approximately 200 manufacturers¹³⁶ actually produced the DES ingested by her mother. The case did not involve the causal issue of whether DES was in fact responsible for the injuries, but instead concerned the causal issue of which of the numerous defendants had supplied the DES in question. As to this issue, the court allowed the burden of proof to be shifted to the defendants.¹³⁷

136. 26 Cal. 3d at 602, 607 P.2d at 931, 163 Cal. Rptr. at 139.

137. *Id.* at 610-13, 607 P.2d at 936-38, 163 Cal. Rptr. at 144-46. The court in *Sindell* extended the principles underlying *Summers* to a factual situation that was not faced in *Summers* because there were only two defendants involved in that case. It is unclear how *Summers* would have been decided if there had been three defendants. If each one had fired one shot, absent any other evidence, the probability of any individual defendant's being the cause of the plaintiff's injury would have been 33⅓%. Even with the burden of proof shifted to the defendants, each could have overcome that burden by mathematically showing that it was more probable than not (66⅔%) that he or she was not the actual cause. The two defendants in *Summers* could only show a 50% probability that they individually were not the cause of the plaintiff's injury. Because a party with the burden of proof needs to show more than a 50% probability under the preponderance of the evidence standard in order to overcome that burden, neither defendant in *Summers* was able to overcome his burden. Conceivably, in the hypothetical case involving three hunters, a court could hold all defendants liable for that percentage of the damages corresponding to their individual probabilities of having caused the whole injury.

It must be emphasized that the goal is to apportion liability for damages in a manner that corresponds to the defendants' respective probabilities of having caused the injury. In the absence of other evidence, apportionment of damages according to market share is the fairest way to accomplish this goal. However, in a particular case, the appropriate market share must be identified. For example, assume four manufacturers with these respective market shares: A—45%, B—25%, C—20%, and D—10%. The output of these four manufacturers constitutes 100% of the market. But if it is determined by evidence unrelated to market share that C could not have caused the injury, then the output of the remaining manufacturers, A, B, and D, constitutes 100% of the market from which the injury-causing drug could have come. This is the appropriate market for apportioning liability. The manufacturers' respective shares of this market are: A—56%, B—31%, and D—13%. By comparison, where C is not excluded by evidence that it could not have caused the injury, but becomes insolvent, C's output still constitutes a portion of the appropriate market because the injury-causing drug could have come from C. Hence, the original market shares still apply for apportionment of liability, because C's insolvency does not affect the respective causal probabilities of A, B, and D as represented by their market shares. In such a case, the

The court's opinion clarified several aspects of the principle underlying *Summers*. First, it stated that a defendant need not have superior knowledge of the cause of the plaintiff's injury as a prerequisite for shifting the burden of proof.¹³⁸ Second, the court found that a defendant need not be at fault for the absence of evidence before the burden of proof may be shifted.¹³⁹

percentage of recovery represented by C's market share would be uncollectable. A recent commentator has failed to make these distinctions. See Note, *Industry-Wide Liability and Market Share Allocation of Damages*, 15 GA. L. REV. 423, 444-45 (1981).

Essentially, this is the approach adopted by the court in *Sindell*. The court held it "reasonable in the present context to measure the likelihood that any of the defendants supplied the product which allegedly injured plaintiff by the percentage which the DES sold by each of them for the purpose of preventing miscarriage bears to the entire production of the drug sold by all for that purpose." *Id.* at 611-12, 607 P.2d 937, 163 Cal. Rptr. at 145. Thus, a defendant DES manufacturer whose share of the market was 10% would be liable for 10% of the plaintiff's damages. Presumably, if a manufacturer could demonstrate with evidence unrelated to market share that it was not a cause, it could exculpate itself. Exculpatory evidence unrelated to market share could include, for example, proof that the prescribing physician and pharmacist never used brand X, that brand X was not available at the time in question, or that brand X was a tablet and the plaintiff's mother remembers taking only capsules. See Note, *DES and a Proposed Theory of Enterprise Liability*, 46 FORDHAM L. REV. 963, 994-95 (1978). This point is seemingly endorsed by the court in *Sindell*. See 26 Cal. 3d at 612, 607 P.2d at 937, 163 Cal. Rptr. at 145. Therefore, under *Sindell* a defendant may be held proportionately liable even though he or she can demonstrate mathematically that it is more probable than not that he or she *did not* cause the plaintiff's injury. *Id.* at 616, 607 P.2d at 939, 163 Cal. Rptr. at 147 (Richardson, J., dissenting).

