LITIGATING NONIONIZING RADIATION INJURY CLAIMS: TRADITIONAL APPROACHES TO A CONTEMPORARY PROBLEM

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I. INTRODUCTION

Each day, American industry mass-produces countless devices designed to make homelife more enjoyable and the workplace more efficient. However beneficial these technological achievements may be, they are, unfortunately, often accompanied by unexpected health and safety hazards.[1] One such technological product area consists of devices which utilize nonionizing radiation.[2]

Since the beginning of the 20th century, American industry and military research have developed many devices which, in the course of operation, emit nonionizing radiation.[3] Today, these products perform a number of important functions in our lives, ranging from radar guidance for airplanes to microwave cooking. Although increasing numbers of Americans are exposed to nonionizing radiation at home, in the workplace, and outdoors,[4] scientists have only

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1. Automobiles, for example, have transformed America into a mobile society, but only at the expense of hundreds of thousands of lives. Also, many new wonder drugs, while producing numerous benefits, have been found to induce dangerous, sometimes fatal, side effects.

2. Nonionizing radiation is radiation with insufficient energy to cause atoms and molecules to ionize. For a detailed discussion of the nature and common sources of nonionizing radiation see *infra* Sections II.A. & B., text and notes at notes 15-52.

3. *See* Massey, *The Challenge of Nonionizing Radiation: A Proposal for Legislation,* 105 DUKE L.J. 105, 110-114 (1979).

4. *Research on Health Effects of Nonionizing Radiation: Hearings Before the Subcomm. on Natural Resources & Env't of the House Comm. on Science and Technology,* 96th Cong., 1st Sess. 1 (1979) (statement of Chairman Jerome Ambro) [hereinafter cited as *1979 Hearings*].

recently begun to research the biological effects of exposure to nonionizing radiation.[5] There are indications that exposure to nonionizing radiation may produce harmful effects ranging from cataracts to genetic defects.[6] The results of much of the research, however, are as yet surrounded by uncertainty and much controversy.[7]

Recently, the controversy surrounding the effects of nonionizing radiation has also found its way to the courts. A number of suits have been brought by plaintiffs who allege injury resulting from exposure to nonionizing radiation.[8] The majority of the suits seek compensation from employers for workplace injuries, or from manufacturers of products which emit nonionizing radiation.[9] Presently, no comprehensive legislation specifically provides a cause of action for injury caused by exposure to nonionizing radiation.[10] Therefore, plaintiffs who seek compensation for nonionizing radiation injury must proceed under existing workers' compensation schemes[11] and under common law tort theories.[12]

Very few of the nonionizing radiation suits have been finally resolved;[13] consequently, the success of the nonionizing radiation plaintiff remains an open question. The purpose of this article is to examine the present status of the nonionizing radiation plaintiff with the intent of assisting the plaintiff's attorney in preparing the nonionizing radiation injury claim. The article is divided into two major sections. The first section provides a technical and legal overview. The second focuses on the litigation of the nonionizing radiation injury claim.

The first section of the article begins with a brief description of the nature and common sources of nonionizing radiation. Next, the current status of the research on biological effects of exposure to nonionizing radiation is presented and discussed. An overview of existing federal and state regulatory schemes relating to nonionizing radiation follows.

The second section of the article is devoted to a detailed examina-

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5. *See infra* Section II.C., text and notes at notes 53-74.

6. *See* Massey, *supra* note 3, at 118.

7. *See, e.g.,* studies cited in Lerner, *RF Radiation: Biological Effects,* IEEE Spectrum, Dec. 1980, at 51.

8. *See* Nat'l L. J., Sept. 14, 1981, at 1.

9. *See Id.* at 24.

10. *See infra* Section II.D., text and notes at notes 75-98.

11. *See infra* Section III.C., text and notes at notes 170-210.

12. *See infra* Section III.D. & E., text and notes at notes 211-379.

13. *See* Nat'l L. J., *supra* note 8, at 24.

tion of methods of litigating a nonionizing radiation injury claim. First, it discusses statutes of limitations and proof of causation. These are two significant legal obstacles which virtually every plaintiff in a nonionizing radiation injury case is likely to encounter. Second, the section specifically explores recovery under three existing theories: workers' compensation; strict products liability; and nuisance. The elements of each theory and the particular problems that plaintiffs proceeding under each theory are likely to encounter are discussed in depth. Finally, observations about the future intersection of nonionizing radiation and the law are presented.

II. BACKGROUND[14]

A. *Radiation and the Electromagnetic Spectrum*

Radiation is a general term used to describe the emission of energy from a source.[15] The term radiation usually refers to the emission of electromagnetic energy.[16] Electromagnetic energy includes gamma rays, X-rays, ultraviolet waves, visible light, infrared waves, microwaves, and radio waves.[17]

Electromagnetic radiation is measured in terms of either frequency or wavelength. Frequency, the number of oscillations per unit of time, is expressed in terms of cycles per second (hertz).[18] Wavelength, the distance between corresponding points of two consecutive waves,[19] is expressed in terms of meters. Mathematical formulas relate the two measuring systems.[20] Thus, reference to a particular frequency corresponds uniquely to a particular wavelength.

The whole range of frequencies or wavelengths, from the lowest to

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14. For additional background information, see Massey, *supra* note 3, at 105-147. For an excellent collection of more technical background than is within the scope of this article, see *Biological Effects and Medical Applications of Electromagnetic Energy,* 68 PROCEEDINGS OF THE IEEE (Jan. 1980) (a collection of papers describing the extent of environmental and professionally encountered electromagnetic fields, microwave biological effects and medical applications of nonionizing radiation); *Biological Effects of Electromagnetic Waves,* 14 Radio Science, Nov.-Dec. 1979.

15. *Potential Health Effects of Video Display Terminals and Radio Frequency Heaters and Sealers: Hearings before the Subcomm. on Investigations & Oversight of the House Comm. on Science and Technology,* 97th Cong., 1st Sess. 28 (1981) [hereinafter cited as *1981 Hearings*].

16. The term radiation may also refer to acoustic radiation, including sound and ultrasound. *Id.* at 28-29. *See* J. WILLIAMS, F. TRINKLEIN & H. C. METCALFE, MODERN PHYSICS 285, 691-93 (1976).

17. M. ALONSO & E. FINN, FUNDAMENTAL UNIVERSITY PHYSICS 763-67 (1967).

18. D. HALLIDAY & R. RESNICK, FUNDAMENTALS OF PHYSICS 224 (1970). One thousand hertz are equivalent to one kilohertz (kHz); one thousand kilohertz equal one megahertz (MHz); and one thousand megahertz are equivalent to one gigahertz (GHz). *Id.*

19. *Id.* at 304.

20. *See Id.* at 304-305.

the highest, forms a continuum called the electromagnetic spectrum.[21] The electromagnetic spectrum may be subdivided into many different regions where physical properties of the radiation in that segment of the spectrum are similar.[22] For the purposes of this article, the important distinction is that between regions of the spectrum known as ionizing and nonionizing radiation.

1. Ionizing Radiation

The amount of energy emitted from a source is directly related to the frequency; the higher the frequency, the greater the energy associated with the radiation.[23] Ionizing radiation is found at the higher frequencies along the electromagnetic spectrum.[24] Ionizing radiation is so named because it contains sufficient energy to cause a neutral atom or molecule to acquire a positive or negative charge, in other words, become ionized.[25] When biological matter is exposed to ionizing radiation, physical and chemical changes which may eventually lead to mutations, malignancies, and diseases occur within the living cells of the radiated matter.[26]

2. Nonionizing Radiation

Nonionizing radiation does not possess enough energy to cause molecules or atoms to become ionized. On the electromagnetic spectrum, nonionizing radiation extends from ultraviolet radiation,[27]

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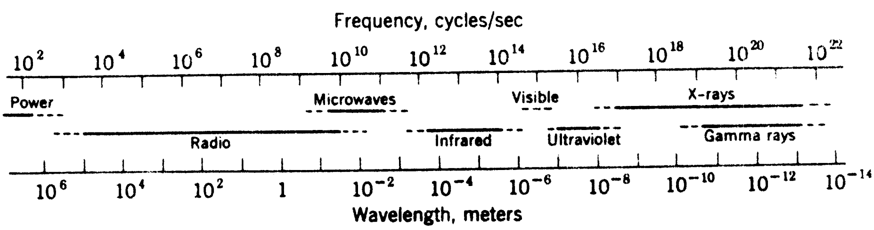
21. The following illustration appears in D. HALLIDAY & R. RESNICK, *supra* note 18, at 654.

ELECTROMAGNETIC WAVES



The electromagnetic spectrum. Note that the wavelength and frequency scales are logarithmic.

22. For example, visible light consists of that region of the electromagnetic spectrum that can be detected by the human eye.
23. *1981 Hearings, supra* note 15, at 28.
24. Sources of ionizing radiation include gamma rays and X-rays. *Id. See also supra* note 21.
25. Ionization is the production of electrically charged atoms or molecules. Massey, *supra* note 3, at 110.
26. *Id.*
27. "Near" or lower frequency ultraviolet radiation produces biological effects similar to

through visible light, infrared radiation, microwaves, and other radiofrequency (RF) radiation.[28]

Much of the public concern to date and most of the recent scientific research has dealt with the effects of radiofrequency and microwave radiation.[29] Therefore, this article deals primarily with sources of nonionizing radiation in the microwave to radiofrequency ranges. The general term "nonionizing radiation" will be used to refer primarily to this area of the spectrum. It should be remembered, however, that nonionizing radiation includes emissions at both lower and higher frequencies as well.[30]

B. Sources of Nonionizing Radiation

Americans are exposed to nonionizing radiation from a wide variety of sources, including microwave ovens, radar, and high-voltage transmission lines.[31] One of the most popular consumer products utilizing nonionizing radiation is the microwave oven. In 1978, approximately eight million such ovens were in use in American homes.[32] Other household sources of nonionizing radiation include citizens' band radios and intrusion protection devices.[33] Thus, sources of nonionizing radiation exist in millions of American households.

Nonionizing radiation is also present in the workplace. It has been estimated that up to twenty-one million workers are currently exposed to nonionizing radiation.[34] As many as one million people could be exposed to nonionizing radiation from the use of radiofrequency (RF) sealers alone.[35] These sealers have been used for more than thirty years in a variety of industries.[36] Specific uses include glue setting; embossing and drying operations in the textile, paper, plastic, and leather industries; and curing of various materials, including

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those of other forms of nonionizing radiation, while "far" ultraviolet radiation produces biological effects more like those of ionizing radiation. *Id.* at 110 n. 3. *See also supra* note 21.

28. *1981 Hearings, supra* note 15, at 29. *See also supra* note 21.

29. Massey, *supra* note 3, at 112.

30. One source of lower frequency (60Hz) nonionizing radiation is extra-high-voltage power lines. Higher frequency nonionizing radiation sources include sunlamps and lasers. *Id.*

31. *1979 Hearings, supra* note 4, at 1.

32. STAFF OF SENATE COMM. ON COMMERCE, SCIENCE AND TRANSPORTATION, 95TH CONG., 2D SESS., REPORT ON RADIATION HEALTH AND SAFETY 19 (Comm. Print 1978) [hereinafter cited as 1978 REPORT].

33. Intrusion protection devices use electronic systems such as microwaves to detect and warn of the presence of unauthorized individuals. *Id.*

34. *1979 Hearings, supra* note 4, at 29 (statement of Rep. Elizabeth Holtzman).

35. *1981 Hearings, supra* note 15, at 429 (statement of Sheldon Samuels).

36. *See id.* at 583 (listing of occupations which use RF sealers).

plasticized polyvinyl chloride, wood resins, polyurethane foam, concrete binder materials, rubber tires, and epoxy resins.[37] Other workers commonly exposed to nonionizing radiation include operators of medical diathermy machines,[38] radar and communications systems technicians,[39] air traffic controllers,[40] and those who use microwave ovens in their jobs.[41] Workers in a wide variety of jobs, then, are routinely exposed to nonionizing radiation.

Exposure to nonionizing radiation is not limited to the home and workplace. Nonionizing radiation—from both natural and man-made sources—also pervades the outdoors. Natural sources of nonionizing radiation include pulsed electromagnetic waves which occur ahead of a cold front or during an electrical storm,[42] and extremely low-power fields of radiation from the Earth's atmospheric resonances.[43] Man-made devices, however, are the primary source of nonionizing radiation outdoors. Man-made sources of nonionizing radiation are used by both the military and the private sector. The Department of Defense is the nation's largest user of nonionizing radiation devices.[44] Its contribution to nonionizing radiation in the outdoor environment is mainly through the use of military radar tracking weapons and guidance systems, and communications installations.[45]

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37. *Id.* at 457 (statement of Dr. Joe Lary).

38. Microwave diathermy machines are used to relieve pain through the application of electromagnetic energy to body tissues. In administering these treatments the operator may be exposed to radiation which escapes from the intended treatment area. Ruggera, Measurements of Emission Levels During Microwave and Shortwave Diathermy Treatments, 1980 (HHS Pub. No. (FDA) 80-8119).

39. Radar is an electronic system which uses radio waves to detect objects invisible to the naked eye because of distance, darkness, or cloud cover. The radar system transmits waves of radio frequency energy via a transmitting antenna. When the radio waves are interrupted by an object (the target), part of the energy (the echo) is reflected back and picked up by a receiver. The position of the target is then determined by measuring the time required for the radio wave to travel from the transmitter to the target and back to the receiver. Most radar systems operate at frequencies between 1,000 and 35,000 megahertz. 15 ENCYCLOPAEDIA BRITANNICA 368 (15th ed. 1980). Radio and television transmission operates on similar principles. *See infra* note 46.

40. Air traffic controllers use radar screens to monitor the positions of aircraft. *1981 Hearings, supra* note 15, at 103 (statement of Dr. Milton Zaret).

41. Microwave ovens are commonly used in restaurants, cafeterias, and other places where food is prepared. Microwaves are produced inside a microwave oven by an electron tube called a magnetron. The microwaves bounce back and forth inside the oven until they are absorbed by the food. Microwaves cause the water molecules in the food to vibrate, thereby producing the heat that cooks the food. It is not unusual for a small amount of microwave radiation to leak from an oven during operation. Microwave Oven Radiation (HHS Pub. No. (FDA) 80-8120).

42. Massey, *supra* note 3, at 114 n. 40 (citing K. MARHA, J. MUSIL & M. TUHA, ELECTROMAGNETIC FIELDS AND THE LIFE ENVIRONMENT 43, 59 (1971)).

43. Lerner, *supra* note 7, at 51.

44. 1978 REPORT, *supra* note 32, at 19.

45. Massey, *supra* note 3, at 113.

Private sector sources of nonionizing radiation include radio and television transmitters,[46] point-to-point microwave communications relay towers,[47] satellite ground stations,[48] and overhead high-voltage electrical transmission lines.[49]

The use of nonionizing radiation sources has increased rapidly throughout the past decade.[50] In addition, continued research will certainly result in new ways to use nonionizing radiation in the future. Projected uses include such devices as auto collision avoidance systems[51] and solar powered generators located in space which beam energy back to earth via microwaves.[52] The increasing use of devices which emit nonionizing radiation, however, will apparently not be without its health hazards.

C. Health Effects of Exposure to Nonionizing Radiation

The use of nonionizing radiation represents a major technological boon to our society. In almost every aspect of life—industry, medicine, communications, national defense, and even cooking—ionizing radiation has been harnessed for our protection and convenience. Thus, our society has a large stake in the continued use and proliferation of nonionizing radiation devices. As is often the case, however, scientific research on the biological effects of nonionizing

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46. Radio and television broadcast systems send radio frequency waves from transmitting antennas to receivers. AM radio broadcasting systems operate at frequencies between 535 and 1635 kHz. FM radio stations and VHF television stations (channels 2 to 13) operate at frequencies between 30 MHz and 300 MHz. UHF television stations (channels 14 to 83) operate at frequencies between 0.3 and 3 GHz. Most space and satellite communications systems operate at from 3 to 300 GHz. 23 ENCYCLOPEDIA AMERICANA 121aa (1977).

There are approximately 10,000 radio stations and 1000 television stations operating in the United States, 1978 REPORT, *supra* note 32, at 19.

47. Microwave relay towers transmit microwaves which are reflected by the Earth's ionosphere and received by stations in other countries. *See* 18 ENCYCLOPAEDIA BRITANNICA 92 (15th ed. 1980).

48. Satellite ground stations transmit radio frequency signals to man-made satellites orbiting the Earth. The equipment aboard the satellite receives the signals, amplifies them, and rebroadcasts them to another Earth station. This technology is used to provide international telephone service and to transmit live television programs and news events between countries. 16 ENCYCLOPAEDIA BRITANNICA 261 (15th ed. 1980).

49. High-voltage AC electrical transmission lines carry electric power across thousands of miles of the United States. Sixty-hertz electric fields are created in the areas surrounding the power lines. The strength of such fields is a function of the voltage of the line and the distance from the line. Exposure to 60 Hz electric fields has produced biological effects in rats and mice. As yet, however, the human health hazards associated with exposure to such fields are unknown. *See 1979 Hearings, supra* note 4, at 329.

50. In 1976, for example, the Environmental Protection Agency (EPA) estimated that radiofrequency and microwave sources alone were increasing at the rate of 15 percent annually. Massey, *supra* note 3, at 114.

51. *Id.*

52. *Id.* at 114 n. 36.

radiation has not kept pace with technological developments in the area.[53] Research is beginning to show that our progress in this field may be at the expense of the health of millions.

1. Thermal Effects

Most scientists agree that exposure to nonionizing radiation at power levels high enough to cause heating of body tissues, a phenomenon known as "thermal effects," can be a health hazard.[54] Health hazards associated with exposure to radiation power densities[55] high enough to produce thermal effects include cataract formation, brainwave pattern changes, skin burns, and birth defects.[56] The Environmental Protection Agency (EPA) has studied the extent to which thermal effects occur at various power densities. Its research indicates that at levels less than one milliwatt per square centimeter (1 mW/cm^2), thermal effects are improbable; at levels between 1 to 10 mW/cm^2, weak but noticeable thermal effects occur; and at levels greater than 10 mW/cm^2, distinct thermal effects occur.[57] Therefore, there is little dispute that exposure to nonionizing radiation at radiation power densities greater than 10 mW/cm^2 can be hazardous.[58]

2. Nonthermal Effects

Once the existence of thermal effects was established, the scientific community in this country assumed that these effects were the only health hazards presented by nonionizing radiation.[59] A report in 1965 that the United States Embassy in Moscow was being ir-

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53. *Id.* at 114-15.

54. *Id.* at 115. *See 1981 Hearings, supra* note 15, at 118 (statement of Col. Philip Winter).

55. Power density is the measure of the amount of power that passes through a square centimeter of space per second. Massey, *supra* note 3, at 115 n. 42. It is expressed in terms of watts (W) per square centimeter (cm^2). Low power densities will often be expressed in terms of milliwatts (mW) or microwatts (*u*W) per square centimeter. One milliwatt is equal to one-thousandth (0.001) of a watt. One microwatt is equal to one-thousandth of a milliwatt.

56. *See* Massey, *supra* note 3, at 118.

57. *Id.* (citing OFFICE OF RADIATION PROGRAMS, EPA, REVIEW OF RADIATION PROTECTION ACTIVITIES 1974 at 81 (1975)).

58. *See, e.g., 1981 Hearings supra* note 15, at 576 (citing JOINT NIOSH/OSHA CURRENT INTELLIGENCE BULLETIN # 3, RADIOFREQUENCY (RF) SEALERS AND HEATERS: POTENTIAL HEALTH HAZARDS AND THEIR PREVENTION (Dec. 4, 1979)).

Exposure to nonionizing radiation power densities great enough to cause thermal effects is probably limited to certain occupational groups. Workers using RF sealers, for example, may be exposed to up to 100 mW/cm^2. Some warship personnel are also exposed to over 1 mW/cm^2. Lerner, *supra* note 43, at 52.

59. *See* Massey, *supra* note 3, at 116 (citing Tyler, Overview of Electromagnetic Radiation Research: Past, Present and Future, in *Biological Effects of Nonionizing Radiation*, 247 AN-

radiated by low-level microwave radiation—ten to fifteen microwatts per square centimeter (10 to 15 uW/cm^2)—prompted new research into the effects of exposure to low-level nonionizing radiation.[60] The new studies suggest that nonionizing radiation has significant health impacts beyond those associated with thermal effects.

Today, few scientists would deny that exposure to low-level nonionizing radiation can, in some cases, cause biological effects other than heating of body tissues.[61] There is still a controversy, however, about how these so-called nonthermal effects are produced and how much danger they present to humans.[62] There are several reasons for the continuing controversy in this area. First, manufacturers continue to produce new devices for measuring exposure to nonionizing radiation.[63] Therefore, earlier experiments must be repeated using these new, more sensitive devices. Second, evidence shows that effects of nonionizing radiation depend not only on the power density of the incident radiation, but also on such factors as frequency, intensity, duration, and number of exposures; the area of the body that is irradiated; individual tolerance differences; and even the presence of other environmental stresses such as high temperature and humidity.[64] A third problem arises because most of the research in this country has been performed on animals, not on humans. Even where there is agreement among scientists about the effects of nonionizing radiation on animals, there is no consensus about how, or even if the results can be extrapolated to humans.[65] Nearly all scientists point to the lack of epidemiological studies[66] as an explanation for the lack of conclusive results in this area.[67]

Despite these problems, however, the evidence of low-level biological effects is increasing. Recognized effects include alteration in brain activity,[68] behavioral changes,[69] alteration of the blood-brain

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NALS N.Y. ACAD. SCI. 6, 7 (1975)).

60. Lerner, *supra* note 43, at 53.

61. *See id.* at 54.

62. *See id.* at 51.

63. *See, e.g., 1981 Hearings, supra* note 15, at 525 (statement of Dr. David Conover).

64. Massey, *supra* note 3, at 121-26; Galloway, *BRH Update on Bioeffects of Microwave Radiation* 4-5, a selected paper from A DECADE IN PROGRESS, 10TH ANNUAL NATIONAL CONFERENCE ON RADIATION CONTROL, April 30-May 4, 1978, Harrisburg, Pa. [hereinafter cited as *Galloway*].

65. *1981 Hearings, supra* note 15, at 118; 1978 REPORT, *supra* note 32, at 26, 39.

66. Long-term studies of the incidence of disease in exposed human populations. WEBSTER'S THIRD NEW INTERNATIONAL DICTIONARY 762 (1976).

67. *See, e.g., 1981 Hearings, supra* note 15, at 458 (statement of Dr. Joe Lary); *id.* at 483 (statement of Dr. Ralph J. Smialowicz).

68. Galloway, *supra* note 64, at 2.

69. *Id.*

barrier,[70] interference with the immunological system,[71] and general effects on growth and aging processes.[72] Scientists are still uncertain however, about how these effects are produced, and about how much nonionizing radiation is needed to trigger them. Thus, most scientists agree that more research is needed.[73] The perceived research priorities are: effects of long-term, low-level exposure on animals; epidemiological studies; research into the mechanisms of biological interaction with nonionizing radiation; and additional development of techniques for computing comparable dosages, for measuring emissions, and for relating findings on animals to effects on man.[74] As the evidence of a link between nonionizing radiation and biological effects accumulates, the next issue comes into focus: how have the Federal and state governments responded to this suspected health threat?

D. Regulations and Standards Relating to Nonionizing Radiation

1. Federal Regulations

At present, the only mandatory federal standards relating to products which emit nonionizing radiation[75] are the performance standards for microwave ovens,[76] laser products,[77] sunlamp products,[78] and high-intensity mercury vapor discharge lamps.[79] These standards are promulgated by the Bureau of Radiological Health (BRH) of the Department of Health and Human Services under authority of the Radiation Control for Health and Safety Act.[80] The standards set forth radiation emissions limitations and establish mandatory safety

70. *Id.* The blood-brain barrier is the chemical barrier that prevents blood toxins from entering the brain. Massey, *supra* note 3, at 120.

71. Galloway, *supra* note 64, at 4.

72. *See* Massey, *supra* note 3, at 120.

73. *See, e.g.*, Galloway, *supra* note 64, at 6.

74. 1978 REPORT, *supra* note 32, at 28-29.

75. These standards relate to sources of RF, microwave, and all other forms of nonionizing radiation.

76. 21 C.F.R. § 1030.10 (1981).

77. *Id.* §§ 1040.10, 1040.11 (1981).

78. *Id.* § 1041.20 (1981).

79. *Id.* § 1040.30 (1981).

80. 42 U.S.C. §§ 263b-263n (1976 & Supp. I 1977 & Supp. IV 1980). The Radiation Control for Health and Safety Act of 1968 was enacted to protect the public from the dangers of electronic product radiation. It provides for the establishment of a program to promulgate emissions standards for products which emit ionizing or nonionizing radiation, and to encourage research into the effects and control of radiation emissions. *Id.* § 263b (1976 & Supp. IV 1980).

A proposed standard has also been issued for microwave diathermy machines, 45 Fed. Reg. 50,359 (1980) (to be codified at 21 C.F.R. § 1030.20).

features and warnings.[81] Despite the existence of an enforcement and inspection program, however, it is difficult for BRH to enforce the standards once products leave the manufacturer.[82] Since many products which emit nonionizing radiation do so in the course of operation, the absence of controls or safeguards at the user level is significant.

The only federal standard regulating human exposure to nonionizing radiation is a voluntary occupational guideline of 10 mW/cm^2 [83] set by the Occupational Safety and Health Administration (OSHA)[84] of the United States Department of Labor. OSHA promulgated its standard as a mandatory radiation protection guide for exposure to nonionizing radiation frequencies between 10 Megahertz (MHz) and 100 Gigahertz (GHz).[85] In *In re: Swimline Corp.*,[86] however, an administrative law judge for the Occupational Safety and Health Review Commission pronounced the standard "advisory" only.

The 10 mW/cm^2 standard has been sharply criticized by scientists and other groups for a number of reasons.[87] First, the standard is based only on a consideration of thermal effects resulting from exposure to nonionizing radiation,[88] without regard to nonthermal ef-

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81. The microwave oven standard, for example, provides that radiation emitted "shall not exceed 1 milliwatt per square centimeter at any point 5 centimeters or more from the external surface of the oven, measured prior to acquisition by the purchaser, and thereafter 5 milliwatts per square centimeter at any point 5 centimeters or more from the external surface of the oven." 21 C.F.R. § 1030.10(c)(1) (1981). The standard also provides for a system of safety interlocks and requires that the product be accompanied by specific user instructions and warning labels. 21 C.F.R. §§ 1030.10(c)(2)-1030.10(c)(6) (1981).

82. The FDA estimates that less than one percent of all microwave ovens are inspected per year. Massey, *supra* note 3, at 138.

83. 29 C.F.R. § 1910.97(a)(2) (1981). See *infra* note 86 regarding the involuntary nature of the standard.

84. OSHA administers the Occupational Safety and Health Act of 1970. 29 U.S.C. §§ 651-678 (1976 & Supp. IV 1980). This Act authorized the establishment of mandatory occupational health and safety standards applicable to businesses affecting interstate commerce. The Act provides for both on-site inspections of occupational conditions and proceedings to enforce these standards. *Id.*

85. The standard is 10 mW/cm^2 for periods of six minutes or longer, averaged over the six minute period. This includes continuous or intermittent radiation, and whole or partial body exposure. 29 C.F.R. § 1910.97(a)(2) (1981).

86. EMPL. SAFETY & HEALTH GUIDE (CCH) ¶ 20,397 (Feb. 17, 1976), *aff'd*, EMPL. SAFETY & HEALTH GUIDE (CCH) ¶ 21,656 (Apr. 12, 1977). The employer was cited for a violation of the 10 mW/cm^2 exposure standard. The administrative law judge vacated the citation, finding the standard advisory rather than mandatory because the word "should" rather than "shall" was used in the regulation. *Id.*

87. *See, e.g., 1979 Hearings, supra* note 4, at 27 (statement of Rep. Elizabeth Holtzman); Shore, *Review of the History of the Ten-Milliwatt Per Square Centimeter Microwave Standard* 5, a selected paper from A DECADE IN PROGRESS, 10TH ANNUAL NATIONAL CONFERENCE ON RADIATION CONTROL, April 30-May 4, 1978, Harrisburg, Pa. [hereinafter cited as Shore].

88. Shore, *supra* note 87, at 2. *See generally* Steneck, Cook, Vander & Kane, *The Origins of the U.S. Safety Standards for Microwave Radiation*, 208 SCIENCE, 1230 (1980).

fects. Second, critics point out that the 10 mW/cm^2 standard considers only power density. This ignores the importance of other parameters of radiation exposure such as wave frequency and duration of exposure.[89] Finally, the United States exposure standard is much less restrictive than standards which have been promulgated in other countries.[90] Thus, many critics question whether the United States standard is stringent enough to protect the public from harmful exposure to nonionizing radiation.[91]

2. State Regulations

Few states are actively engaged in the regulation of nonionizing radiation sources.[92] In Massachusetts, for example, public health statutes[93] contain enabling legislation for the control of ionizing and nonionizing radiation hazards.[94] Chapter 111, section 5B of the Massachusetts General Laws provides that the department of public health "may require registration of sources of ionizing and nonionizing radiation and shall, from time to time, after a public hearing, prescribe and establish rules and regulations to control the radiation hazards of . . . machines which emit ionizing and nonionizing radiation for the purpose of protecting the general public . . . ."[95] Pursuant to this statutory authority, Massachusetts has enacted exten-

89. Lerner, *supra* note 43, at 58.

90. The proposed Chinese standard of 50 uW/cm^2 is 200 times more restrictive than the 10mW/cm^2 OSHA standard. Microwave News, Vol. I, No. 6, June 1981, at 1. The Soviet Union has an occupational standard of 10 uW/cm^2 (1,000 times more restrictive than the OSHA standard) and a general population standard of 1 uW/cm^2 (10,000 times more restrictive than the OSHA standard). Lerner, *supra* note 43, at 51. The Soviet exposure standards were based primarily on studies of occupationally exposed persons. From these studies, it was concluded that nonthermal effects did occur at low levels of exposure. Therefore, the Soviets set their standards accordingly. Massey, *supra* note 3, at 119 n. 72.

"The additional factor of safety for members of the general population recognizes the additional problem associated with uncontrolled exposure, in an uncontrolled environment, of an uncontrolled population of mixed sensitivity to radiation insult." Shore, *supra* note 87, at 3. There has been at least one report that the Soviet Union has raised its occupational exposure limit to 25 uW/cm^2. Microwave News, Vol. 1, No. 8, Sept., 1981, at 4. The report could not be confirmed, however. *Id.*

91. *See, e.g.*, Shore, *supra* note 87, at 5; *1979 Hearings*, *supra* note 4, at 97-100 (letter of Dr. Louis Slesin to Dr. Anthony Robbins); *1981 Hearings*, *supra* note 15, at 98 (statement of John C. Viliforth).

92. The results of a survey released by the New York State Department of Labor in January, 1981, revealed that only six states (Alaska, California, Oregon, Rhode Island, Texas, and Vermont) had actually promulgated RF/microwave exposure standards. State and Local Jurisdiction Summary of RF/Mw Exposure Standards (unpublished survey available from the N.Y. State Dep't of Labor).

93. MASS. GEN. LAWS ANN. ch. 111-114 (West 1981).

94. *Id.* ch. 111, § 5B (West 1981).

95. *Id.*

sive regulations controlling the hazards of radioactive material and of machines which emit ionizing radiation.[96] At present, however, the only regulations dealing with nonionizing radiation sources are those relating to lasers.[97] Thus, while plenary enabling legislation does exist, Massachusetts has actually adopted very few regulations relating to nonionizing radiation sources.[98] Since comprehensive regulation of nonionizing radiation exposure does not exist at either the federal of state level, persons allegedly injured by this exposure have turned to the courts for relief.

III. Litigation

The recent evidence that nonionizing radiation can produce harmful effects in humans has spawned a "wave of litigation"[99] springing from the use of nonionizing radiation by government and industry.[100] This section of the article focuses on some of the more important methods and problems involved in litigating a nonionizing radiation injury claim. First, two obstacles facing virtually all non-

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96. Rules and Regulations to Control the Radiation Hazards of Radioactive Material and of Machines Which Emit Ionizing Radiation, MASS. ADMIN. CODE tit. 105, § 120.000 (1978).

97. Rules and Regulations Relative to the Use of Laser Systems, Devices or Equipment to Control the Hazards of Laser Rays or Beams, MASS. ADMIN. CODE tit. 105, § 121.000 (1978). The Massachusetts Department of Public Health has recently proposed regulations of some additional nonionizing radiation sources. Regulations Governing Fixed Facilities Which Generate Electromagnetic Field in the Frequency Range of 300 kHz to 100 GHz. MASS. ADMIN. CODE tit. 105, §§ 122.00-122.040 (proposed 1982). These regulations apply to any stationary facility which generates an electromagnetic field in the frequency range 300 kHz to 100 GHz and to any person who operates or controls the operation of such facility. MASS. ADMIN. CODE tit. 105, § 122.001(A),(B) (proposed 1982). Several sources are excluded from regulation, however. These include:

> (1) Facilities maintained by the Federal government.
>
> (2) All non-fixed radio frequency devices, machines, or facilities such as: portable, hand-held and vehicular transmission machines.
>
> (3) All scientific and medical equipment operating at frequencies designated for that purpose by the FCC and all Class A and B computing devices as defined by FCC.
>
> (4) Radio frequency machines which have an effective radiated power of 7 watts or less.
>
> (5) Radio frequency machines which are designated and marketed as consumer products (except microwave ovens) such as: citizen band radios, remote control toys, etc.
>
> (6) Radio frequency machines which are in storage, shipment or on display for sale, provided such machines are not operated.
>
> (7) Radio frequency machines not connected to a radiating device.

Id.

98. Other states, including Arizona, Indiana, and Kentucky, also have enabling legislation, but have enacted no regulations relating to nonionizing radiation sources.