The imposition of liability according to market share does more than simply shift the burden of proof on factual causation. It changes the standard by which that burden must be overcome. Usually proof by a preponderance of the evidence is sufficient to overcome the burden in a civil case. See PROSSER, *supra* note 109, § 41, at 241. In the absence of other evidence, that standard could be met easily by a defendant whose market share was less than 50%; it would be more likely than not that such a defendant was not a cause. If no manufacturer of DES had a market share greater than 49%, for example, then each manufacturer would be able to exonerate itself despite the shift in the burden of proof. Under *Sindell*, proof by a preponderance of the evidence that it was not a cause of the plaintiff's injury will not exculpate a manufacturer unless that evidence is unrelated to market share. This constitutes not only a shift in the burden of proof, but also a change in the standard required to overcome that burden. Although the court in *Sindell* did not discuss this point, the authority of the California Supreme Court to effect such a change in the standard can be found in CAL. EVID. CODE § 115 (West 1966), which states: "Except as otherwise provided by law, the burden of proof requires proof by a preponderance of the evidence." (Emphasis added). "'Law' includes constitutional, statutory, and *decisional* law." *Id.* § 160 (emphasis added). See *People v. Burnick*, 14 Cal. 3d 306, 314, 535 P.2d 352, 357, 121 Cal. Rptr. 488, 493 (1975).

138. 26 Cal. 3d at 600-02, 607 P.2d at 929-30, 163 Cal. Rptr. at 137-38.

139. The court stated: "Nor do we conclude that the absence of evidence on this subject is due to the fault of defendants." *Id.* at 601, 607 P.2d at 930, 163 Cal. Rptr. at 138. The court later stated: "[A]lthough the absence of such evidence is not attributable to the defendants . . . their conduct in marketing a drug the effects of which are delayed for many

The evidentiary problems facing atomic veterans is most closely analogous to the facts in *Haft*. In both situations, single defendants engaged in unreasonable conduct from which injuries to the innocent plaintiffs could have arisen. In *Haft*, failure to provide a lifeguard as required by law established the defendant's negligence. Regarding the veterans, the government knew of the hazards involved with radiation exposure, yet exposed non-volunteers and misinformed them regarding those hazards. The AEC delegated its responsibility for troop safety to the military, which then authorized levels of radiation exposure in excess of levels recommended by the AEC's medical division. The unreasonable nature of the conduct is further established by the inadequate dosimetry, protection, medical monitoring, and recordkeeping by the government.

The similarity of the relationship between the atomic veterans and the government and that between the parties in *Haft* is further established because in both situations the lack of evidence was a direct and foreseeable result of the unreasonable party's conduct. Although foreseeability is not a requirement for shifting the burden of proof, the foreseeability of an evidentiary void does serve to enhance the unreasonable quality of the government's conduct and make it more equitable that the burden of proof be shifted. In *Haft*, the court found that the absence of evidence on causation was a direct and foreseeable result of the defendant's negligent conduct in failing to provide a lifeguard. Two facets of the government's conduct account for the foreseeability of an evidentiary void in suits brought by veterans. First, a large amount of information was available to the government when it exposed the veterans to nuclear explosions. The scientific community of the 1950's knew enough about the nature of radiation to appreciate the hazards involved with such exposure, including the *latent health risks* and the *difficulty of establishing causal connection* between radiation exposure and the diseases such exposure may induce. The government knew or should have known all of this. With re-

years played a significant role in creating the unavailability of proof." *Id.* at 611, 607 P.2d at 936, 163 Cal. Rptr. at 144. This latter comment by the court seems unclear, for if "their conduct . . . played a significant role in creating the unavailability of proof," how can it be said that "the absence of such evidence is not attributable to defendants"? More precisely, the court is probably saying that the evidentiary void created by the defendants' conduct was not a foreseeable result of that conduct. Thus defendants possess no fault for the evidentiary void as did the defendant in *Haft*. See notes 129-30 & accompanying text *supra*.

gard to the areas of uncertainty, conscious ignorance should have dictated caution. Second, inadequate dosimetry, protection, medical monitoring, and recordkeeping by the government compounded the magnitude of the evidentiary void facing the veterans. It is not surprising that veterans who cannot prove the dosage of radiation that they were exposed to, and who have been without proper medical surveillance, are having great difficulty in establishing a causal connection between their exposure to radiation and their health problems. Because of these particular aspects of the government's conduct and its general knowledge of radiation injury in the 1950's, the evidentiary problems facing the veterans and their families today were foreseeable. Therefore, unlike the defendants in *Summers* and *Sindell*, but like the defendant in *Haft*, the government is at fault for the evidentiary void in these cases.