99. Nat'l L. J., *supra* note 8, at 1, col. 1.

100. The plaintiffs in the lawsuits which have been initiated thus far are a diverse group. They include former personnel of the United States Embassy in Moscow, former radar technicians, communications systems operators, air traffic controllers, and users of microwave

ionizing radiation plaintiffs are examined: statutes of limitations, and proof of the causal connection between exposure to nonionizing radiation and the injury for which recovery is sought. Next, three bases of liability are analyzed: workers' compensation statutes; strict products liability theory; and the common law of nuisance.

A. *Statutes of Limitations*

A major problem facing the plaintiff in a nonionizing radiation case is a short statute of limitations. For example, most jurisdictions have a tort claims statute of limitations of no more than five years.[101] Similarly, most state workers' compensation statutes have notice and filing limitations of one or two years from the date of injury.[102] In many instances, the negative effects of exposure to nonionizing radiation do not manifest themselves until many years after exposure.[103] Thus, where a statute of limitations or filing time period begins to run upon the exposure to nonionizing radiation, the claim can be barred if the plaintiff does not become aware of his injuries within the short time limitation period.

A short statute of limitations or filing period can preclude a plaintiff's recovery in some cases.[104] This is not always true, however. In fact, there are three judicial approaches which alleviate some of the hardships imposed by short statutes of limitations. First, some states treat prolonged exposure to hazardous substances as a series of separate torts or injuries.[105] Under this approach, a new cause of action accrues with each exposure, and the plaintiff's action is not barred until the end of the statutory period following his *last* exposure.

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ovens. *Id.* at 24-25.

As a response to the recent suits, a symposium sponsored by major corporations was held in May, 1981, to educate corporate defense attorneys about recent medical and scientific information regarding the use of nonionizing radiation. In addition, the Microwave Radiation Information and Action Center has been formed in Washington, D.C. The Center will publish a newsletter and act as a clearinghouse for potential plaintiffs and attorneys involved in nonionizing radiation litigation. *Id.* at 24.

101. Hurwitz, *Environmental Health: An Analysis of Available and Proposed Remedies for Victims of Toxic Waste Contamination,* 7 AM. J. L. & MED. 61, 73 (1981).

102. Kutchins, *The Most Exclusive Remedy Is No Remedy at All: Workers' Compensation Coverage for Occupational Diseases,* 32 LABOR L. J. 212, 219 n. 50 (1981).

103. *See, e.g.,* Garrett v. Raytheon Co., 368 So. 2d 516 (Ala. 1979) (radar instructor exposed to microwave radiation from 1955 to 1957 whose injuries were not diagnosed until 1977).

104. *See, e.g.,* Garrett v. Raytheon Co., 368 So. 2d 516 (Ala. 1979); Schwartz v. Heyden Newport Chemical Corp., 12 N.Y.2d 212, 188 N.E.2d 142, 237 N.Y.S.2d 714 (1963).

105. Estep & VanDyke, *Radiation Injuries: Statute of Limitations Inadequacies in Tort Cases,* 62 MICH. L. REV. 753, 761-62 (1964). Some of the states which have followed this theory are: Alabama: Augustus v. Republic Steel Corp., 100 F. Supp. 46 (N.D. Ala. 1951); Missouri; Farrar v. St. Louis-San Francisco R. Co., 361 Mo. 408, 235 S.W.2d 391 (1951); New Jersery: Biglioli v. Durotest Corp., 44 N.J. Super. 93, 129 A.2d 727 (1957); New York: Wright v. Carter

Even this accrual approach, however, presents problems for the victim of nonionizing radiation exposure. The problem is clearly evidenced in the recent case of *Garrett v. Raytheon Co.* [106] In *Garrett*, a former radar instructor was exposed to "massive quantities" of microwave radiation from 1955 to 1957.[107] He brought suit in February, 1978, against Raytheon Company and several other corporations alleged to have been responsible for the design, manufacture, installation, or maintenance of the radar systems. Although the plaintiff's radiation injury was not diagnosed until March, 1977, the court found that his cause of action accrued in 1957, the date of his last exposure to radiation.[108] Therefore, the court held that Garrett's action was barred by Alabama's one-year statute of limitations.[109]

As a second means of alleviating the strict time requirement, some commentators have advocated a longer statute of limitations—thirty years, for example—in cases involving latent injuries.[110] This approach could prevent the preclusion of many claims. Even a long statute of limitations, however, will not help the plaintiff whose injury has not manifested itself within the statutory time period, a situation which is possible with some nonionizing radiation injuries.[111]

The third approach, application of the so-called "discovery rule," appears to be the most beneficial for the nonionizing radiation plaintiff. The discovery rule, as its name implies, provides that the statute of limitations does not begin to run until such time as the claimant

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Products, Inc., 244 F.2d 53 (2d Cir. 1957); Tennessee: Armour & Co. v. Mitchell, 262 F.2d 580 (6th Cir. 1958).

106. 368 So. 2d 516 (Ala. 1979).

107. *Id.* at 518.

108. *Id.* at 521. *See generally* Note, *The Application of the Statute of Limitations to Actions for Tortious Radiation Exposure*: Garrett v. Raytheon Co., 31 ALA. L. REV. 509 (1980). Alabama subsequently passed a statute of limitations for products liability actions involving some radiation injuries of one year from the date on which the plaintiff should reasonably have discovered the injury. The statute, however, limits all such actions to ten years from the time the product was first put to use. *Id.* at 516.

109. 368 So. 2d at 521.

110. *See, e.g.*, Moore, *Radiation and Preconception Injuries, Some Interesting Problems in Tort Law*, 28 S. W. L. J. 414, 434 (1974). The author argues that thirty years would protect both the interests of the victim and the interests of the defendant who must defend against the stale claim. This idea was embodied in the 1975 extension of the Price Anderson Act (providing, *inter alia*, a strict liability cause of action for victims of an extraordinary nuclear accident) which lengthened the statute of limitations under the Act from ten to twenty years. *See* 42 U.S.C. § 2210 (n) (l) (iii) (1976 & Supp. IV 1980).

111. There is evidence that exposure to radiofrequency/microwave radiation affects the reproductive systems of animals. *1981 Hearings*, *supra* note 15, at 459 (statement of Dr. Joe Lary). If the same is true of humans, the effects of exposure to nonionizing radiation may not appear until the next generation. Therefore, it is likely that many of these claims would not be protected by a thirty-year statute of limitations.

discovers or reasonably should have discovered his injury.[112] In *Urie v. Thompson*,[113] for example, the United States Supreme Court considered the case of a locomotive fireman who sought compensation for silicosis under the Federal Employers' Liability Act (FELA).[114] FELA has a three-year statute of limitations.[115] The Court held in *Urie* that the cause of action did not accrue, and thus the statute of limitations did not begin to run, until the plaintiff either knew or had reason to know that he had contracted the disease.[116]

Since *Urie*, the discovery rule has been applied by many courts faced with similar factual situations.[117] Where the discovery rule has not been adopted, however, recovery for a latent effect of exposure to nonionizing radiation may be impossible.[118] In any event, it must be remembered that clearing the statute of limitations hurdle is only a threshold step; the claimant must now put forth a prima facie case.

B. Causation

The issue of causation is an essential element in the plaintiff's case whether he proceeds under a workers' compensation statute, [119] on a

112. Conerly v. Morris, 575 S.W.2d 633 (Tex. Civ. App. 1979).

113. 337 U.S. 163 (1949).

114. 45 U.S.C. §§ 51-60 (1976). The Federal Employers Liability Act (Railroads) provides that every railroad operating in interstate or foreign commerce shall be liable in damages to any person suffering injury or death while employed by such railroad in such commerce.

115. 45 U.S.C. § 56 (1976).

116. 337 U.S. 163, 170-71.

117. *See, e.g.*, Borel v. Fibreboard Paper Products Corp., 493 F.2d 1076 (5th Cir. 1973) (statute of limitations in action against asbestos manufacturer for contraction of asbestosis begins to run when effects of exposure appear); United States v. Reid, 251 F.2d 691 (5th Cir. 1958) (claim under Federal Tort Claims Act for faulty medical advice did not accrue until advanced tubercular condition manifested itself); Raymond v. Eli Lilly & Co., 117 N.H. 164, 371 A.2d 170 (1977) (discovery rule held to apply to products liability case in which injury was allegedly caused by a drug); LeVine v. Isoserve, Inc., 70 Misc. 2d 747, 334 N.Y.S.2d 796 (1972) (in foreign object malpractice action, cause of action did not accrue until the patient reasonably could have discovered the malpractice).

118. In general, commentators note a trend toward application of the discovery rule. *See, e.g.*, McGovern, *The Status of Statutes of Limitations and Statutes of Repose in Product Liability Actions: Present and Future,* 16 FORUM 416, 423 (1981) (14 states have specifically adopted the discovery rule in tort statutes of limitations, and courts in 27 more states have applied the discovery rule on at least one occasion); Comment, *Statutes of Limitation Eased to Permit Latent Disease Claims*, 11 ENVT'L L. REP., 10,082, 10,083 (1981) (noting trend favoring adoption of a discovery rule). There is, however, a noticeable "counterflow." McGovern, *supra*, at 423. *See also* Bozzuto v. Oueillette, 408 A.2d 697 (Me. 1979) (plaintiff's ignorance of defendant's misfeasance did nothing to prevent the running of the statute of limitations in the absence of a showing of fraudulent concealment); Locke v. Johns-Manville Corp., 221 Va. 951, 275 S.E.2d 900 (1981) (holding that cause of action accrues when injury occurs; the court emphasized that it was not adopting the "discovery rule"); Thornton v. Roosevelt Hospital, 47 N.Y.2d 780, 391 N.E.2d 1002, 417 N.Y.S.2d 920 (1979) (injury occurs when there is a wrongful invasion of personal property rights, even though the injury is not discovered for 20 years).

119. The causation element in workers' compensation schemes generally takes the form of a requirement that the worker's injury arise out of his employment. *See, e.g.*, ARIZ. REV. STAT.

strict products liability theory, or in nuisance. Under any of these approaches, the plaintiff must show a reasonable causal connection between exposure to nonionizing radiation and the damage which he has suffered.[120] While the standard of proof of causation may be less rigorous under a workers' compensation statute than in a tort action,[121] the nonionizing radiation plaintiff faces similar problems in establishing the requisite causal link regardless of the avenue of recovery he pursues.

Proving causation is the hardest task facing the nonionizing radiation plaintiff. There are two major sources of difficulty. First, the presently available scientific evidence regarding the biological effects of nonionizing radiation on humans is inconclusive.[122] To meet proof of causation requirements, the plaintiff, in effect, has to prove what science has not yet been able to prove. Second, nonionizing radiation injury does not usually manifest itself until long after exposure has occurred;[123] the diseases which result from exposure to nonionizing radiation can occur even without such apparent exposure.[124] These two factors present tremendous evidentiary obstacles for the plaintiff attempting to establish the causal link between exposure to nonionizing radiation and the resulting injury.

1. Scientific Uncertainty

Typically, the plaintiff bears the burden of proving causation.[125] Presently, there is little conclusive evidence of the harmful effects—particularly nonthermal effects—of nonionizing radiation.[126] Shortcomings in scientific and medical knowledge, however, do not

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ANN. § 23-1021 (1971); MINN. STAT. ANN. § 176.021 (West Supp. 1982).

The burden of proving causation in a workers' compensation case may sometimes be less rigorous than in a common law tort action. *See, e.g.*, Tapp v. Tapp, 192 Tenn. 1, 236 S.W.2d 977 (1951) (proximate cause in a workers' compensation action is not the same as proximate cause in the law of negligence, but instead is cause in the sense that the accident had its origin in the hazards to which the employment exposed the employee). *See also* O'Toole, *Radiation, Causation and Compensation*, 54 GEO. L. J. 751, 766 (1966) (arguing that the context of liability should affect the required quantum of proof of causation). Nevertheless, the problems facing the nonionizing radiation plaintiff in proving causation will be similar, regardless of the theory under which he proceeds.

120. W. PROSSER, HANDBOOK OF THE LAW OF TORTS § 41 (4th ed. 1971).

121. *See supra* note 119.

122. *See supra* text and notes at notes 62-67.

123. *See supra* note 103

124. *See supra* text and note at note 56.

125. *See, e.g.*, Mahoney v. United States, 220 F.Supp. 823 (E.D. Tenn. 1963), *aff'd*, 339 F.2d 605 (6th Cir. 1964); Parker v. Employers Mutual Liability Ins. Co. of Wis., 440 S.W.2d 43 (Tex. 1969). *But see* Favish, *Radiation Injury and the Atomic Veteran: Shifting the Burden of Proof of Factual Causation*, 32 HASTINGS L. J. 944, 963-72 (1981) (The author discusses cases in which the burden of factual causation has been shifted to the defendant).

126. *See supra* text and notes at notes 62-67.

alter the plaintiff's legal burden of establishing causation.[127] Therefore, the victim of harmful exposure to nonionizing radiation must make the best use of existing evidence in order to establish the requisite causal link. Specifically, the plaintiff's attorney must use evidence of existing safety standards, statistical information, and expert witnesses in order to present the case effectively.

a. Safety standards

Violation of a safety standard by the defendant can be powerful evidence of causation for the plaintiff. This is especially true in a case where the plaintiff's injury is precisely the harm which the standard was meant to prevent.[128] Some cases have stated in the extreme that violation of a statute or regulation bars the defendant from refuting causation altogether.[129] Despite this legal approach, courts may be reluctant to go this far in a case where the scientific evidence of causation is uncertain. Nevertheless, the plaintiff should take full advantage of any evidence that the defendant has violated safety standards.

On the other hand, defendants often use their compliance with government standards that limit exposure to harmful substances as evidence to refute the plaintiff's causation allegations. They argue that since the plaintiff was not exposed to the substance in excess of the amount permitted, his injuries could not have been caused by the sustained exposure.[130] Although some commentators suggest that compliance with standards should be a per se defense on the issue of causation,[131] the courts have held uniformly that, while this information does have evidentiary value, it is not determinative of any issue.[132] The argument against compliance as an absolute defense

127. Robblee, *The Dark Side of Workers' Compensation: Burdens and Benefits in Occupational Disease Coverage*, 2 INDUS. REL. L. J. 596, 605 (1978).

128. *See, e.g.*, Louisville Trust Co. v. Morgan, 180 Ky. 609, 203 S.W. 555 (1918) (absence of fire escapes in violation of state statute presumed to be the proximate cause of victim's death in hotel fire). *See also* W. PROSSER, *supra* note 120, § 41, at 243.

129. Pirece v. Albanese, 144 Conn. 241, 129 A.2d 606 (1957), *appeal dismissed*, 355 U.S. 15 (1957); Wilson v. Hanley, 244 Or. 570, 356 P.2d 556 (1960). These cases appear to be the exception, however.

130. *See, e.g.*, Mahoney v. United States, 220 F.Supp. 823 (E.D. Tenn. 1963), *aff'd*, 339 F.2d 605 (6th Cir. 1964); Bulloch v. United States, 145 F.Supp. 824 (D. Utah 1956).

131. *See, e.g.*, Keyes & Howarth, *Approaches to Liability for Remote Causes: The Low-Level Radiation Example*, 56 IOWA L. REV. 531, 574 (1971).

132. *See, e.g.*, Silkwood v. Kerr-McGee Corp., 485 F. Supp. 566, 580-83 (W.D. Okl. 1979) (compliance with government safety regulations should be accepted as evidence of acting reasonably, but should not be used as conclusive proof); Mahoney v. United States, 220 F.Supp. 823 (E.D. Tenn. 1963), *aff'd*, 339 F.2d 605 (6th Cir. 1964) (compliance with guideline

should be especially persuasive in the nonionizing radiation case because existing standards are currently under attack and are based on uncertain scientific evidence.[133]

b. Statistical studies

The lack of conclusive evidence of the effects of nonionizing radiation may force the plaintiff to rely heavily on statistical studies to demonstrate an unusually high occurrence of a particular disease among the exposed population. This type of evidence, however, presents two problems. First, there is currently a paucity of such data.[134] Second, courts often reject proof of injury by inference from statistical data.[135] While courts recognize that statistics might indicate proof of causation in a general population, they often hold that such proof does not necessarily extend to a particular member of that population.[136]

There are indications, however, that courts are becoming more receptive to statistical evidence,[137] particularly where such evidence has been supported by medical specialists. Nevertheless, the plaintiff in a nonionizing radiation case should approach the use of statistical studies with caution; such evidence must be painstakingly prepared and presented carefully.[138] Even with such precautions, there is no assurance that the evidence will be accepted as legally sufficient to demonstrate causation.

c. The role of experts

A more useful source of evidence for the nonionizing radiation plaintiff is expert testimony. The medical expert plays an important

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limits treated only as some evidence of lack of causal nexus between exposure to ionizing radiation and injury).

133. *See supra* text and notes at notes 87-91.

134. *See supra* text and note at note 67.

135. *See, e.g.*, Maxwell v. Bishop, 398 F.2d 138 (8th Cir. 1968), *vacated*, 398 U.S. 262 (1970); Green v. American Tobacco Co., 304 F.2d 70 (5th Cir. 1962), *rev'd on rehearing*, 325 F.2d 673 (5th Cir. 1963), *cert. denied*, 377 U.S. 943 (1964), *aff'd on rehearing per curiam*, 409 F.2d 1166 (5th Cir. 1969). *See generally* Large & Michie, *Proving that the Strength of the British Navy Depends on the Number of Old Maids in England: A Comparison of Scientific Proof with Legal Proof*, 11 ENVT'L L. 555, 599 (1981).

136. *See supra* cases cited at note 135.

137. Large & Michie, *supra* note 135, at 602-03. *See also* Ethyl Corp. v. EPA, 541 F.2d 1 (D.C. Cir. 1976), *cert. denied*, 426 U.S. 941 (1976); South Terminal Corp. v. EPA, 504 F.2d 646 (1st Cir. 1974).

138. For problems encountered in using statistical data see People v. Collins, 68 Cal. 2d 319, 438 P.2d 33, 66 Cal. Rptr. 497 (1968); Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329 (1971).

role in any case involving a technical question of medical causation.[139] Experts usually testify about two "levels" of causation: first, whether the defendant's conduct could cause harm like the plaintiff's in *any* case; and, second, whether the defendant's conduct actually caused the plaintiff's injury in *this* case.[140] In most instances where expert testimony is required, conclusive evidence exists as to the first level of causation.[141] Based on this evidence, the expert can give his opinion about the second level of causation.

Plaintiffs seeking compensation for injuries resulting from exposure to nonionizing radiation, however, face a double burden. In such cases, the medical and scientific evidence on both levels of causation are often contradictory and inconclusive.[142] This is particularly true where radiation in the nonthermal effects range is the alleged source of injury.[143] Thus, the nonionizing radiation plaintiff must rely on the expert to convince the trier of fact of both levels of causation.

In a case where the evidence of factual causation is complicated and contradictory, both parties must obtain the most highly qualified experts to testify. The recent case of *Yannon v. New York Telephone Co.*[144] clearly illustrates the importance of the role which highly qualified experts play in a case where the medical, scientific, and statistical evidence is inconclusive. *Yannon*, a New York Workers' Compensation Board case, represents the first damages award for death attributable to microwave injury.[145] A three-member Workers' Compensation Board panel upheld the ruling of an administrative law judge that the claimant, a New York Telephone Company radioman, had died from overexposure to microwave radiation.

During the course of the hearing in *Yannon*, the defendant's experts testified that there was no causal connection between Yannon's death and his exposure to microwaves.[146] The plaintiff's witnesses, on the other hand, testified that Yannon's prolonged exposure to microwave radiation resulted in the degenerative disease which ultimately caused his death.[147] In its decision, the Board found

139. *See, e.g.*, Mahoney v. United States, 220 F.Supp. 823 (E.D. Tenn. 1963), *aff'd*, 339 F.2d 605 (6th Cir. 1964).

140. *See id.* at 831.

141. *See, e.g.*, Kostamo v. Marquette Iron Mining Co., 405 Mich. 105, 126-27, 274 N.W.2d 411, 420 (1979).

142. *See supra* text and notes at notes 62-67.

143. *Id.*

144. N.Y.W.C.B. Nos. 07142308, 07523602 (1980).

145. Microwave News, Vol. 1 No. 14, Apr. 1981 at 1; NAT'L L. J., *supra* note 8, at 24.

146. Yannon v. N.Y. Telephone Co., N.Y.W.C.B. Nos. 07142308, 07523602 (1980) at 2-3.

147. *Id.* at 2. Yannon had been exposed to microwaves for eleven years. Claimant's brief,

"a direct causal relationship between decedent's exposure to microwave radiation during his employment and his subsequent disability, all of which ultimately resulted in his death."[148] The Board's opinion drew heavily upon the testimony of the experts and appeared to be based on an evaluation of the experts' credibility rather than an independent analysis of the scientific evidence.[149] Credible expert witnesses, then, were essential to a ruling in favor of the plaintiff.

Unlike the *Yannon* case, the plaintiff's presentation of qualified medical opinion as to causation may not always be enough. It has frequently been noted that law and science have different standards by which to measure causation.[150] At law, the plaintiff need not prove the causal connection beyond a reasonable doubt;[151] he is required only to prove causation by a preponderance of the evidence, convincing the trier of fact that the defendant's conduct more probably than not caused his injury.[152] Medical experts base their opinions regarding causation on etiology—the scientific theory of the causation of disease.[153] Where the etiology of a disease is uncertain, or where the effects of exposure to a substance are unknown, medical experts may be reluctant to testify as to distinct probabilities of injury.[154] If the trier of fact is depending on experts' assertions of probability for its determination of causation, the experts' reluctance may result in a finding of no causation.[155] In most cases, a judicial finding of causation will turn neither on semantics nor on the use by a witness of a particular term or phrase, such as "medical certainty" or "more probably than not," to describe causation.[156] Courts will generally look to the evidence as a whole in determining whether the requisite legal causal nexus exists.[157] Nevertheless, the nonionizing radiation

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Yannon v. N.Y. Telephone Co., N.Y.W.C.B. Nos. 07142308, 07523602, at 1.

148. Claimant's brief, Yannon v. N.Y. Telephone Co., at 3.

149. *Id.*

150. O'Toole, *supra* note 119, at 773. *See also* Kostamo v. Marquette Iron Mining Co., 405 Mich. 105, 126-27, 274 N.W.2d 411, 420 (1972); Parker v. Employers Mutual Liability Ins. Co. of Wis., 440 S.W.2d 43, 49 (Tex. 1969).

151. W. PROSSER, *supra* note 120, § 41, at 242.

152. *Id.* at 241.

153. O'Toole, *supra* note 119, at 767.

154. *See, e.g.*, Parker v. Employers Mutual Liability Ins. Co. of Wis., 440 S.W.2d 43, 49 (Tex. 1969); Clark v. State Workmen's Compensation Commn'r., 155 W. Va. 726, 187 S.E.2d 213 (1972).

155. Parker v. Employers Mutual Liability Ins. Co. of Wis., 440 S.W.2d 43 (Tex. 1969); Clark v. State Workmen's Compensation Commn'r., 155 W. Va. 726, 187 S.E.2d 213 (1972).

156. Insurance Co. of North America v. Myers, 411 S.W.2d 710, 713 (Tex. 1966) (reasonable probability of causation is determined by considering the *substance* of the expert's testimony; but doctor's testimony which did no more than express medical possibility of causal connection was not sufficient).

157. *See, e.g.*,Besner v. Walter Kidde Nuclear Labs., 24 App. Div. 2d 1045, 265 N.Y.S.2d

plaintiff must recognize that proving causation will be difficult if his expert is unwilling to testify in terms of probabilities in a manner which respects legal as well as scientific standards of proof.[158]

2. The Nature of the Harm

The second problem facing the nonionizing radiation plaintiff attempting to prove causation involves the nature of the harm. A plaintiff's claim in these cases typically involves an injury which manifests itself long after exposure to the radiation has occurred.[159] Because of this time lag, certain evidence, such as the intensity and duration of exposure, may be unavailable by the time the plaintiff's case comes to trial. In addition, there may have been intervening factors since the time of the exposure which could have contributed to or caused the plaintiff's injury.[160] Often these multiple intervening factors—age, stress, or environmental conditions—make the isolation of nonionizing radiation as the cause of an injury a problematic exercise of hindsight. Thus, the long latency period generally makes it very difficult to establish a direct causal link between the plaintiff's exposure and his injury.[161]

A further problem arises because the diseases caused by exposure to nonionizing radiation frequently are medical conditions which also occur in the general population.[162] The plaintiff seeking compensa-

312, 313 (1965).

158. A noteworthy case is Reserve Mining Co. v. EPA, 514 F.2d 492 (8th Cir. 1975). In that case, the court found cause in fact without the existence of a provable scientific cause and effect relationship. *See* Large & Michie, *supra* note 135, at 604-05.

The scope of this article has necessitated only a very brief examination of the complex problems surrounding the differences between scientific and legal notions of causation. For further discussions in this area see Large & Michie, *supra* note 135; O'Toole, *supra* note 119.

159. *See, e.g.*, Garrett v. Raytheon Co., 368 So. 2d 516 (Ala. 1979).

160. If, for example, the plaintiff is seeking recovery for cancer, he could have been exposed to another cancer-causing agent between the time of exposure to nonionizing radiation and the time of trial.

161. Favish, *supra* note 125 at 964; Note, *Updating the Injunction to Protect Human Health and Safety*, 11 SUFFOLK U. L. REV. 114, 124 (1976) [hereinafter cited as *Updating the Injunction*].

162. *See supra* text and notes at 53-74. This is unlike asbestosis, for example, which does not occur in the absence of exposure to asbestos fibres.

163. *See, e.g.*, Parker v. Employers Mutual Liability Ins. Co. of Wis., 440 S.W. 2d 43, 48 (Tex. 1969) (causes other than the plaintiff's on-the-job exposure to radiation, such as natural radiation, virus or infection, have not been designated *improbable* causes of the plaintiff's cancer).

Courts most often make exceptions in workers' compensation cases. *See, e.g.*, McAllister v. Workmen's Compensation Appeals Bd., 69 Cal. 2d 408, 445 P.2d 313, 71 Cal. Rptr. 697 (1968) (recovery allowed for lung cancer linked to smoke inhalation by a veteran fire-fighter); Kostamo v. Marquette Iron Mining Co., 405 Mich. 105, 274 N.W.2d 411 (other possible or

tion for cataracts, for example, must prove that his condition more probably resulted from exposure to nonionizing radiation than from another natural or man-made source known to cause the same condition. This presents a tremendous, though not insurmountable, obstacle for the plaintiff in many cases.[163] Consequently, the circumstances surrounding a nonionizing radiation injury—the latency of the injury and the possibility of intervening causes—contribute to the difficulty of the plaintiff's case.

3. Easing the Burden of Proving Causation

As the discussion above suggests, proving causation presents the greatest obstacle for the nonionizing radiation plaintiff. Scientific uncertainty and the nature of the plaintiff's injuries make it difficult to establish that nonionizing radiation probably caused the harm.[164] Commentators have recognized this problem and have proposed methods for easing the plaintiff's burdens in such cases. For example, it has been suggested that, in the area of workers' compensation, a rebuttable presumption be created where strong support for a work-disease connection has been shown.[165] This presumption would shift the burden of proof to the employer to show that a nonwork-related factor produced the disease.[166] Another commentator has advocated a "floating burden of proof" to be determined by balancing the seriousness of the harm to the plaintiff, the benefits to the community from the defendant's conduct, and the degree of uncertainty regarding the causal link.[167] Still others have suggested the establishment of a victim compensation fund supported primarily by industry contributions. The fund would compensate some victims of exposure to harmful substances in the environment for medical costs and property damage upon the showing of a "reasonable likelihood" that exposure to hazardous substances released by the defendant caused or contributed to their injury.[168] Plaintiff's attorney should

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probable causes of injury need not be excluded beyond doubt); Powell v. State Workmen's Compensation Commn'r, 273 S.E.2d 832, 836 (W. Va. 1980) (employee seeking compensation for lung cancer need not negative all possible nonoccupational causes of the disease).

164. *See supra* text and notes at notes 125-63.

165. Note, *Compensating Victims of Occupational Disease*, 93 HARV. L. REV. 916 (1980) [hereinafter cited as *Compensating Victims*].

166. *Id.* at 931.

167. Kuster, *Toxic Substances Contamination: The Risk-Benefit Approach to Causation*, 14 U. MICH. J. L. REF. 53, 56 (1980).

168. Estep & Forgotson, *Legal Liability for Genetic Injuries from Radiation*, 24 LA. L. REV. 1, 49 (1963); Moore *supra* note 110, at 434. Such a fund for victims of hazardous waste contamination was proposed in the original "Environmental Emergency Response Act," (S. 1480). The final version of the bill, the "Comprehensive Environmental Response Compensa-

urge the court to consider these alternatives and to adopt them where feasible. At the very least, such suggestions indicate a growing awareness in the legal community that problems of causation involved in radiation exposure injuries are not fully addressed by traditional legal standards.

If the court in the plaintiff's jurisdiction is unwilling to adopt one of these alternatives,[169] the plaintiff's attorney must make the best use of available evidence to prove causation. Violations of applicable safety standards may be used to buttress the plaintiff's allegations of a causal nexus. Reliable, state-of-the-art statistical studies can also be very persuasive. Finally, the plaintiff must obtain highly qualified experts to testify that, in the context of the plaintiff's case, nonionizing radiation probably caused the plaintiff's injury, according to the best scientific understanding of such injuries.

Statutes of limitations and proof of causation are two very difficult obstacles which virtually every nonionizing radiation plaintiff is likely to encounter. The specific avenue of recovery that the plaintiff chooses to pursue, however, depends on the particular facts of his case. The remainder of this section explores three potential avenues of recovery for nonionizing radiation injury: workers' compensation, strict products liability, and nuisance.

C. Workers' Compensation Relief

A plaintiff alleging nonionizing radiation injury resulting from on-the-job exposure[170] can attempt to recover under a workers' compensation statute.[171] The elements of a claim based on workers' compensation will depend on the statutory scheme of the claimant's state and the judicial interpretation of that scheme. Workers' compensation schemes provide relief for injury arising out of employment without regard to negligence on the part of the employer.[172] Many

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tion and Liability Act of 1980" (Superfund), Pub. L. No. 95-510, 94 Stat. 2767 (1980), eliminated victim compensation, however. 42 U.S.C. §§ 9601-9657 (1980).

169. Courts and legislatures have not been quick to alter traditional concepts of causation. A notable exception is Reserve Mining Co. v. EPA, 514 F.2d 492 (8th Cir. 1975) (the court addressed the problem of scientific uncertainty and applied a risk-benefit analysis in determining causation; note also that the court appeared to defer to the agency's expertise—an element lacking in most plaintiff injury suits).

170. *See supra* text and notes at notes 34-41.

171. Every state presently has some form of workers' compensation. 1 A. LARSON, THE LAW WORKMEN'S COMPENSATION § 5.30 (1978). It is important to note, however, that a workers' compensation remedy is exclusive of all other remedies by an employee or his dependents against the employer for the same injury. 2A *Id.* at § 65.00 (1982).

172. 1 *Id.* at § 1.10

statutes provide that once statutory filing limits are met,[173] recovery is contingent only upon establishing the causal connection between the alleged injury and the employment.[174] Other state workers' compensation schemes have inherent limitations which may present obstacles to recovery by the employee injured on the job by exposure to nonionizing radiation.[175]

1. History of Workers' Compensation Statutes

Workers' compensation statutes first appeared around the time of the Industrial Revolution in response to a tremendous increase in the number of workplace injuries.[176] Because of the very limited tort liability of the master to his servant at common law, the vast majority of workplace accident victims received no compensation for their injuries.[177] A system of workers' compensation gradually developed in the form of statutes which placed liability on the employer for all employee injuries arising out of his business.[178] In effect, workers' compensation served as a form of insurance that the employer would bear the cost of all injuries arising out of employment.[179]

The early workers' compensation statutes were designed to provide compensation for accidental injuries directly traceable to sudden, unexpected occurrences in the workplace.[180] As time went on, courts and legislatures began to broaden workers' compensation coverage to include benefits for victims of work-related diseases as well.[181] This broadening is significant for the nonionizing radiation claimant. In most instances of nonionizing radiation injury there is no traumatic, time-definite event such as that anticipated and required by the early workers' compensation statutes. Instead, the injury results from "ordinary," routine exposure to nonionizing radiation over a long period of time, and is more accurately characterized as a disease. Their expansion to include work-related diseases makes workers' compensation statutes a potential means of recovery for exposure to nonionizing radiation.

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173. *See supra* text and note at 102.
174. *See supra* text and notes at notes 119-63.
175. *See infra* text and notes at notes 186-208.
176. *See* Kutchins, *supra* note 102, at 212.
177. W. PROSSER, *supra* note 120, § 80, at 525-30.
178. *Id.* at 531.
179. *See id.*
180. Larson, *Occupational Diseases Under Workmen's Compensation Laws*, 9 U. RICH. L. REV. 87 (1974).
181. Kutchins, *supra* note 102, at 212.

Today, every state has general compensation coverage for occupational diseases.[182] The development of this coverage, however, has differed from state to state. In Massachusetts, for example, the courts expanded the statutory definition of injury to include occupational diseases.[183] Other states specifically included coverage for diseases in their workers' compensation statutes.[184] Still other states enacted statutes which exclusively encompass occupational diseases.[185] Given this varied development, the problems faced by the nonionizing radiation plaintiff differ from state to state. Two commonly encountered problems, however, are a requirement that the injury arise out of an occupational "accident," and that such injury fall within the statute's often narrow definition of "occupational disease."