Finally, the plaintiffs in both *Haft* and the atomic veteran litigation have gone as far as fairly can be required in establishing factual causation. Because no persons witnessed the drownings in *Haft*, there was a lack of proof inherent in the situation created by the defendant. To require more proof from the plaintiff would have been unfair. The veterans face a similar evidentiary void. The situation created by the government involved exposure to radiation. This alone makes proof of factual causation extremely difficult. In addition, the inadequate dosimetry, protection, medical monitoring, and recordkeeping that was done by the government has created even larger problems of proof for the veterans. For some veterans, the only evidence they will be able to provide is their own assertion that they attended a nuclear blast, general medical knowledge of radiation and its health effects, and evidence of their own injury. To require them to establish factual causation to a greater degree would allow the government to gain an advantage from the evidentiary void inherent in the situation it created.

Conclusion

Many veterans who participated in military maneuvers in conjunction with atmospheric nuclear tests are having difficulty in obtaining compensation for injuries that are allegedly radiation-induced. The VA has denied the existence of such a causal relationship, and the courts have not yet reached the issue of factual causation in any veteran's case.

The burden of proof on factual causation thus far has been

placed on the veterans. Should courts reach the issue of factual causation, the burden of proof can be shifted to the government. This shift would be justified by several reasons. First the unreasonable nature of the government's conduct, demonstrated by: (1) the knowledge by the government at the time of its conduct of both the pathological and genetic hazards of ionizing radiation; (2) the AEC's delegation of its responsibility for troop safety to the DOD, which then authorized levels of radiation exposure in excess of levels recommended by the AEC's medical division; (3) the inadequacy of the DOD's dosimetry program, which has prevented assessment of the true levels of exposure; (4) the inadequate protection given to the soldiers; (5) the nonvolunteer status of the soldiers and the government's failure accurately to inform them of the hazards involved; and (6) the government's failure to conduct adequate medical monitoring of these soldiers and their offspring, and the loss and destruction of many of these veterans' records. Second, these veterans and their families are innocent of any breach of duty to others in this matter. Third, the veterans have gone as far as they fairly can be asked to go in proving the requisite causal relationship. Fourth, the evidentiary void that faces them in this matter is a direct and foreseeable result of the government's conduct.

For the above stated reasons, the policy rationale that underlies the decisions¹⁴⁰ in *Summers*, *Haft*, and *Sindell* should be applied in the cases of these veterans. A shift in the burden of proof, however, will not guarantee recovery. The government can still at-

140. Courts in jurisdictions other than California have also shifted the burden of proof on factual causation in certain cases. See, e.g., *Bowman v. Redding & Co.*, 449 F.2d 956, 967-68 (D.C. Cir. 1971); *Hall v. E.I. Du Pont de Nemours & Co.*, 345 F. Supp. 353, 378-80 (E.D.N.Y. 1972); *Greene v. Union Optical Center, Inc.*, 290 N.W.2d 111, 113 (Mich. App. 1980); *Anderson v. Somberg*, 67 N.J. 291, 300-02, 338 A.2d 1, 6-7 (1975); *Hood v. Hagler*, 606 P.2d 548, 553-54 (Okla. 1980).

Recently, a federal district court has had an opportunity to apply *Summers*, *Haft*, and *Sindell* in a wrongful death action arising out of U.S. Army spraying of San Francisco with bacteria in 1950. See *Nevin v. United States*, Civ. No. C-78-1713SC (N.D. Cal., filed May 20, 1981) (denying a shift in the burden of proof). Although the government's conduct was found to have been reasonable, *id.* at 21, the court's analysis of California law contained serious flaws. The court found that cases involving multiple defendants such as *Summers* and *Sindell* were "inapposite" to a single-defendant case such as *Nevin*. *Id.* at 34. Such reasoning, however, was not embraced by the California Supreme Court in *Haft* when it expressly relied on *Summers*. See 3 Cal. 3d at 772-74, 478 P.2d at 475-77, 91 Cal. Rptr. at 755-57. In addition, the district court erroneously relied on the "substantial probability" language of *Haft*, see *Nevin*, *supra*, at 35, without taking into account other relevant language in that opinion. See notes 131-33 & accompanying text *supra*.