2. The Injury "By Accident" Requirement

Many states have chosen to provide benefits for occupational diseases by specifically amending existing injury coverage statutes to include diseases.[186] Several of these states, however, continue to require an "accidental" incident as a prerequisite to compensation.[187] This has caused some courts, in interpreting these statutes, to look for a sudden, unexpected event which caused the disease.[188] This may present an insignificant problem for the nonionizing radiation claimant who has been exposed to a sudden burst of radiation. On the other hand, it can serve to deny the claims of those workers who allege injury from chronic, routine workplace exposure to nonionizing radiation. With the expansion of occupational disease legislation, the "by accident" clauses have clearly lost some of their force over the years.[189] In some cases, however, they continue to result in the denial of benefits for diseases associated with chronic workplace exposure to harmful agents.[190]

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182. 1B A. LARSON, *supra* note 171, § 41.00 (1980).

183. *See, e.g., In re* Hurle, 217 Mass. 223, 104 N.E. 336 (1914); Johnson v. London Guar. & Accident Co., 217 Mass. 388, 104 N.E. 735 (1914).

184. *See, e.g.,* KAN. STAT. ANN. § 44-5a01 (1981); N. D. CENT. CODE § 65-01-02 (8) (a) (Supp. 1981); WIS. STAT. ANN. § 102.01(2)(c) (West 1981-1982).

185. *See, e.g.,* ALA. CODE §§ 25-5-110 to 25-5-123 (1975 & Supp. 1979); IND. CODE ANN. §§ 22-3-7-1 to 22-3-7-38 (Burns 1974 & Cum. Supp. 1981); PA. STAT. ANN. tit. 77, § 1201 (Purdon 1952).

186. *See supra* note 184.

187. *See Compensating Victims, supra* note 165, at 921.

188. *See, e.g.,* Johnson v. Gulfport Laundry & Cleaning Co., 249 Miss. 11, 162 So. 2d 859 (1964) (claimant denied compensation for nervous condition caused by overwork where no accident or unusual event had occurred).

189. 1B A. LARSON, *supra* note 171, § 41.31.

190. *See, Compensating Victims, supra* note 165, at 921 n.42.

3. Narrow Statutory Definitions of "Occupational Disease"

Some states have added sections to their workers' compensation statutes providing compensation for occupational diseases.[191] Other states have enacted entirely separate acts to provide such compensation.[192] In both situations problems may still exist for the nonionizing radiation claimant. The major source of these problems is the usually narrow statutory definition of occupational disease. This definition may take the form of an exclusive schedule of compensable diseases;[193] a requirement that the disease be peculiar to the employment;[194] or an exclusion for ordinary diseases of life.[195]

a. Schedules

In some states, occupational disease is defined by an enumerated exclusive schedule of diseases for which benefits will be provided.[196] While this is clearly advantageous to the claimant whose injury appears on the schedule, it poses an insurmountable obstacle for the claimant whose disease is not listed. This obstacle exists even where there is a clear connection between the disease and the employment.[197] Many of the states that use the schedule-type coverage, however, have recently added a catch-all phrase which provides for compensation for any occupational disease, as long as it is shown to have arisen from the employment.[198] Thus, in these states, the nonionizing radiation plaintiff's chances for success are greatly enhanced.

b. "Peculiar to employment" requirements

States often limit coverage for occupational diseases by requiring that the disease for which compensation is sought be peculiar to the worker's occupation.[199] This requirement presents a serious obstacle to recovery for the nonionizing radiation claimant. Damaging expo-

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191. *See, e.g.,* ARK. STAT. ANN. § 81-1314 (1947); OR. REV. STAT. § 656.804 (1979).

192. *See, e.g.,* IND. CODE ANN., §§ 22-3-7-1 to 22-3-7-38 (Burns 1974 & Cum. Supp. 1981); PA. STAT. ANN. tit. 77, § 1201 (Purdon 1952).

193. *See infra* text and notes at notes 196-98.

194. *See infra* text and notes at notes 199-204.

195. *See infra* text and notes at notes 205-07.

196. *See, e.g.,* N.Y. WORK. COMP. LAW § 3(2) (McKinney 1965 & Supp. 1981-82); P.R. LAWS ANN. tit. 11, § 3 (1977); R.I. GEN. LAWS § 28-34-2 (1956).

197. Of those statutes which contain a schedule of diseases, none could be found which specifically lists injury from nonionizing radiation. Where radiation injuries are compensable, they are sometimes limited to injuries from exposure to ionizing radiation. *E.g.,* NEV. REV. STAT. § 617.450 (1981).

198. *See, e.g.,* N.Y. WORK. COMP. LAW § 3 (McKinney 1965 & Supp. 1981-82); OHIO REV. CODE ANN. § 4123.68(BB) (Baldwin Supp. 1981).

199. *See, e.g.,* ALA. CODE § 25-5-110(i) (1975); R.I. GEN. LAWS § 28-34-1(c) (1956).

sure to nonionizing radiation most often manifests itself as a disease which also occurs among members of the general population who are not exposed to nonionizing radiation in their jobs. Courts have, in the past, denied recovery where the disease is not peculiar to the worker's occupation.[200]

On the other hand, some courts have been more lenient in their interpretation of "disease peculiar to employment" clauses. The New Mexico Supreme Court, for example, has interpreted disease "peculiar to the occupation in which the employee was engaged"[201] as not meaning "exclusive to" that employment.[202] Instead, the court held that, assuming the disease arose out of the employment, it would be compensable if the conditions of employment created a hazard distinct from those in most other occupations.[203] The court reasoned that any other use of the phrase would place an unreasonable burden on the employee and would do injustice to the beneficent nature of workers' compensation legislation.[204] Thus, while the "disease peculiar to employment" requirement may not necessarily bar the nonionizing radiation claimant's compensation, it should be noted that the possibility exists.

c. "Ordinary diseases of life" limitations

Some states limit the definition of occupational diseases by excluding "ordinary diseases of life" from coverage.[205] Since harmful exposure to nonionizing radiation often manifests itself as a disease which also occurs among the public generally, this exclusion presents another obstacle to the claimant seeking compensation for nonionizing radiation injuries. As in the "disease peculiar to employment" limitation, some courts have adopted a narrow interpretation of the statutory language and denied claims for diseases which are found

200. *See, e.g.,* Scott v. United States Steel Corp., 203 Pa. Super. 459, 201 A.2d 243 (1964) (compensation denied widow of employee where court took judicial notice of the fact that lung cancer was not peculiar to the employee's industry). *But see* Utter v. Asten-Hill Mfg. Co., 453 Pa. 401, 309 A.2d 583 (1973) (cancer can be an occupational disease though it exists in the general public, if it is "peculiar to the claimant's occupation by its causes and the characteristics of its manifestation").

201. N.M. STAT. ANN. § 52-3-33 (1978).

202. Martinez v. Univ. of Cal., 93 N.M. 455, 457, 601 P.2d 425, 427 (1979) (petitioner was not required to show that anxiety neurosis was suffered exclusively by members of his occupation in order to qualify for benefits).

203. *Id.* For cases reaching a similar conclusion *see, e.g.,* Glodenis v. American Brass Co., 118 Conn. 29, 170 A. 146 (1934); Gaddis v. Rudy Patrick Seed Div., 485 S.W.2d 636 (Mo. App. 1972); Utter v. Asten Hill Mfg., 453 Pa. 401, 309 A.2d 583 (1973).

204. Martinez v. Univ. of Cal., 93 N.M. 455, 457, 601 P.2d 425, 427 (1979).

205. *See, e.g.,* MICH. COMP. LAWS § 418.401(c) (1982); MO. REV. STAT. § 287.067 (Vernon Supp. 1982).

among the general public.[206] On the other hand, many courts have softened the harsh effects of the "ordinary disease of life" exclusion by allowing compensation for a disease which also occurs among the general public when conditions of employment present a hazard greater than or different from the risk to the public generally.[207] Thus, epidemiological studies showing a statistical concentration of a certain disease among workers in a particular occupation can be helpful to the plaintiff.

To summarize, the success of a claimant seeking compensation for nonionizing radiation injuries under workers' compensation statutes depends, to a great extent, upon the state's statutory scheme and the judicial interpretation of that scheme. There are, however, some particular problems of which the claimant's attorney should be aware. In addition to proof of causation[208] and statutes of limitations[209] problems, the claimant may face legal obstacles such as a requirement that the injury occur "by accident;" a narrow statutory definition of occupational disease which limits recovery to those illnesses covered by a schedule; or an exclusion of diseases occurring in the general population. Nevertheless, workers' compensation statutes present a potential avenue of recovery for the nonionizing radiation plaintiff injured on the job. Courts have been willing, in some cases, to apply the accidental injury requirement expansively so as to include occupational disease claims. In addition, courts have liberally interpreted narrow statutory definitions of coverage in order to reach more reasonable results. Because workers' compensation schemes are intended to provide compensation to all workers whose injuries arise out of employment,[210] plaintiffs' lawyers should urge that such interpretations be adopted by their courts. If they are successful, the prospects of recovery for nonionizing radiation injury under workers' compensation will be greatly improved.

D. Strict Products Liability

1. Development of the Strict Liability Cause of Action

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206. *See, e.g.,* Booker v. Duke Medical Center, 32 N.C. App. 185, 231 S.E.2d 187 (1977) (compensation for hepatitis denied to laboratory worker handling hepatitis-contaminated blood).

207. The broader interpretation appears to be the more common. *See, e.g.,* Allis-Chalmers Mfg. v. Indus. Comm., 33 Ill. 2d 268, 211 N.E.2d 276 (1965); Collins v. Neevel Luggage Mfg., 481 S.W.2d 548 (Mo. App. 1972).

208. *See supra* text and notes at Section III.B.

209. *See supra* text and notes at Section III.A.

210. *See supra* text and notes at notes 178, 179.

The law of products liability deals with the liability of sellers or suppliers of goods to third persons with whom they are not in privity of contract.[211] Traditionally, products liability actions have been brought under theories of negligence and/or implied warranty.[212] The plaintiff alleging negligence as a basis for a products liability action must show that the defendant—usually the product manufacturer or seller—did not exercise reasonable care in producing or marketing the product.[213]

The earliest products liability actions brought under a negligence theory were often frustrated by the firmly established rule that the manufacturer's duty extended only to the immediate purchaser.[214] The landmark case of *MacPherson v. Buick Motor Company*,[215] removed that legal obstacle by holding the manufacturer liable to a subsequent purchaser of the product under ordinary principles of tort law. After *MacPherson*, however, the products liability plaintiff still faced the tremendous burden of proving that a negligent act had occurred during the long and often complex path from manufacture to sale.[216]

Around the beginning of the 20th century, partly as a result of the problems in proving negligence in product liability actions, plaintiffs began to rely on warranty concepts to establish that a product was not of merchantable quality when sold.[217] The implied warranty approach was advantageous to the plaintiff because it did not require proof that the seller had been negligent. To recover, the plaintiff had to prove only that the product was not fit for the ordinary purpose for which it was sold.[218]

In many cases, however, courts continued to require privity between the buyer and seller. This judicial requirement effectively denied recovery in products liability cases, since, in the typical situation, no privity existed between the plaintiff, who bought from a dealer or retailer, and the manufacturer. This situation existed until

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211. W. PROSSER, *supra* note 120, at 641.

212. *See generally* Birnbaum, *Unmasking the Test for Design Defect: From Negligence [to Warranty] to Strict Liability to Negligence,* 33 VAND. L. REV. 593 (1980).

213. W. PROSSER, *supra* note 120, § 96, at 644.

214. *See, e.g.,* Hasbrouk v. Armour & Co., 139 Wis. 357, 121 N.W. 157 (1909). Thus, the customer who purchased from a retailer would have no cause of action against the manufacturer.

215. 217 N.Y. 382, 111 N.E. 1050 (1916).

216. *See* Birnbaum, *supra* note 212, at 595-96.

217. W. PROSSER, *supra* note 120, § 97, at 650; Birnbaum, *supra* note 212, at 594.

218. Wade, *On Product "Design Defects" and Their Actionability,* 33 VAND. L. REV. 551, 552-53 (1980).

the leading decision of *Henningsen v. Bloomfield Motor's Inc.*,[219] dispensed with the privity requirement in warranty cases.

Plaintiffs continued to face complications even after *Henningsen*, because warranties on the sale of goods were governed by the Uniform Sales Act, and its successor, the Uniform Commercial Code.[220] Both statutes had been drafted with the view that contracts would exist between sellers and their immediate buyers.[221] Therefore, the plaintiff with a cause of action in implied warranty against a distant manufacturer continued to face problems because his contractual relationship was usually with the seller, not the manufacturer.[222]

The inability of the negligence and warranty theories to afford relief to many of those injured by defective consumer goods eventually led to the application of a strict liability theory to these cases.[223] In general terms, strict liability imposes liability for injury without requiring proof of the defendant's fault.[224] The imposition of strict liability often involves a policy determination that the cost of an injury should be borne by the party best able to bear it.[225] The elements of the strict products liability cause of action are set out in section 402A of the Restatement (Second) of Torts. This section states:

> Special Liability of Seller of Product for Physical Harm to User or Consumer
>
> (1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if (a) the seller is engaged in the business of selling a product, and (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold. (2) The rule stated in Section (1) applies although (a) the seller has exercised all possible care in the preparation and sale of his product, and (b) the user and consumer has not bought the product from or entered into any contractual relation with the seller.[226]

219. 32 N.J. 358, 161 A.2d 69 (1960).

220. U.C.C. §§ 2-313, 2-314. *See also* W. PROSSER, *supra* note 120, § 97, at 655.

221. W. PROSSER, *supra* note 120, § 97, at 655.

222. These problems include provisions which preclude the buyer from recovering unless he gives notice of the breach of warranty to the seller, and disclaimers of warranty by the seller which in effect defeat the warranty. *Id.* at 655-56.

223. *See generally id.* § 98.

224. *See generally id.* § 75.

225. *Id.* at 495. Outside the area of products liability, strict liability is most often applied in cases involving ultrahazardous activities. *See generally id.* § 78.

226. RESTATEMENT (SECOND) OF TORTS § 402A (1977).

Thus, strict products liability makes it unnecessary for the plaintiff to prove negligence or breach of warranty. All that the plaintiff must do is show that the product which caused his injury was in a defective condition when it left the defendant's control.[227]

One of the first cases to apply strict liability theory to a defective product was *Greenman v. Yuba Power Products, Inc.*[228] *Greenman* involved a suit brought by a man who was injured while using a power tool. The court held that "a manufacturer is strictly liable in tort when an article he places on the market, knowing that it is to be used without inspection for defects, proves to have a defect that causes injury to a human being."[229] The court reasoned that strict liability, rather than implied warranty, is appropriate in products liability actions because it insures that the costs of injuries resulting from defective products are borne by those most able to do so—the manufacturers and/or sellers.[230] Today, nearly every state recognizes some form of strict products liability;[231] most of these states cite section 402A and *Greenman* as the authoritative legal basis of the doctrine.[232]

Despite its widespread recognition, the development of strict products liability law has not been orderly. Confusion has resulted as courts have set about applying the elements of strict products liability to the facts of particular cases.[233] The most troublesome element of strict products liability for the courts has been that of defining what makes a product "defective."[234] Courts have used a variety of tests for this purpose.[235] The resulting confusion has led one commentator to observe that strict liability law has become "a swampy quagmire ... [which] threatens to split into several different streams with diverse destinations."[236]

The nonionizing radiation plaintiff who pursues a cause of action in strict products liability will find himself in the midst of the confusion surrounding the definition of a defective product. Therefore, in order to assist the nonionizing radiation plaintiff's attorney in pre-

227. *See* Wade, *supra* note 218, at 553.

228. 59 Cal. 2d 57, 377 P.2d 897, 27 Cal. Rptr. 697 (1963).

229. 59 Cal. 2d at 62, 377 P.2d at 900, 27 Cal. Rptr. at 700.

230. 59 Cal. 2d at 63, 377 P.2d at 901, 27 Cal. Rptr. at 701.

231. PROD. LIAB. REP. (CCH) ¶ 4016 (1981) (44 states, Puerto Rico, and the District of Columbia have adopted some form of strict products liability).

232. Thirty-six states have adopted strict liability in the form set out in § 402A of the RESTATEMENT (SECOND) OF TORTS (1977). *Id.*

233. *See* Wade, *supra* note 218, at 557.

234. Birnbaum, *supra* note 212, at 597-600.

235. *See infra* text and notes at notes 241-74.

236. Wade, *supra* note 218, at 557.

paring a strict products liability case, the remainder of this section will focus on the concept of a defective product. First, the discussion will focus on those situations in a strict products liability action in which the need to define the term "defect" arises. Second, the various judicial tests for determining whether a defect exists, and the problems each test may present for the nonionizing radiation plaintiff will be explored. Finally, the discussion will turn to an analysis of the approach to defective product cases adopted in the Uniform Products Liability Act.

2. Defining "Defective"

a. Manufacturing or design defect

There are two distinct situations in which a defect can arise. First is the case in which the product becomes dangerous as a result of manufacturing errors. Second is the case where the product presents a risk of harm due to an intentional design decision. In the former case, the meaning of "defect" usually creates little difficulty: a product is defective if it is different from the standard produced by the manufacturer.[237] The manufacturer may, therefore, be liable for any injuries caused by the product, notwithstanding the use of due care in the preparation and sale of the product.[238] In the design defect case, however, the definition is not so simple because the product has reached the consumer as the manufacturer intended. Nevertheless, some aspect of the manufacturer's conscious design decision has harmed the plaintiff. Thus, the courts have tried, in these latter cases, to determine at what point the design decisions were so unjustifiable as to make the product defective in the eyes of the law.