tempt to disprove the causal link.¹⁴¹ Thus the proper resolution of this matter may involve a compensation program that is outside of traditional tort law.¹⁴² Amendments to the VA laws specifically dealing with the atomic veterans have been introduced in Congress.¹⁴³ Regardless of the type of remedy, however, the legal maze that faces these veterans should not obscure the critical ethical analysis that is always required in cases of human experimentation.¹⁴⁴

141. On proving a causal relation in radiation cases, see generally 17 AM. JUR. PROOF OF FACTS 2d 575 (1966); STASON, ESTEP & PIERCE, ATOMS AND THE LAW (1959); Estep, *Radiation Injuries and Statistics: The Need for a New Approach to Injury Litigation*, 59 MICH. L. REV. 259 (1960); Estep & Forgotson, *Legal Liability for Genetic Injuries from Radiation*, 24 LA. L. REV. 1 (1963); Hutton, *Evidentiary Problems in Proving Radiation Injury*, 46 GEO. L.J. 52 (1957); Hutton, *Workmen's Compensation and Radiation Injury*, 12 VAND. L. REV. 145 (1958); Keyes & Howarth, *Approaches to Liability for Remote Causes—The Low Level Radiation Example*, 56 IOWA L. REV. 531 (1971); O'Toole, *Radiation, Causation, and Compensation*, 54 GEO. L.J. 751 (1966); Stason, *Tort Liability for Radiation Injuries*, 12 VAND. L. REV. 93 (1958); Comment, *The Irradiated Plaintiff: Tort Recovery Outside Price-Anderson*, 6 ENV'T'L LAW 859 (1976); Note, *Radiation Injury: A Technical and Legal Survey*, 6 CLEV.-MAR. L. REV. 171 (1957); Note, *Radiation and Preconception Injuries: Some Interesting Problems in Tort Law*, 28 SW. L.J. 414 (1974).

142. Congress has authorized compensation for residents of the Marshall Islands who were exposed to radiation from a thermonuclear detonation at Bikini Atoll in 1954. See Act of Oct. 15, 1977, Pub. L. No. 95-134, 91 Stat. 1159; Act of Aug. 22, 1964, Pub. L. No. 88-485, 78 Stat. 598. Recently, bills have been introduced to compensate the civilians who lived near the Nevada Test Site. See H.R. 4766, 96th Cong., 1st Sess., 125 CONG. REC. H5864 (daily ed. July 12, 1979); S. Res. 1865, 96th Cong., 1st Sess., 125 CONG. REC. S14,251-55 (daily ed. Oct. 9, 1979) (remarks of Senator Kennedy). For other compensation ideas, see INTERAGENCY TASK FORCE ON THE HEALTH EFFECTS OF IONIZING RADIATION, FINAL REPORT (June, 1979) (United States Dep't of Health, Education & Welfare publication); INTERAGENCY TASK FORCE ON COMPENSATION FOR RADIATION-RELATED ILLNESSES: PHASE I, REPORT (Feb. 1, 1980) (United States Dep't of Justice publication); Soble, *A Proposal for the Administrative Compensation of Victims of Toxic Substance Pollution: A Model Act*, 14 HARV. J. LEGIS. 683 (1977).

143. See H.R. 872, 97th Cong., 1st Sess., 127 CONG. REC. H116 (daily ed. Jan. 16, 1981) (Representative Henry Gonzales); H.R. 1564, 97th Cong., 1st Sess., 127 CONG. REC. H349 (daily ed. Feb. 3, 1981) (Representative Joseph Addabbo); H.R. 1733, 97th Cong., 1st Sess., 127 CONG. REC. H412 (daily ed. Feb. 5, 1981), reprinted in 127 CONG. REC. at E386 (daily ed. Feb. 5, 1981) (Representative Norman Mineta); H.R. 1769, 97th Cong., 1st Sess., 127 CONG. REC. at H413 (daily ed. Feb. 5, 1981) (Representative Fernand J. St. Germain).

144. See generally EXPERIMENTATION WITH HUMAN SUBJECTS (P. Freund ed. 1970); EXPERIMENTATION WITH HUMAN BEINGS (J. Katz ed. 1972); Ratnof & Smith, *Human Laboratory Animals: Martyrs for Medicine*, 36 FORDHAM L. REV. 673 (1968).