The circumstances of each case will determine whether a manufacturing or design defect theory is most appropriate for the particular nonionizing radiation plaintiff. Since the meaning of manufacturing defect should present few problems,[239] this section will focus on those cases in which the plaintiff alleges injury from a design defect.

b. Tests for defining a design defect

Courts have set about determining what constitutes a design defect in numerous ways. Most courts agree, however, that a deter-

237. Birnbaum, *supra* note 212, at 599; Wade, *supra* note 218, at 551.

238. Hall v. Chrysler Corp., 526 F.2d 350 (5th Cir. 1976) (applying Michigan Law).

239. See *supra* text and notes at notes 237, 238.

mination of strict products liability for design defects should not focus on the negligence-laden concept of the manufacturer's conduct, but instead should concentrate on the condition of the product itself.[240] Following this rationale, some courts test for design defect by asking whether the product meets ordinary consumer expectations of safety;[241] others ask whether a reasonable manufacturer with knowledge of the product's propensity to injure would have sold the product despite its hazards;[242] still others use a combination of tests.[243] Since the means of defining design defect varies from jurisdiction to jurisdiction, each of the above tests will be briefly explained.

i. The consumer expectations test

In 1965, two years after the *Greenman* case was decided, the American Law Institute published its final version of section 402A of the Restatement (Second) of Torts.[244] Comment i to this section explains that "[t]he rule stated in this section applies only where the defective condition of the product makes it unreasonably dangerous to the user or consumer."[245] The comment continues by defining "unreasonably dangerous" as "dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics."[246] Today, virtually every state has adopted section 402A,[247] and courts in many of these states rely on the definition of unreasonably dangerous found in comment i.[248]

From the nonionizing radiation plaintiff's perspective the "consumer expectations" test appears to be a favorable approach. The ordinary purchaser of a microwave oven, for example, would not ex-

240. *See, e.g.,* Barker v. Lull Eng'g Co., 20 Cal. 3d 413, 418, 573 P.2d 443, 447, 143 Cal. Rptr. 225, 229 (1978).

241. *See, e.g.,* Young v. Tide Craft, Inc., 270 S.C. 453, 242 S.E. 2d 671 (1978). *See also* RESTATEMENT (SECOND) OF TORTS § 402A comment i (1977).

242. *See, e.g.,* Phillips v. Kimwood Machine Co., 269 Or. 485, 525 P.2d 1033 (1974). Keeton, *Manufacturer's Liability: The Meaning of "Defect" in the Manufacture and Design of Products,* 20 SYRACUSE L. REV. 559, 568 (1969); Wade, *On the Nature of Strict Tort Liability for Products,* 44 MISS. L.J. 825 (1973).

243. Barker v. Lull Engineering Co., 20 Cal. 3d 413, 573 P.2d 443, 143 Cal. Rptr. 225 (1978); Caterpiller Tractor Co. v. Beck, 593 P.2d 871 (Alaska 1979).

244. Birnbaum, *supra* note 212, at 598.

245. RESTATEMENT (SECOND) OF TORTS, § 402A comment i (1977).

246. *Id.*

247. PROD. LIAB. REP. (CCH) ¶ 4016. *See also supra* note 231.

248. *See* Young v. Tide Craft, Inc., 270 S.C. 453, 242 S.E. 2d 671 (1978). *See generally* PROD. LIAB. REP. (CCH) ¶ 4015.

pect to be exposed to a harmful substance. Critics of the consumer expectations test, however, argue that it is difficult to apply in cases involving technologically complex products about which the consumer may not know enough to have accurate safety expectations.[249] In addition, one court, purporting to follow comment i to section 402A, based its decision not on the expectations of the ordinary consumer, but on the expectations of a person with the special knowledge of the particular consumer (in this particular case, plaintiff's decedent).[250] While such interpretive applications can pose problems for the plaintiff, they do not appear to present a major difficulty for the nonionizing radiation plaintiff in a jurisdiction which has adopted the consumer expectations test.

ii. "The reasonably prudent manufacturer" test

A second test for defining design defects, the so-called "reasonably prudent manufacturer" test,[251] has been applied by some courts and advocated by commentators.[252] This test defines a defect by assuming that the seller or manufacturer knew of the product's propensity to injure.[253] The test then considers whether, with such knowledge, the seller or manufacturer would have been negligent in selling the product without a warning.[254] Although this test sounds like a negligence test, it is actually a test in strict liability because the courts' impute to the manufacturer knowledge of the product's propensity to cause harm.

The major difficulty with applying the reasonably prudent manufacturer test lies in determining how much knowledge of the product's propensity for injury will be imputed to the manufacturer. The views of Dean Wade[255] and Dean Keeton,[256] two of the nation's foremost writers on the subject of products liability, represent the most common approaches to imputing knowledge to the manufacturer. Under Dean Wade's approach, knowledge of the product's propensity for harm as that knowledge existed *at the time of*

249. Keeton, *Product Liability and the Meaning of Defect,* 5 ST. MARY'S L.J. 30, 37 (1973); Wade, *supra* note 242, at 829. It may also be argued, however, that one need not know how a product works to have an expectation of safety.

250. Young v. Tide Craft, Inc., 270 S.C. at 471-72, 242 S.E.2d at 680. This approach, however, appears to be the exception.

251. *See, e.g.,* Phillips v. Kimwood Machine Co., 269 Or. 485, 525 P.2d 1033 (1974).

252. *See, e.g.,* Keeton, *supra* note 242; Wade, *supra* note 242.

253. Phillips v. Kimwood Machine Co., 269 Or. 485, 491-92, 525 P.2d 1033, 1036 (1974).

254. *Id.*

255. John W. Wade, Distinguished Professor of Law, Vanderbilt University, Reporter, RESTATEMENT (SECOND) OF TORTS (1977).

256. W. Page Keeton, Dean of the University of Texas Law School.

manufacture is imputed to the manufacturer.[257] In contrast, Dean Keeton would impute to the manufacturer knowledge of all risks known *at the time of trial*.[258]

> Since the test is not one of negligence, it is not based upon the risks and dangers that the maker should have, in the exercise of ordinary care, known about. It is, rather, danger in fact, as that danger is found to be at the time of the trial that controls.[259]

Thus, Dean Keeton would impute knowledge of even those dangers that were scientifically unknowable at the time of manufacture.[260]

This distinction is crucial for the nonionizing radiation plaintiff if the defendant claims that his product's propensity for injury was scientifically unknown or unknowable at the time he placed it on the market. Under the Wade approach, only knowledge that existed at the time of manufacture is imputed to the defendant. Thus, if the defendant convinces the jury that the dangers of nonionizing radiation were not known at the time the product was made, he will likely defeat the plaintiff's claim.[261] The Keeton approach, on the other hand, does not excuse the defendant merely because the dangerous propensity of the product was scientifically unknowable at the time of manufacture.[262] Thus, under the Keeton approach, the defendant in a nonionizing radiation case would be charged with knowledge of his product's harmful character, whether or not he could have had such knowledge at the time he placed the product on the market. Whether the product is defective would then be determined by asking whether a reasonably prudent manufacturer or seller, knowing of the particular risk, would have put the article into the stream of commerce.[263]

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257. Wade, *supra* note 242, at 839-40.

258. Keeton, *supra* note 242.

259. *Id.* at 568.

260. Birnbaum, *supra* note 212, at 622.

261. *See,* Woodill v. Parke-Davis & Co., 79 Ill. 2d 26, 402 N.E. 2d 194 (1980) (holding that manufacturer could not be held liable for failure to warn of a danger of which it would be impossible to know).

262. *See* Hamilton v. Hardy, 37 Colo. App. 375, 549 P.2d 1099 (1976) (under strict liability theory, a manufacturer must warn of dangers and risks, whether or not a causal relationship between use and injury has been definitively established at the time of the warning); Cepeda v. Cumberland Eng'g Co., 76 N.J. 152, 386 A.2d 816 (1978) (foreseeability of dangerous proclivity of the product is not requisite to liability); Newman v. Utility Trailer and Equip. Co., 278 Or. 395, 564 P.2d 674 (1977) (in applying strict liability, it is assumed that the manufacturer or seller was aware of the risk involved whether or not the manufacturer had such knowledge or reasonably could have had it).

263. The determination of reasonableness proceeds on a case-by-case basis and usually consists of a balancing of various risk-utility factors. Wade, *supra* note 242, at 837-38.

There are sound reasons for applying the Keeton analysis. By making foreseeability of the product's propensity to injure irrelevant, the Keeton approach is faithful to the concept of strict liability. The Wade approach, on the other hand, blurs the distinction between strict liability and negligence by considering the foreseeability of the harm at the time of manufacture.[264] The deficiency in the Wade approach is considered justified by the otherwise adverse impact the Keeton approach would have on the development and introduction of new products to the marketplace. For example, the Wade analysis has often been used in cases involving drug manufacturers.[265] Courts reason that to hold a drug manufacturer liable for side effects which were not known at the time the drug was marketed would deter other drug manufacturers from introducing potentially beneficial products for fear that they would be held liable for any number of unknowable side effects.[266] With the possible exception of machines used to diagnose or treat illness, the potential benefits of a new product which emits nonionizing radiation, however, are arguably not as great as the potential benefits of a new "wonder drug." Therefore, use of the Keeton approach would appear to be both more faithful to the principles and policies underlying strict products liability and more appropriate in a nonionizing radiation injury case.

iii. A combination of tests

Finally, some jurisdictions have adopted a combination of tests in their attempts to find a suitable way to define a design defect.[267] The California Supreme Court, for example, took such an approach in *Barker v. Lull Engineering*.[268] In *Barker*, the plaintiff was injured while operating a high-lift loader at a construction site. An earlier California case[269] had rejected the "unreasonably dangerous" test set forth in the Restatement, but had substituted no other test for it.[270] The *Barker* court, therefore, proposed the following test:

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264. *See* Newman v. Utility Trailer & Equipment Co., 278 Or. at 397, 564 P.2d at 675-76. *See also* Keeton, *supra* note 242 at 568.

265. *See, e.g.,* Singer v. Sterling Drug, Inc., 461 F.2d 288 (7th Cir. 1972); Basko v. Sterling Drug, Inc., 416 F.2d 417 (2d Cir. 1969); McEwen v. Ortho Pharmaceutical Corp., 270 Or. 375, 528 P.2d 522 (1974).

266. *See* Woodill v. Parke-Davis & Co., 79 Ill. 2d at 37, 402 N.E.2d at 199; Keeton, *supra* note 242, at 571.

267. *See infra* cases cited at note 271.

268. 20 Cal. 3d 413, 573 P.2d 443, 143 Cal. Rptr. 225 (1978).

269. Cronin v. J.B.E. Olson Corp., 8 Cal. 3d 121, 501 P.2d 1153, 104 Cal. Rptr. 433 (1972).

270. Birnbaum, *supra* note 212, at 603.

> [I]n design defect cases, a court may properly instruct a jury that a product is defective in design if (1) the plaintiff proves that the product failed to perform as safely as an ordinary consumer would expect when used in an intended or reasonably foreseeable manner, or (2) the plaintiff proves that the product's design proximately caused injury and the defendant fails to prove, in light of the relevant factors, that on balance the benefits of the challenged design outweigh the risk of danger inherent in such design.[271]

Similarly, in *Welch v. Outboard Marine Corp.*,[272] the Fifth Circuit of Appeals, applying Louisiana law, stated that "[a] product is defective and unreasonably dangerous when a reasonable seller would not sell the product if he knew of the risks involved or if the risks are greater than a reasonable buyer would expect."[273] When a court adopts a combination of tests, the plaintiff must deal with the problems and uncertainties of each. The "either/or" approach of the above tests, however, may be an advantage to the nonionizing radiation plaintiff by allowing him to "choose" the test which is most easily satisfied by the facts of his case.

3. The Model Uniform Products Liability Act

Another approach to the concept of design defect is presented in the Model Uniform Products Liability Act (MUPLA).[274] The Act, proposed by the Department of Commerce in 1979, was primarily the product of business writers and manufacturers who were greatly concerned that serious problems were being created by the haphazard judicial development of products liability law.[275] Chief among these problems was a substantial increase since 1974 in the cost of products liability insurance.[276]

The Act was offered to the states with the hope that, if adopted, it would assure that persons injured by unreasonably unsafe products would receive reasonable compensation for their injuries.[277] Its sponsors also hoped that the Act would bring uniformity and stability to

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271. Barker v. Lull Eng'g Co., 20 Cal. 3d 413, 426-27, 573 P.2d 443, 452, 143 Cal. Rptr. 225, 234 (1978) (emphasis omitted). The same approach was adopted by the Alaska Supreme Court in Caterpiller Tractor Co. v. Beck, 593 P.2d 871 (Alaska 1979).

272. 481 F.2d 252 (5th Cir. 1973) (plaintiff sustained serious injury when a lawnmower manufactured by the defendant threw a piece of wire which became embedded in the plaintiff's ankle).

273. *Id.* at 254.

274. 44 Fed. Reg. 62,714 (1979).

275. *See id.* at 62,716. *See also* Schwartz, *The Uniform Product Liability Act — A Brief Overview*, 33 VAND. L. REV. 579 (1980).

276. Schwartz, *supra* note 275, at 580.

277. 44 Fed. Reg. 62,714 (1979).

products liability insurance rates.[278] Thus, the Act takes a more pro-manufacturers stance than is currently taken under strict products liability law. This orientation is evident in the Introduction of the Act which states: "[t]he cost of an accident should be shifted from a claimant to a product seller when there is a logical and articulate rationale for deeming it (as compared with the injured individual or society at large) 'responsible' for the claimant's injuries."[279] The Act stresses, further, that its basis is in tort law and that "tort law is not a compensation system similar to Social Security or Worker Compensation."[280] It does not, therefore, provide that a product seller will be asked to pay damages merely because its product caused injury.[281]

Section 104[282] of the MUPLA specifically provides that a product manufacturer is liable if the plaintiff proves by a preponderance of the evidence that the defective product was the proximate cause of his harm.[283] Under this scheme, a product may be proven defective in any of four ways. It may be either:

1) unreasonably unsafe in construction;
2) unreasonably unsafe in design;
3) unreasonably unsafe because adequate warnings or instructions were not given; or
4) unreasonably unsafe because it did not conform to an express warranty.[284]

Since this section has focused on design defects, the following discussion will examine factor number two.

The comment accompanying section 104[285] notes the "uncertain strict liability principles in the area of design [defect]"[286] and concludes that the attempt to apply strict liability to design defect cases has "plunged [the courts] into a foggy area that is neither true strict liability nor negligence. The result has been the creation of a wide variety of legal 'formulae,' unpredictability for consumers and instability in the insurance market."[287] To correct this perceived con-

278. *Id.* at 62,715.
279. *Id.*
280. *Id.*
281. Schwartz, *supra* note 275 at 584.
282. 44 Fed. Reg. 62,721 (1979).
283. *Id.* at 62,721.
284. *Id.*
285. 44 Fed. Reg. 62,721-26 (1979).
286. *Id.* at 62,722.
287. *Id.*

fusion, section 104 provides a balancing test for determining whether a product is unreasonably unsafe in design. The claimant, under this test, must show that the likelihood that the product would cause his injury or a similar injury and the seriousness of the injury suffered outweighs the burden on the manufacturer to design a product that would have prevented those harms and any adverse effects that alternative design would have on the usefulness of the product.[288] This determination of reasonableness in design is based on knowledge as it existed at the time of manufacture.[289] Thus, the Act provides for a negligence-type balancing test which specifically rejects the use of judicial hindsight and relies instead on the weighing of factors as they existed at the time of manufacture.[290]

If the MUPLA is an indication of the future of strict liability law, it represents a tremendous setback for the nonionizing radiation plaintiff who cannot show negligence on the defendant's part. Rather than propose a workable rule for applying strict liability to design defect cases, the Act rejects strict products liability for design defects in favor of a fault standard[291] which is significantly more difficult to satisfy.

4. Summary of Strict Products Liability

This section has focused on strict products liability as a means of recovery for nonionizing radiation plaintiffs. Strict products liability was developed by the courts in order to circumvent some of the problems and limitations presented by negligence and breach of warranty theories.[292] A strict liability suit, however, presents problems of its own. Courts have been unable to agree on a satisfactory definition of design defect,[293] making the field of strict products liability unpredictable. Courts have also been reluctant to impute to manufacturers knowledge about the product not available at the time of manufacture.[294] Finally, the recently proposed Uniform Products Liability Act rejects strict liability for design defects in favor of a fault or negligence standard.[295]

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288. *Id.* at 62,723.
289. *Id.*
290. *See* Schwartz, *supra* note 275 at 586.
291. Birnbaum, *supra* note 212, at 642. It appears that none of the major commercial states have adopted MUPLA.
292. *See supra* text and notes at notes 214-23.
293. *See supra* text and notes at notes 240-73.
294. *See supra* text and notes at notes 255-66.
295. *See supra* text and notes at notes 274-90.

Nevertheless, strict products liability can be a useful theory for the nonionizing radiation plaintiff. A faithful application of strict liability principles makes consideration of the foreseeability of the plaintiff's injury irrelevant. Thus, a manufacturer can be held liable for a defect that was undiscoverable at the time of manufacture. The policy considerations which have made courts reluctant in the past to impute to manufacturers knowledge that was not available at the time of manufacture are not very strong in nonionizing radiation cases.[296] Therefore, plaintiffs should carefully consider the possibility of using a theory of strict products liability when seeking damages for nonionizing radiation injury.

E. Nuisance

The previous two sections have dealt with cases in which the plaintiff alleges personal injury resulting from exposure to nonionizing radiation either in the workplace[297] or from a product which he has used or with which he has come in contact.[298] Man-made nonionizing radiation sources, however, are present throughout the environment.[299] Suppose, for example, that a family lives in the vicinity of a powerful radar installation;[300] the family may allege that the threat to its health caused by the emission of microwave radiation from the radar system constitutes a substantial interference with the use and enjoyment of its property. For this family, the most appropriate theory of recovery lies in the common law of nuisance.

1. Public and Private Nuisance

Unfortunately, "[t]here is perhaps no more impenetrable jungle in the entire law than that which surrounds the word 'nuisance.' " [301] One source of confusion is the use of the single word "nuisance" to describe the invasion of two very distinct interests.[302] The first is an interference with common public rights; the other is an invasion of

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296. *See supra* text and notes at notes 265, 266.

297. *See supra* text and notes at notes 34-41.

298. *See supra* text and notes at notes 32-52.

299. *Id.*

300. The plaintiff's attorney should be aware that if such a radar system is operated by the government, the plaintiff's action may be barred by the doctrine of governmental immunity. *See generally* W. PROSSER, *supra* note 120, § 131. A discussion of governmental immunity is beyond the scope of this article. Therefore, for purposes of this section, it will be assumed that the radar system is operated by a private party.

301. W. PROSSER, *supra* note 120, § 86, at 571.

302. *Id.* at 572.

private interests in the use and enjoyment of land. Each of these concepts will now be discussed in more detail.

a. Public nuisance

A public nuisance is "an unreasonable interference with a right common to the general public."[303] For instance, using the example of the radar installation in a residential area, if nonionizing radiation emissions from the radar system make the use of a nearby public beach or drinking water unsafe, the radar may constitute a public nuisance. The concept of public nuisance in the civil common law grew out of early criminal prohibitions of conduct which interfered with the rights of the community at large.[304] Just as enforcing criminal laws is a function of the government, redressing a public nuisance has traditionally been left to the state.[305] Courts usually allow only public authorities, as representatives of the people, to bring suit against those creating a public nuisance.[306]

A private individual can maintain an action for public nuisance only if he has suffered harm of a different kind than that suffered by the general public.[307] Therefore, if the only loss suffered by the family living near the radar installation is use of the public beach, the family may not bring an action in public nuisance. If, however, a member of the family earns his living by fishing from the public beach, his injury could be sufficiently different in kind to afford him standing in a public nuisance action.[308] Although the prospect of private citizen public nuisance actions appears to be improving,[309]

303. RESTATEMENT (SECOND) OF TORTS § 821B(1) (1977).

304. *Id.* comment (a). Examples include encroachments upon public health or the right to the free and safe use of the public highway.

One article has noted that public nuisance is appropriate for challenging the invasion of the health, comfort, and beauty of the community. Bryson & Macbeth, *Public Nuisance, the Restatement (Second) of Torts and Environmental Law,* 2 ECOLOGY L.Q. 241, 277 (1972).

305. RESTATEMENT (SECOND) OF TORTS § 821C comment a (1977).

306. *See* W. PROSSER, *supra* note 120, § 86, at 586-87.

307. RESTATEMENT (SECOND) OF TORTS § 821C(1). *See also* Burgess v. M/V Tamano, 370 F. Supp. 247 (D. Me. 1973).

308. *See* Columbia River Fishermen's Protective Union v. Saint Helen's, 160 Or. 654, 87 P.2d 195 (1939); Burgess v. M/V Tamano, 370 F. Supp. 247 (D. Me. 1973). *But see* Kuehn v. Milwaukee, 83 Wis. 583, 53 M.W. 912 (1892) (standing denied to fishermen who sued to enjoin pollution of the waters in which they fished because fishing is open to everyone).

In some cases, the plaintiff may have an action in both public and private nuisance. This occurs if the injury which gives the plaintiff standing in public nuisance also affects the use and enjoyment of his property. *See, e.g.,* Awad v. McColgan, 357 Mich. 386, 98 N.W.2d 571 (1959).

309. Bryson and Macbeth, *supra* note 305 at 263. *See also* Wade v. Campbell, 200 Cal. App. 2d 54, 19 Cal. Rptr. 173 (1962) (proximite alone to source of nuisance may constitute sufficient damage on which to base standing); Karpisek v. Cather & Sons Const., 174 Neb. 234, 117

the limitations of this theory must be recognized. These limitations have generally precluded such public nuisance actions brought by individuals.[310]

b. Private nuisance

Private nuisance has been defined as a nontrespassory[311] invasion of another's interest in the private use and enjoyment of land.[312] "The ownership or rightful possession of land necessarily involves the right not only to the unimpaired condition of the property itself, but also to some reasonable comfort and convenience in its occupation."[313] Thus, private nuisance actions have been brought for interferences ranging from damage to the physical condition of the land or house thereon,[314] to injury to the health or peace of mind of the occupants.[315] In one noteworthy case, the court even allowed recovery for the unfounded fear of contagion from a tuberculosis hospital.[316]

2. Elements of Liability

The continued use of the single word "nuisance" to describe both public and private nuisance has "led to the application in public

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N.W.2d 322 (1962) (injury of those living close to asphalt plant found to be different in kind as well as degree from that suffered by people living farther away); RESTATEMENT (SECOND) OF TORTS § 821C(1) (1979).

310. If the plaintiff can overcome the standing limitations, public nuisance is an especially attractive nuisance theory because many of the defenses to a private nuisance action do not apply to public nuisance. *See infra* text and notes at notes 359-67.

311. Trespass may also be an appropriate theory of liability for the nonionizing radiation plaintiff. Trespass is an interference with possessory interests in, rather than use and enjoyment of, land. Trespass may be advantageous to the nonionizing radiation plaintiff for several reasons. First, trespass is an intentional tort. Therefore, the reasonableness of defendant's conduct is never an issue. Second, the plaintiff can recover in trespass without proof of actual damages. As long as a disturbance of the plaintiff's exclusive possession of land is shown, nominal damages will be awarded. Finally, the statute of limitations for trespass is often longer than for nuisance. *See generally*, W. PROSSER, *supra* note 120 at 594-96.

Traditionally trespass was confined to tangible invasions of land. In recent years, however, courts have been more receptive to finding a trespass even where the invading element is intangible. *See, e.g.,* Martin v. Reynolds Metals Co., 221 Or. 86, 342 P.2d 790 (1959) (invisible flouride gases and particulates from the defendant's plant settled on plaintiff's land rendering it unfit for livestock).

312. RESTATEMENT (SECOND) OF TORTS § 821D.

313. W. PROSSER, *supra* note 120, § 89, at 591.

314. Transcontinental Gas Pipe Line Corp. v. Gault, 198 F.2d 196 (4th Cir. 1952).

315. Yaffe v. Fort Smith, 178 Ark. 406, 10 S.W.2d 886 (1928).

316. Everett v. Paschall, 61 Wash. 47, 111 P. 879 (1910). This case may be especially helpful for the nonionizing radiation plaintiff who fears injury from nonionizing radiation but cannot prove actual physical harm. The court ruled that the maintenance, in a residential district, of a

nuisance cases, . . . of an analysis substantially similar to that employed for the tort action for private nuisance."[317] Therefore, the elements of liability discussed below will, unless otherwise noted, apply to actions for both public and private nuisance. The requisite elements of a nuisance cause of action are: (1) a basis of liability in either intentional tort, negligence, or strict liability; (2) a substantial interference with public or private rights; and (3) an unreasonable invasion of those rights.

a. Basis of liability

Since nuisance is a *field* of tort liability rather than a *type* of tortious conduct,[318] liability must be based on one of the types of conduct that serve in general as bases for all tort liability.[319] Thus, liability for nuisance may rest upon an intentional invasion of the plaintiff's interests, a negligent invasion, or conduct which falls within the principle of strict liability.[320] Courts often fail to distinguish among these three bases of liability when dealing with nuisance cases.[321] Nevertheless, a cause of action in nuisance will be successful only if it has a basis in intentional tort, negligence, or strict liability.[322]

i. Intentional invasion

The Restatement (Second) of Torts provides two examples of an intentional invasion of another's use and enjoyment of land:[323] (1) an invasion inspired by ill will or malice;[324] and (2) "an invasion that the actor knowingly causes in the pursuit of a laudable enterprise without any desire to cause harm."[325] Under the Restatement definition, an intentional invasion exists as long as the defendant knows

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sanitarium for the treatment of tuberculosis patients is a nuisance where the fear induced by the proximity of the sanitarium disturbs the comfortable enjoyment of adjacent property. The court reached this result notwithstanding evidence that the fear was unsustained by science.

317. RESTATEMENT (SECOND) OF TORTS § 821B comment e.

318. The focus is on the interest invaded, rather than on a single type of tortious conduct. W. PROSSER, *supra* note 120, § 87.

319. RESTATEMENT (SECOND) OF TORTS § 822 comment a.

320. W. PROSSER, *supra* note 120, § 87.

321. *Id.* at 576.

322. Note, *Environmental Law—The Nuances of Nuisance in a Private Action to Control Air Pollution,* 80 W.V. L. REV. 48, 58-59 (1977-78) [hereinafter cited as *Nuances of Nuisance*].

323. RESTATEMENT (SECOND) OF TORTS, § 825.

324. *Id.* at comment c.

325. *Id.*

that his conduct is causing interference with another's use and enjoyment of land. The defendant need not know or intend that this invasion will result in a particular type of harm.[326] In the earlier example,[327] as long as the radar operator knows that its radar system sends nonionizing radiation onto the family's land, there is an intentional invasion.[328] Intentional means "not that a wrong or the existence of a nuisance was intended but that the creator ... intended to bring about the conditions which are in fact found to be a nuisance."[329] Thus, it is the *invasion*, itself, and not its *result* which must be intentional.[330]

ii. Negligent invasion

Nuisance may also result from conduct which is negligent, that is, where the defendant has failed to act reasonably under the circumstances.[331] Proving negligence may be a difficult task for the nonionizing radiation plaintiff. Negligence is usually determined by a community standard of reasonable conduct.[332] Therefore, if the defendant has behaved as have others engaged in similar activities under similar circumstances, the plaintiff will be hard put to convince a court that the defendant has acted unreasonably.[333] On occasion, however, the customs of an entire industry have been found to be negligent.[334] This may be the best argument for the nonionizing radiation plaintiff in the absence of evidence indicating deviance from industry-wide custom.

iii. Strict liability for abnormally dangerous activities

Finally, a nuisance may be based on the strict liability which arises from abnormally dangerous activities.[335] Section 520 of the Restate-

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326. Melendres v. Soales, 105 Mich. App. 73, 306 N.W.2d 399 (1981).

327. *See supra* text and note at note 300.

328. *See* Melendres v. Soales, 105 Mich. App. 73, 306 N.W.2d 399 (1981).

329. 105 Mich. App. at 79, 306 N.W.2d at 402 (citing Denny v. Garavaglia, 333 Mich. 317, 331, 52 N.W.2d 521 (1952)).

330. Of course, an invasion will always be intentional if the defendant continues his conduct after having been informed that it is interfering with the use and enjoyment of another's property. *See* RESTATEMENT (SECOND) OF TORTS § 825 comment d, illustration 4.

331. W. PROSSER, *supra* note 120, § 87, at 575.

332. *Id.* § 33, at 166.

333. *See id.*

334. *See, e.g.,* The T.J. Hooper, 60 F.2d 737 (2d Cir. 1932), *cert. denied,* 287 U.S. 662 (1932) (defendant negligent for failing to install radio sets in oceangoing tugs, notwithstanding the fact that it had never been done in the industry before). Prosser notes that these cases will likely be infrequent, however. W. PROSSER, *supra* note 120, § 33, at 167.

335. W. PROSSER, *supra* note 120, 387, at 575.

ment (Second) of Torts provides a list of factors to be used when determining what constitutes an abnormally dangerous activity:

> (a) Whether the activity involves a high degree of risk of some harm to the person, land or chattels of others;
> (b) Whether the gravity of the harm which may result from it is likely to be great;
> (c) Whether the risk cannot be eliminated by the exercise of reasonable care;
> (d) Whether the activity is not a matter of common usage;
> (e) Whether the activity is appropriate to the place where it is carried on; and
> (f) The value of the activity to the community.[336]

Given the uncertainty surrounding the risks of exposure to nonionizing radiation[337] and the acceptance of the social utility of most activities in which it is involved,[338] it seems unlikely that a court would find operation of a radar system or a television station, for example, to be an abnormally dangerous activity.[339] Thus, in most cases, nuisance based on strict liability would not be an appropriate theory for the nonionizing radiation plaintiff to pursue.

b. Substantial interference

In order to prove nuisance, the plaintiff must show that the defendant's conduct has resulted in substantial interference with the public or private interests involved. [340] Even if the court finds an intentional invasion in a private nuisance action, it will not grant relief unless the plaintiff can show significant harm to his property interest or to his personal comfort.[341]

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336. RESTATEMENT (SECOND) OF TORTS, 520 (1979).

337. *See supra* text and notes at notes 62-67.

338. *See supra* text and notes at notes 32-52.

339. In a somewhat analogous situation, courts have generally refused to find that the transmission of electricity is an abnormally dangerous activity. *See, e.g.,* Brigham v. Moon Lake Electric Ass'n, 24 Utah 2d 292, 470 P.2d 393 (1970) (court refused to place strict liability on one who supplies electricity because our civilization could not survive without electricity, and those who supply it are benefactors to mankind); Bosley v. Cent. Vermont Pub. Serv. Corp., 127 Vt. 581, 255 A.2d 671 (1969) (strict liability should be confined to things or activities which are extraordinary, exceptional or abnormal, but the transmission of electric current in this day and age is a normal practice for the benefit of the community).

340. W. PROSSER, *supra* note 120, § 87, at 577. *See also* Smejkal v. Empire Lite-Rock, Inc., 274 Or. 571, 547 P.2d 1363 (1976); Citizens for Preservation of Waterman Lake v. Davis, 420 A.2d 53 (R.I. 1980).

341. The nuisance must affect the comfort of the hypothetical "ordinary person." Northwest Water Corp. v. Pennetta, 29 Colo. App. 1, 479 P.2d 398 (1970); Hay v. Stevens, 271 Or. 16, 530 P.2d 37 (1975). The sensitivities of a particular plaintiff are generally not considered. W. PROSSER, *supra* note 120, § 87, at 578-79.

The requirement of a substantial interference may present some problems for the nonionizing radiation plaintiff. In private nuisance actions, courts most readily find a substantial interference when the physical condition of the plaintiff's land has been affected.[342] Physical damage to land is not likely in a nonionizing radiation case, however. In the alternative, the plaintiff should allege injury to personal health or well-being. [343] The substantial interference requirement of the private nuisance action has, in fact, been met in cases involving only injury to health or peace of mind.[344] Offsetting this approach is the uncertainty of the evidence on the severity of the health risks posed by nonionizing radiation.[345] This situation may make it difficult for the plaintiff to succeed in a private nuisance action without some evidence of actual physical injury.[346] Complicating this discussion is the fact that there does not appear to be a clear dividing line between substantial and insubstantial injury.[347] Therefore, the nonionizing radiation plaintiff's attorney should attempt to make the best possible use of the particular facts of his case and marshal the best possible medical and scientific evidence as well.

c. Unreasonable invasion

In order to prevail in a nuisance action, the plaintiff must show unreasonable as well as substantial invasion or harm.[348] The requirement of an unreasonable invasion is grounded in the "obvious truth that each individual in a community must put up with a certain amount of annoyance, inconvenience and interference and must take a certain amount of risk in order that all may get on together."[349] The requisite unreasonableness of the harm in nuisance, however,

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342. W. PROSSER, *supra* note 120, § 87, at 578. *See also* Prauner v. Battle Creek Coop. Creamery, 173 Neb. 412, 421-22, 113 N.W.2d 518, 524 (1962).

343. *See, e.g.,* Sullivan v. American Mfg. Co., 33 F.2d 690 (4th Cir. 1929).

344. *See, e.g.,* Wilson v. Parent, 228 Or. 354, 365 P.2d 72 (1961) (obscene words and gestures that caused emotional distress were sufficiently substantial interference to establish liability).

345. *See supra* text and notes at notes 62-67.

346. *But see* Everett v. Paschall, 61 Wash. 47, 111 P. 879 (1910) (substantial injury found where plaintiff feared disease from nearby hospital, even though fear was unfounded in scientific fact).

347. *See* Delight Wholesale Co. v. Overland Park, 203 Kan. 99, 453 P.2d 82 (1969) (what may or may not constitute a nuisance depends upon facts and circumstances of a particular case).

348. W. PROSSER, *supra* note 120, § 87, at 580-81; RESTATEMENT (SECOND) OF TORTS § 826. *See also Nuances of Nuisance, supra* note 322, at 58-59.

349. RESTATEMENT (SECOND) OF TORTS § 822 comment g.

should be distinguished from the concept of unreasonableness found in the law of negligence.[350] Unreasonableness in the law of nuisance deals with the character and extent of the *plaintiff's harm* in light of surrounding circumstances.[351] This is to be distinguished from the determination of reasonableness in negligence law which focuses on the *defendant's conduct*.[352] In a nuisance action based on negligence, the reasonableness of the defendant's conduct is, of course, of prime importance. Where negligence is not the basis of the plaintiff's cause of action, however, the reasonableness of the defendant's conduct is not an issue.

Courts generally determine the reasonableness of the invasion of a plaintiff's interests on a case-by-case basis.[353] They often engage in a balancing process, weighing the gravity of the harm to the plaintiff against the utility of the defendant's conduct.[354] Other courts focus on the suitability of the surroundings for the defendant's conduct.[355] In general, courts seek to strike a balance between each party's freedom to use and enjoy its land and the annoyances and inconveniences which go along with modern life, often valued on an economic basis.

As long as the risk of exposure to nonionizing radiation remains uncertain,[356] it will be difficult for the nonionizing radiation plaintiff to meet the unreasonable invasion requirement of the nuisance action, especially if actual physical harm has not yet appeared. This is particularly true in a jurisdiction which balances the gravity of harm to the plaintiff against the utility of the defendant's conduct. The gravity of harm to the nonionizing radiation plaintiff may be unclear or unascertainable altogether, especially where the plaintiff contends that defendant's conduct presents a threat of future harm.[357] The utility of the defendant's conduct, on the other hand, is obvious

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350. *See Nuances of Nuisance*, *supra* note 322, at 59-60.

351. *See id.*

352. *See id.*

353. RESTATEMENT (SECOND) OF TORTS § 826(a) comment e.

354. *See, e.g.*, Pitsenbarger v. No. Natural Gas Co., 198 F. Supp. 665 (S.D. Iowa 1961); Weber v. Pieretti, 72 N.J. Super. 184, 178 A.2d 92 (1962); Gronn v. Rogers Const., 221 Or. 226, 350 P.2d 1086 (1960). *But see* Jost v. Dairyland Power Coop., 45 Wis. 2d 164, 177, 172 N.W.2d 647, 654 (1969) (the court upheld the exclusion of evidence tending to show the utility of the defendant's conduct, commenting: "We conclude that injuries caused by air pollution or other nuisance must be compensated irrespective of the utility of the offending conduct as compared to the injury").

355. *See, e.g.*, Oak Haven Trailer Ct. v. Western Wayne Co. Conservation Ass'n, 3 Mich. App. 83, 89, 141 N.W.2d 645, 648 (1966).

356. *See supra* text and notes at notes 62-67.

357. *See* Note, *Hazardous Wastes: Preserving the Nuisance Remedy*, 33 STAN. L. REV. 675, 690 (1981).

when that conduct is involved with national defense, the national communications system, or even ordinary manufacturing and commerce. The problems may not be as great in a jurisdiction which focuses on the suitability of the surroundings for defendant's conduct. There, the operation of a radar installation in the midst of a dense residential area is likely to be viewed as inappropriate, thus subjecting the operator to greater susceptibility to nuisance claims. Even here, however, the court would probably not find an unreasonable invasion without conclusive evidence of a threat of harm. Once again, the determination of unreasonable invasion is usually done on a case-by-case basis.[358] Therefore, the plaintiff's attorney should emphasize the growing evidence of danger presented by exposure to nonionizing radiation in order to satisfy the unreasonable invasion requirement.

3. Defenses

In order to fully prepare the action in nuisance, the nonionizing radiation plaintiff must be aware of the defenses which may be used against him. The availability of these defenses sometimes depends upon the basis of the nuisance action. For example, where the nuisance action is based on the defendant's negligent conduct, there may be an allegation of contributory negligence if the plaintiff himself has failed to act reasonably.[359]

Assumption of the risk is a defense which may be interposed regardless of the basis of the nuisance action.[360] Where the plaintiff occupied his property before the existence of the nuisance, this defense operates only so far as it requires the plaintiff to take reasonable action to avoid harm under the circumstances.[361] He need not move away or surrender valuable property uses because of the defendant's activities.[362] Where the plaintiff has come to the nuisance by moving next to one already existing, the imposition of assumption of the risk as a defense seems to be in order.[363]

In fact, although some courts have allowed coming to the nuisance as an absolute defense to an action in nuisance,[364] the prevailing rule

358. *See supra* text and note at note 353.

359. Runnells v. Maine Cent. RR, 159 Me. 200, 190 A.2d 739 (1963).

For a complete discussion of contributory negligence see W. PROSSER, *supra* note 120, § 65.

360. Assumption of risk is an appropriate defense when the plaintiff has knowingly encountered a hazard. W. PROSSER, *supra* note 120, § 91, at 610.

361. *Id.*

362. *Id.*

363. *Id.*

364. *See, e.g.,* Riter v. Keokuk Electro-Metals Co., 248 Iowa 710, 721, 82 N.W.2d 151, 158

seems to be that coming to the nuisance does not bar a nuisance action.[365] Thus, it appears that assumption of the risk will not generally bar the nonionizing radiation plaintiff's nuisance action, even if he has moved next to an already existing nonionizing radiation source. Further, the scientific uncertainty with respect to nonionizing radiation would seem to operate in favor of the plaintiff, who could not be expected to know more than experts in the field.

Finally, a defendant who is acting in compliance with legislative authority—zoning, for example—might argue that this authority makes his action, not an actionable nuisance per se.[366] If, however, the plaintiff can prove substantial and unreasonable interference, courts usually hold that compliance with a regulation is not a defense to a nuisance.[367] Thus, even the defendant's compliance with all regulations pertaining to the operation of his radar station will not, in most cases, be a bar to the plaintiff's nuisance action.

4. Remedies

If the plaintiff is able to establish the existence of a nuisance, he may seek damages, an injunction, or both.[368] A damages remedy may include compensation for both past and future injuries.[369] The elements of damages in a nuisance action include loss of the value attached to the use and enjoyment of the property and any personal injury sustained by the plaintiff as a result of the nuisance.[370]

In order to obtain an injunction the plaintiff must show that money damages will not be an adequate remedy.[371] Injunctive relief may also be granted upon a showing of the threat of harm which has not

(1957).

365. *See, e.g.,* Mahone v. Autry, 55 N.M. 111, 227 P.2d 623 (1951). Prosser notes that "coming to the nuisance" is "merely one factor, although clearly not the most important one, to be weighed in the scale along with the other elements which bear upon the question of 'reasonable use.' " W. PROSSER, *supra* note 120, § 91, at 611.

366. *See id.* at 606-07.

367. Venuto v. Owens Corning Fiberglass Corp., 22 Cal. App. 3d 116, 99 Cal. Rptr. 350 (1971). Neither is it a defense to show that a nuisance-causing instrumentality is built in accord with the latest approved methods or that it is operated skillfully. Clause v. Weaver Const. Co., 158 N.W.2d 139, 261 Iowa 225 (1968).

368. W. PROSSER, *supra* note 120, § 90. Prosser also notes that abatement of a nuisance by self-help is also an option. *Id.* at 605-606.

369. Past and future damages will generally be awarded where the court determines that the nuisance is permanent in nature. *See* Spaulding v. Cameron, 38 Cal. 2d 265, 239 P.2d 625 (1952); *Nuances of Nuisance, supra* note 322, at 68.

370. For a more detailed discussion of the damage remedy in a nuisance action see W. PROSSER, *supra* note 120, § 90; *Nuances of Nuisance, supra* note 322, at 67-69.

371. As has been noted:

> Damages . . . will often be deemed inadequate where: (1) the injury suffered cannot be accurately calculated in terms of dollars; (2) the injury to the plaintiff is ir-

yet occurred.[372] This is an advantage for the plaintiff who has not yet suffered personal injury from exposure to nonionizing radiation, but who fears that such injury will occur in the future.

In deciding whether to issue an injunction, courts usually perform a balancing of the equities.[373] In this balancing, the court weighs the harm to the plaintiff if the activity were to continue against the harm to the defendant if he were to be forced to stop.[374] This balancing may work against the nonionizing radiation plaintiff because the difficulty in placing a value on his injuries may make proof of the plaintiff's harm uncertain.[375] Further, before granting an injunction, courts require that the plaintiff prove that the anticipated harm is virtually certain to occur, that is, that the harm is "imminent and irreparable."[376] The present inconclusiveness of scientific evidence regarding the effect of nonionizing radiation on humans[377] may prevent such a showing. Furthermore, courts have recently exhibited some hesitation to issue injunctions where there is any possibility that damages will compensate the plaintiff for present and future injuries.[378] Thus, it appears that the nonionizing radiation plaintiff who seeks an injunction faces a difficult task.

If the plaintiff can surmount these obstacles to recovery, however, nuisance may be a very useful theory on which to base liability for nonionizing radiation injury. By its nature, nuisance can provide a remedy for a large number of plaintiffs suffering from a variety of injuries.[379] A nuisance action based on intentional tort relieves the plaintiff of the burden of proving negligence. This is especially advantageous where the defendant has consistently followed industry safeguards and customs which, nevertheless, have resulted in the plaintiff's injury. Finally, the availability of equitable relief affords

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> reparable; (3) the injury is continuous in nature; or (4) the usefulness of the plaintiff's land is seriously impaired.

Nuances of Nuisance, supra note 322 at 71 (footnotes omitted).

372. W. PROSSER, *supra* note 120, § 90, at 603. *See also* Monsanto Chem. Co. v. Fincher, 272 Ala. 534, 133 So. 2d 192 (1961).

373. *Updating the Injunction, supra* note 161, at 142.

374. *Id.*

375. Comment, *The Environmental Lawsuit: Traditional Doctrines and Evolving Theories to Control Pollution*, 16 WAYNE L. REV. 1085, 1104 (1970).

376. *Updating the Injunction, supra* note 161, at 123. *See also* Falkner v. Brookfield, 368 Mich. 17, 117 N.W. 2d 125 (1962); Marshall v. Consumer Power Co., 65 Mich. App. 237, 237 N.W.2d 266 (1976).

377. *See supra* text and notes at notes 62-67.

378. *See, e.g.,* Boomer v. Atlantic Cement Co., 26 N.Y.2d 219, 257 N.E.2d 870, 309 N.Y.S.2d 312 (1970).

379. *See supra* text and notes at notes 368-72.

the plaintiff a potential remedy for the threat of future harm from an existing nuisance.

In summary, this section has focused on the appropriateness of actions based on the common law of nuisance in cases involving nonionizing radiation injury. As with the other theories examined, the plaintiff faces several difficulties. In a public nuisance action, the plaintiff must show special damage *in order* to sue as a private citizen. Under both public and private nuisance theories, there will be difficulties proving a basis of liability, substantial interference, and unreasonableness of the invasion. Even if the plaintiff successfully overcomes his opponent's defenses and prevails on the nuisance claim, he may face difficulties obtaining an appropriate remedy if personal injury has not yet occurred or if the risk of future harm cannot be proven with sufficient certainty to warrant an injunction. Despite these obstacles, however, the common law of nuisance can be a useful tool for the nonionizing radiation plaintiff. Under a nuisance theory, the plaintiff can seek relief for both personal injury and property damage. Nuisance also affords the flexibility of equitable relief. Therefore, the plaintiff's attorney should explore the common law of nuisance in preparing a nonionizing radiation injury claim.

IV. Conclusion

American industry and military research have developed a large number of devices in the past forty years which emit nonionizing radiation. As a result, millions of Americans are exposed to potentially hazardous nonionizing radiation at work and at home. Nonionizing radiation technology has developed with little federal, state, or local control.[380] As a result, there is little regulatory protection for people who are exposed to nonionizing radiation, and no comprehensive statutory scheme covers those who have been injured by it.[381] Thus, victims of nonionizing radiation injury must resort to existing statutory and common law theories of recovery.

Existing theories of liability present a number of problems for the nonionizing radiation plaintiff. Virtually all nonionizing radiation plaintiffs will encounter a short statute of limitations.[382] This is a problem when the plaintiff's injury has not manifested itself until long after exposure to nonionizing radiation has ended. In addition,

380. *See supra* Section II.D.
381. *Id.*
382. *See supra* text and notes at Section III.A., notes 101-18.

all nonionizing radiation plaintiffs must prove that exposure to the radiation caused their injuries.[383] The uncertainty of the scientific evidence of the biological effects of nonionizing radiation and the nature of the injury itself make proof of causation difficult.[384] These are merely the threshold problems faced by nearly all nonionizing radiation plaintiffs. Additional problems arise when employing existing theories of recovery in nonionizing radiation injury cases.

Workers' compensation statutes represent one possible theory of recovery. They were specifically enacted to provide benefits for workers injured on the job.[385] Many states, however, require that the injury be the result of an "accident," or fit within a narrow statutory definition of "occupational disease."[386] These limitations may preclude the nonionizing radiation plaintiff from recovery.

Plaintiffs injured by consumer products which emit nonionizing radiation may proceed under products liability theories. Under strict products liability, the plaintiff may recover for injuries caused by defective consumer products without proof of manufacturer's fault.[387] Proof of design defect, however, may be difficult because considerable confusion surrounds the present legal definition of design defect.[388] Furthermore, the Model Uniform Products Liability Act removes design defect cases from the field of strict products liability.[389] Thus, the plaintiff proceeding under a strict products liability theory faces many problems.

The common law of nuisance has received renewed attention in recent years as a means of recovery for interference with use and enjoyment of property. Inconclusive scientific evidence, however, makes it very difficult for the nonionizing radiation plaintiff to prove the requisite substantial interference.[390] It may also be difficult to show that the invasion of the plaintiff's rights is unreasonable.[391] Finally, the nonionizing radiation plaintiff who seeks injunctive relief must prevail in a balancing process which is often by nature weighted against him.[392]

Despite these problems, recovery for nonionizing radiation injury

383. *See supra* text and notes at Section III.B., notes 119-69.
384. *See supra* text and notes at notes 125-63.
385. *See supra* text and notes at notes 176-79.
386. *See supra* text and notes at notes 186-207.
387. *See supra* text and notes at notes 223-37.
388. *See supra* text and notes at Section III.D.(2), 237-73.
389. *See supra* text and notes at Section III.D.(3), 274-90.
390. *See supra* text and notes at notes 340-47.
391. *See supra* text and notes at notes 348-58.
392. *See supra* text and notes at notes 371-78.

is not impossible. The severity of the problems facing the plaintiff, however, will depend greatly on the future direction of the courts and on the creativity of lawyers. Because liability for nonionizing radiation injury is an evolving area of law, the plaintiff's attorney will play an important role in determining its direction. Therefore, in preparing the nonionizing radiation injury claim, the plaintiff's attorney must be creative and should not quickly discard any potential theory of recovery.

The nonionizing radiation plaintiff's attorney must argue that the discovery rule should apply in determining when a statute of limitations begins to run.[393] Courts must also be reminded of the difference between medical and legal definitions of causation.[394] If the nonionizing radiation plaintiff proceeds under a workers' compensation statute, his attorney must convince the court to take whatever interpretive steps are possible to insure that worker's compensation statutes provide benefits for *any* disease or injury which arises out of employment.[395] In a strict products liability case, the plaintiff's attorney must advocate a definition of design defect which juries can apply and which remains faithful to the principles and policies of strict liability.[396] Finally, a nuisance action may present the greatest number of problems for the nonionizing radiation plaintiff.[397] Because of the potential scope and flexibility of the remedy in a nuisance action, however, the plaintiff's attorney should make the best use of all available evidence to convince the court that nonionizing radiation presents a substantial and unreasonable interference with the plaintiff's rights.[398]

Due to the problems inherent in existing theories, the best protection for those who are exposed to nonionizing radiation is through a comprehensive regulatory scheme.[399] The development of such a scheme, however, is time consuming. In light of the present trend away from government regulation,[400] regulatory solution may be an unreasonable expectation. Thus, the plaintiff's attorney, through creative use of existing remedies, will play a significant role in the future development of nonionizing radiation liability law.

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393. *See supra* text and notes at notes 112-18.

394. *See supra* text and notes at notes 150-58.

395. *See supra* text and notes at notes 186-207.

396. *See supra* text and notes at notes 223-27.

397. *See supra* text and notes at Section III.E., notes 301-78.

398. *See supra* text and note at note 379.

399. Legislation can provide directives and incentives for continuing research into the biological effects of exposure to nonionizing radiation, as well as regulate present and future sources of nonionizing radiation. For a proposal for such a comprehensive legislative scheme, *see* Massey, *supra* note 3, at 161-88.

400. *See, e.g.*, New York Times, Mar. 23, 1982, at A18, col. 1.